



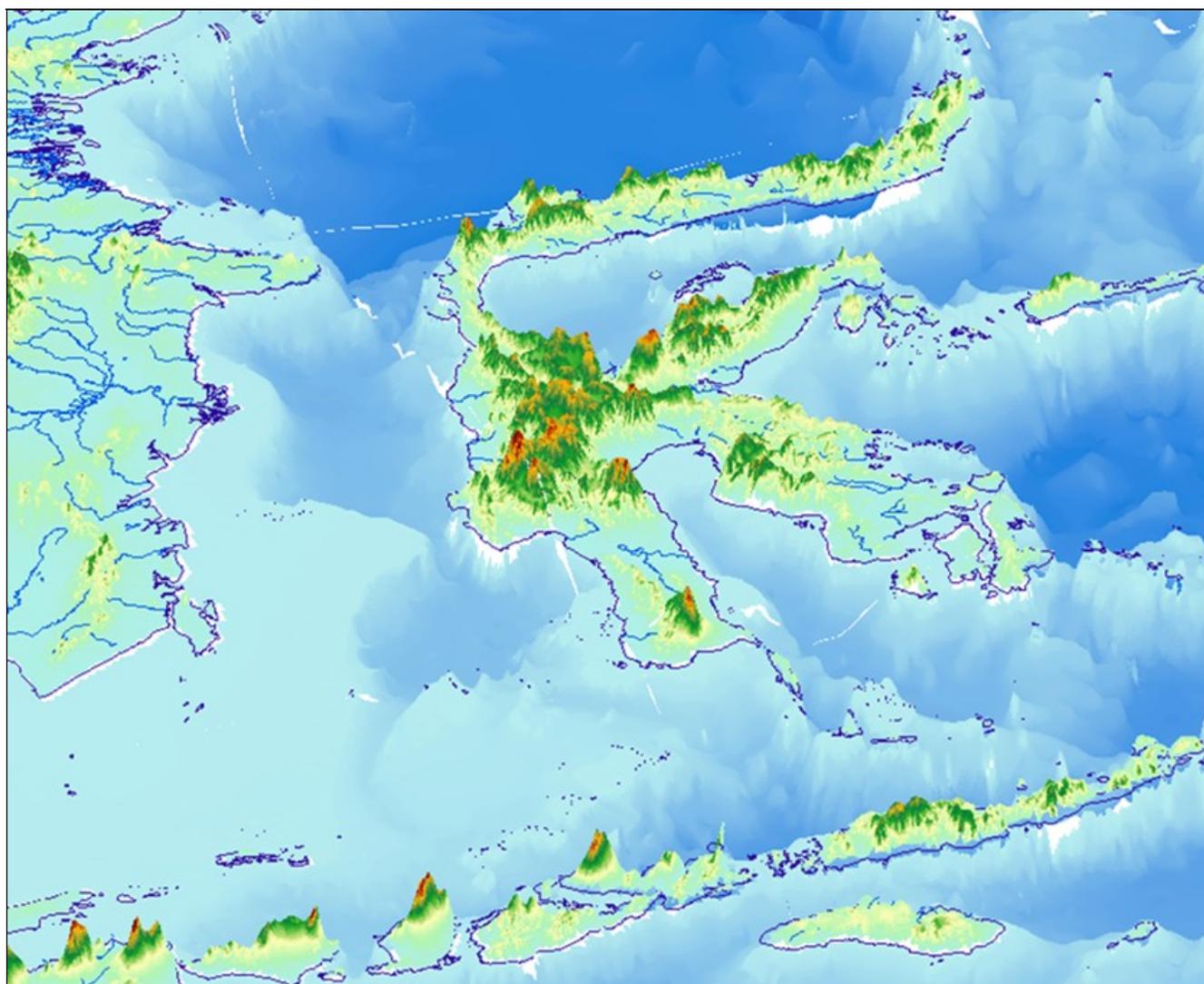
Bibliography of Indonesian Geology

BIBLIOGRAPHY OF THE GEOLOGY OF INDONESIA AND SURROUNDING AREAS

Edition 8.0, February 2026

J.T. VAN GORSEL

V. SULAWESI - BUTON



V. SULAWESI - BUTON	16
V.1. Sulawesi	16
V.2. Banggai Archipelago, Tomori Basin	185
V.3. Buton, Tukang Besi	196

This chapter V of Bibliography 8.0 contains 209 pages with 1366 titles on the Sulawesi region, subdivided in three sub-chapters, Sulawesi main island (2) the Banggai (-Sula) archipelago and Tomori Basin (a New Guinea-margin-derived terrane with Permian-Triassic granites) and Buton Island.

For discussions and papers on surrounding areas see also:

- Makassar Straits: in Chapter IV (Borneo);
- Celebes Sea: in Circum-Indonesia volume (South Philippines)

V.1. Sulawesi

Today Sulawesi is a triple junction of three major tectonic plates, Eurasia to the west, Pacific to the NE and Australia- New Guinea- Indian Ocean to the South and East. Its peculiar K-shape reflects a Cretaceous-Recent history with multiple episodes of subduction, collision and dismemberment of the active margin by hyperextension.

Despite widespread volcanism on Sulawesi during most of Cenozoic time, there is little or no volcanic activity today (except Una Una volcano in Tomini Bay and volcanoes near Manado on the eastern tip of the North Arm, which are part of the Sangihe Arc).

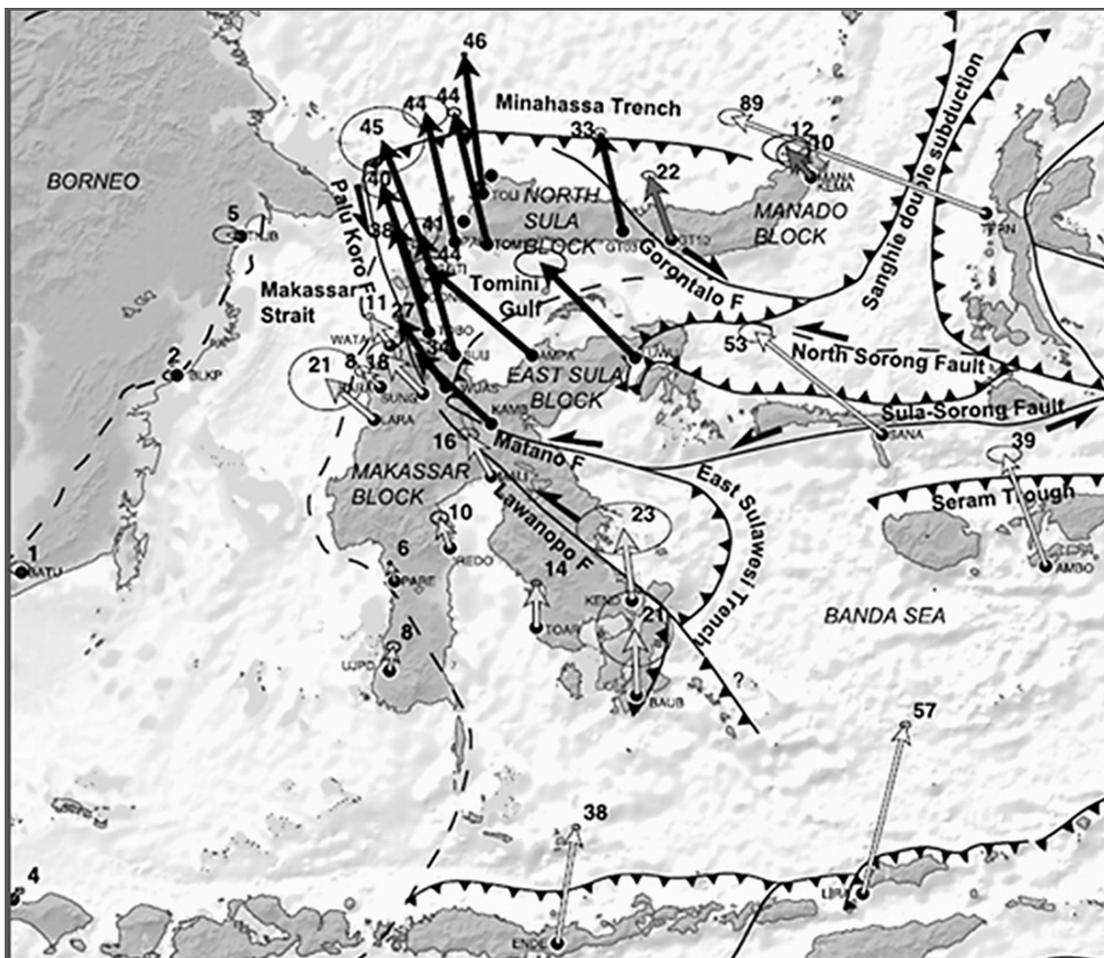


Figure V.1.1. Present-day GPS movements in the Sulawesi region, with arrows showing directions and rates of convergence (mm/year) relative to the Eurasian Plate (Borneo/Sundaland) (Socquet et al. 2006).

Active strike-slip tectonics and block rotations

After the Middle Miocene collision of the Banggai-Sula microcontinent with East Sulawesi, the present-day West-ward convergence of the Pacific Plate relative to the Eurasian Plate (Sundaland) is accommodated in Sulawesi by:

1. movements along major active sinistral strike-slip fault zones the NW-SE trending Palu Koro, Matano, Lawanopo major strike slip faults (causing clockwise rotation of 'Sula Block') (Magetsari et al. 1987, etc.) (Figure V.1.1);
2. multiple thrust belts: off the North Arm of Sulawesi, West Sulawesi (onshore and Makassar Straits) and offshore SE Sulawesi (see below).

The major left-lateral Palu-Koro Fault zone has been known for a long time (Katili 1969, 1970, Tjia 1978).

One significant effects of the ongoing strike-slip faulting is significant rotation of parts of Sulawesi relative to Sundaland: clockwise rotation of the North, NW and East Arms of 2.5-3.0°/ Myr, and counterclockwise rotation of SW Sulawesi and parts of the SE Arm by 1.5°/ Myr (Figure V.1.1; Socquet et al. 2006). The cumulative effect of these rotations, as estimated from paleomagnetic data, is 60° counterclockwise rotation of the SW arm of Sulawesi and 90° clockwise rotation of the North arm (e.g. Panjaitan and Mubroto, 1994).

The active Pacific- Eurasia convergence in the Sulawesi region created young fold-and-thrust belts/accretionary prisms at:

1. the North side of the North Arm, between North Sulawesi and the Minahasa Trench, reflecting subduction of several 100's kilometers of Celebes Sea oceanic crust;
2. the Majene-Kalosi foldbelt at the west side of Sulawesi and its offshore continuation in East Makassar Straits basin, with age of thrusting and uplift latest Miocene and younger (see below and Figure V.1.11), with underthrusting (subduction?) of a large part of the North Makassar Straits basin floor below West Sulawesi (Pubellier et al. 2005);
3. the East Sulawesi/ Tolo trench/foldbelt East of SE Sulawesi.

Significant young uplift of various parts of Sulawesi is clear from various observations, including the outcrops of Late Miocene- Pliocene granites that formed at depths of ~4-12 km, and are now exposed at altitudes of 3000m (Maulana et al. 2016).

The 'arms' of Sulawesi represents three fundamentally different geologic provinces (Figure V.1.2):

1. The SW and NW arms represent a Cenozoic volcanic arc complex that was built on Lower Cretaceous accretionary-collisional basement terrane. This basement formed part of the SE Sunda/ East Borneo active margin prior to Middle- Late Eocene rifting of Makassar Strait. It outcrops at several metamorphic basement complexes (Palu, Bantimala, Barru, etc.);
2. The North arm is mainly a (composite?) intra-oceanic volcanic arc terrane, built on Eocene oceanic crust. At its western end it contains the Paleozoic? Malino metamorphic complex; its eastern end it merges with the active, N-S trending Sangihe volcanic arc;
3. Central Sulawesi (including the western parts of the SE Arm) contains widespread metamorphic rocks, signifying both mid-Cretaceous 'normal' regional metamorphism, locally overprinted by Late Oligocene High P- Low T 'blueschist-facies' metamorphism (Parkinson 1991);
4. East and SE Arms of Sulawesi are dominated by outcrops of the Late Mesozoic East Sulawesi Ophiolite, one of the world's largest ophiolite complexes, which 'obducted' onto the Central Sulawesi metamorphic belt (around Oligocene time?).
5. At the East side of Sulawesi is the Banggai-Sula block, clearly derived from New Guinea, and collided with East Sulawesi in Late Miocene- Early Pliocene time. A Buton- Tukang Besi block at the SE side of Sulawesi is often proposed as a microcontinental block similar to Banggai-Sula, but its history and origin are less obvious.

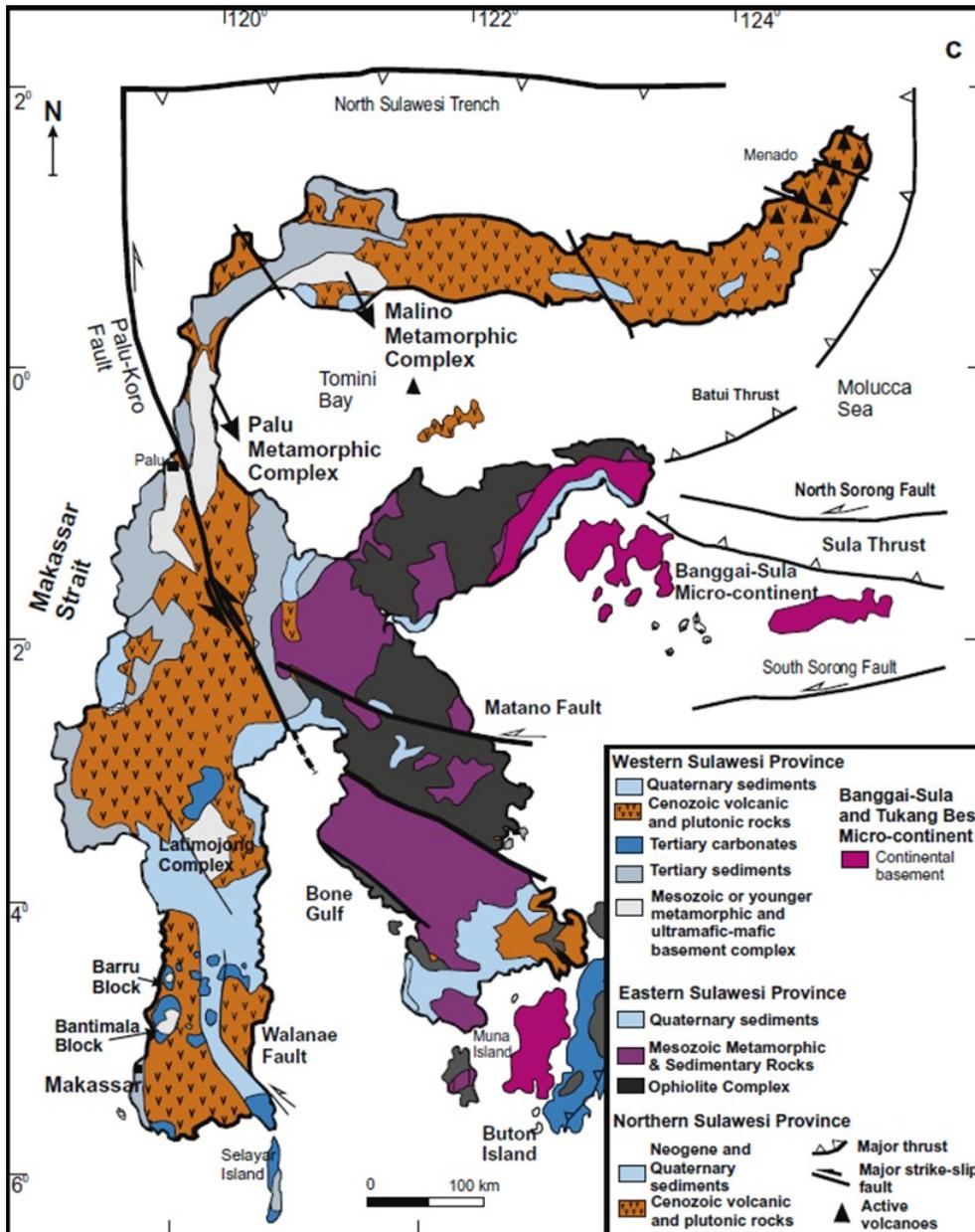


Figure V.1.2. Regional geologic map of Sulawesi Island (Maulana et al. 2016).

Sulawesi North Arm

The North arm of Sulawesi is a volcanic arc terrane built on oceanic crust (Kavalieris et al. 1992, Van Leeuwen and Muhardjo 2005). It is probably a composite of Paleogene and Neogene volcanic arc complexes:

1. Young arc volcanism is from active, South-dipping subduction of Eocene-age oceanic crust of the Celebes Sea, which has subducted to depths up to >400 km (tomography). Most radiometric ages are between 10- 4 Ma;
2. The oldest rocks are Middle-Late Eocene Labunaki basalts and Middle Eocene- Oligocene deep water Papayato island arc volcanics (Van Leeuwen 2011), possibly tied to (present-day) North-dipping subduction?

At its western end it contains the Paleozoic? Malino metamorphic complex (exhumed in Miocene and later time; Van Leeuwen et al. 2007, Advokaat et al. 2017).

SW and West Sulawesi

SW and West Sulawesi outcrops contain volcanic and plutonic rocks of successive Cenozoic magmatic arcs, built on pre-Late Cretaceous accretionary complexes of metamorphic- ophiolitic rocks. These basement terranes may be a continuation of the Cretaceous accretionary complexes of the Meratus in SE Kalimantan and Luk-Ulo in Central Java, etc. (Wakita et al. 1996).

In several areas mid-Cretaceous accretionary basement complexes are overlain by locally thick (>2000m) Late Cretaceous 'flysch' of the Latimojong/ Balangbaru Formations. Current directions from the West and presence of the 'Tethyan' mid-Cretaceous larger foram *Orbitolina* suggest a Sundaland source, while common andesitic detritus suggests a forearc setting (Sukanto 1986, Hasan 1991, Hasibuan and Limbong 2009).

Cretaceous flysch is overlain unconformably by less-deformed clastics in Middle Eocene and younger rift basins. Early rift sediments contain coal beds that were surveyed in detail in the early 1900's, but were never deemed commercial. These are overlain by widespread Late Eocene- Middle Miocene post-rift platform carbonates (Tonasa Limestone; Wilson 1996 and others), and capped by thick Miocene and younger Camba Fm volcanics.

There is relatively little or no present-day volcanic activity in the western half of Sulawesi, but volcanic- plutonic activity was widespread here through much of the Tertiary. Multiple periods of arc volcanism and granitoid intrusions were identified between Late Cretaceous to Pliocene, presumably above West-dipping subduction zones (see papers by Priadi, Polve, Elburg, Soeria-Atmadja, Van Leeuwen, etc.). The main peaks of activity reportedly are (Priadi et al. 1994, Elburg et al. 2002, 2003):

- Late Cretaceous (common arc volcanic detritus in Balangbaru Fm flysch)
- Middle Eocene- Early Oligocene (~50-30 Ma; arc volcanics and/or back-arc basin basalts)
- Middle-Late Miocene (mainly 10-12 Ma; high-K volcanics;)
- Late Miocene- Pliocene (~7-2 Ma; felsic calk-alkaline).

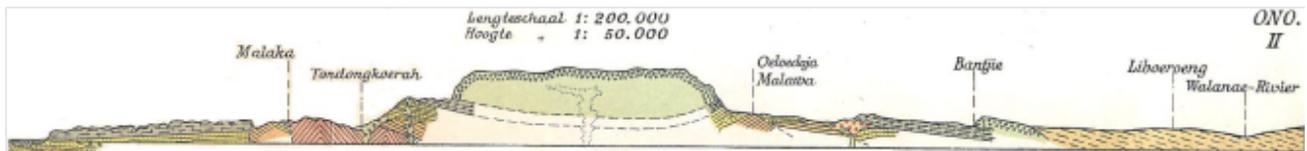


Figure V.1.3. Historic W-E cross-section through SW Sulawesi, showing folded Cretaceous sediments, overlain by Eocene clastics with coal and Late Eocene Nummulites limestone, capped by volcanics (T Hoen and Ziegler, 1915)

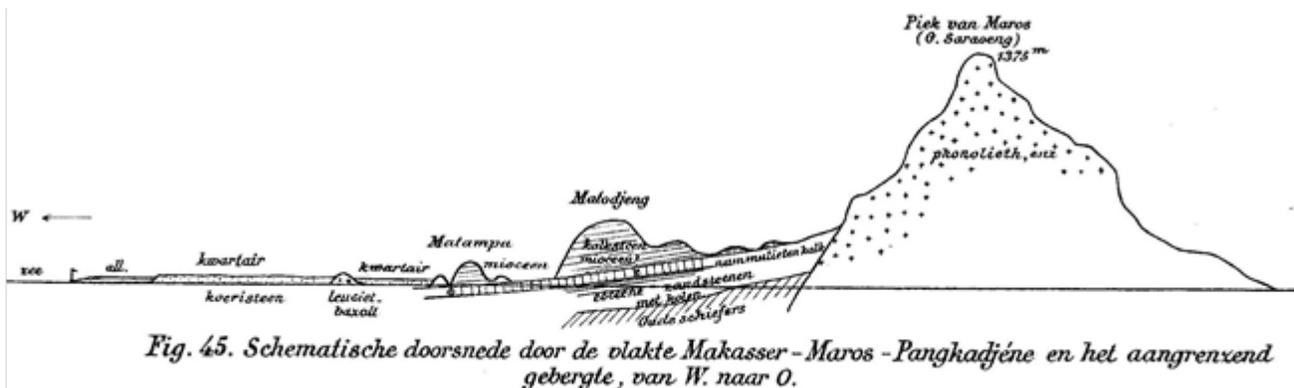


Figure V.1.4. Historic W-E cross-section through SW Sulawesi, showing rel. thick Eocene sandstones with coal on 'Old slates', grading upward into limestone and intruded by large, young Maros granitoid (Verbeek, 1908).

West Sulawesi Cretaceous metamorphic complexes

Basement of West Sulawesi outcrops in a number of Early Cretaceous metamorphic complexes. They are associated with ultramafic rocks and probably represent Early Cretaceous subduction complexes that supposedly became inactive after an Aptian collision with a Gondwanan continental microfragment (Wakita et al. 1996, Parkinson 1998).

From South to North they include Bantimala, Barru, Latimojong, Karossa and Palu. Many of these have well-documented ~mid-Cretaceous (~Aptian) radiometric ages (Wakita et al 1994, 2000) (Palu may be younger?).

The Bantimala Complex contains ENE-dipping thrust slices with high-P glaucophane schists and eclogites with K-Ar ages of 113-132 Ma and with ultramafic rocks in the NE. The complex is overlain by Late Albian- early Cenomanian (~100 Ma) radiolarian cherts (Haile 1974, Wakita et al. 1994, 1996, 2000, Maulana et al. 2008, 2013, 2015), followed by Turonian- Maastrichtian Balangbaru Formation flysch (Hasan 1991).

Munasri (2013) reported older (Valanginian-Barremian) radiolaria from manganese carbonate nodules in dark reddish shale of the Barru melange complex.

The Latimojong complex, viewed as an accretionary complex of metamorphic rocks tectonically mixed with cherts and ophiolitic rocks, contains cherts with Aptian-Albian radiolaria (White et al. 2017).

West and North Sulawesi Neogene granitoids

Widespread young granitoids are known from the West and NW arms of Sulawesi (Figure V.1.5).

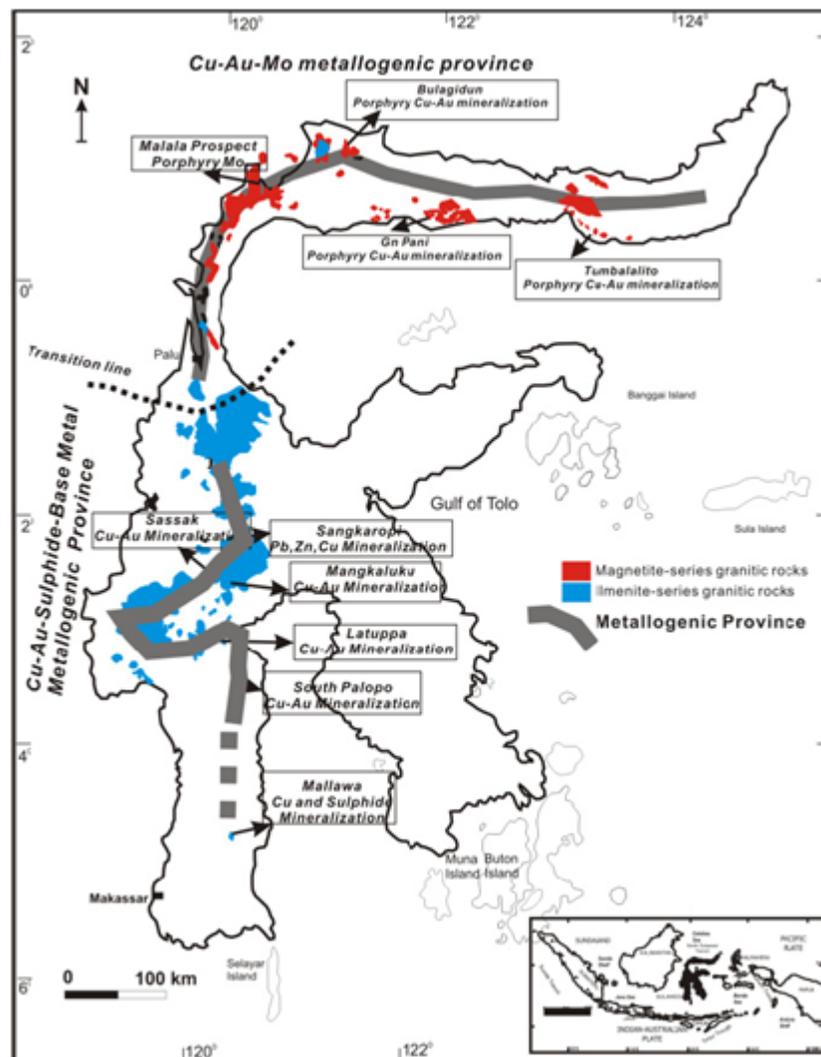


Figure V.1.5. Two groups of Cenozoic granitic rocks, with associated mineral deposits (Maulana et al. 2013). In W Sulawesi mainly Ilmenite I-type granitoids, in North Magnetite-series granitoids.

Central Sulawesi Metamorphic Belt- Neogene metamorphic complexes

The areas of Central Sulawesi and the western part of the SE Arm of Sulawesi are home to outcrops of large metamorphic complexes (Pompangeo and Tokorondo Mountains around Lake Poso, also the Malino Metamorphic Complex in the west part of North arm?). They are probably mainly Paleozoic? metasediments from a continental margin setting.

Detailed petrographic studies by Egeler (1947, 1949) and De Roever (1947, 1950) recognized at least two phases of metamorphism, an older high-grade epidote-amphibolite regional metamorphism, overprinted by younger metamorphic events: (1) in West contact metamorphism around granitoid intrusives, and (2) in East high-P blueschist metamorphism.

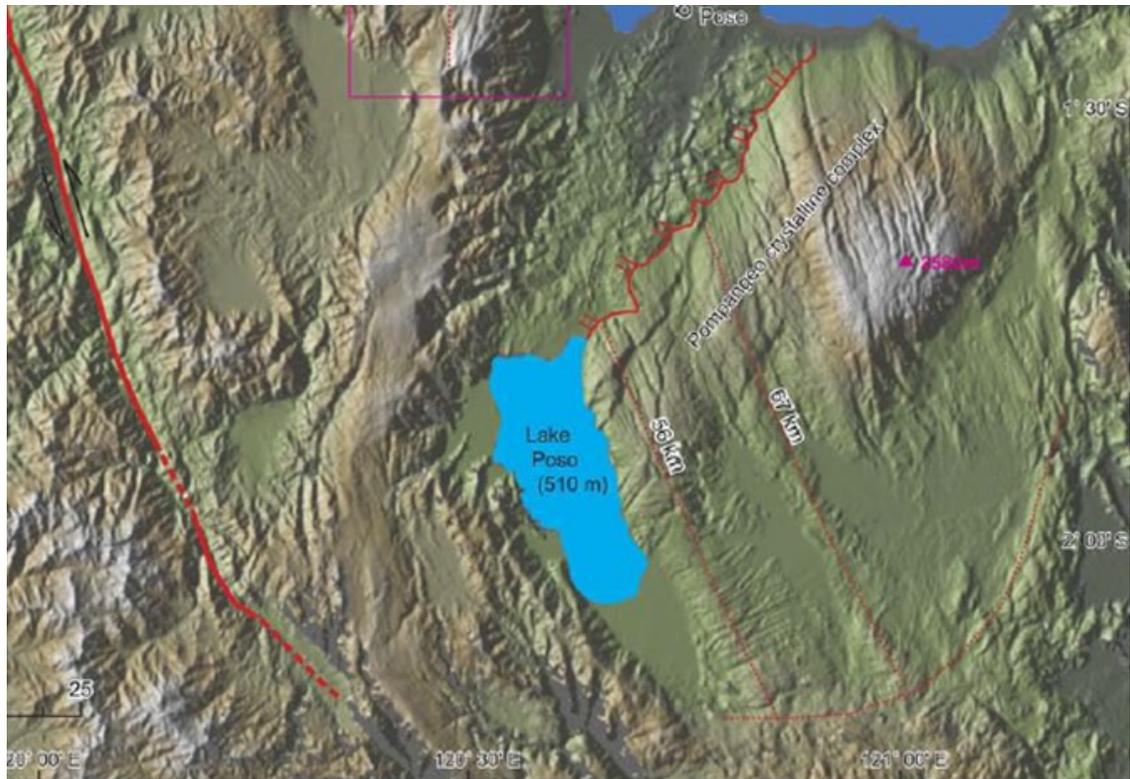


Figure V.1.6. Pompangeo massif, NE of Lake Poso, Central Sulawesi. Interpreted as domed metamorphic core complex, with corrugated surface of NNW-SSE-trending grooves, representing the direction of displacement on the overlying low-angle normal detachment fault plane (Spencer 2010).

Parts of the Central Sulawesi metamorphic complexes are large domes with characteristic corrugated surface with large grooves, interpreted to represent large low-angle extensional detachment faults on top of a metamorphic core complex, exhumed during a period of hyperextension (Figure V.1.6; Spencer 2011). The core complexes probably represent exhumed lower continental crust

East Sulawesi Ophiolite

East Sulawesi is characterized by one of the world's largest ophiolite complexes (Figure V.1.7). A composite section suggests an >15 km thick, relatively complete ophiolite sequence from mantle peridotite at the base to oceanic crust gabbros, overlain by a sheeted dike complex and pillow basalts at the surface. However, in much of East Sulawesi it appears to be a relatively thin and incomplete, but widespread sheet that covers a continental terrane (Surono and Sukarna 1995).

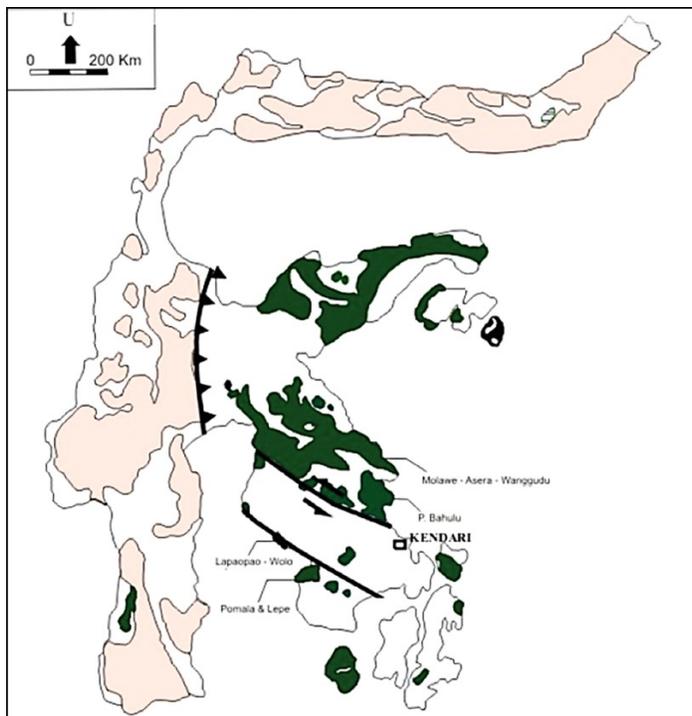


Figure V.1.7. Sulawesi Island, with widespread ophiolites in the East and SE arms (dark green), widespread volcanics in the SW and North Arms (pink) (Dirk 2010).

East Sulawesi ophiolites have yielded Cretaceous- Paleogene radiometric ages (e.g. Kadarusman et al. 2004), but they are overlain by (Upper) Cretaceous pelagic calcilitite of the Matano Formation with radiolaria and *Globotruncana* pelagic foraminifera (Koolhoven 1932, Simandjuntak 1993, 1994). The post-Cretaceous radiometric ages therefore can not reflect the original crystallization age of East Sulawesi ophiolitic mantle rocks.

Geochemistry of the ophiolite rocks were interpreted as suggesting an origin as an Asian marginal oceanic basin (Monnier et al. 1995). Kadarusman et al. (2002, 2004) argued for an origin from a SW Pacific Ocean, mantle plume-influenced setting.

The ophiolite complex is a relatively flat-lying slab that appears to be thrust over a high-pressure metamorphic sole (Pompangeo glaucophane schist) in the western parts of the East and SE Arms. In the Kolonodale area of the eastern part East Sulawesi it overlies imbricated Late Triassic- Paleogene marine passive margin sediments, without much thermal alteration, which may reflect younger (~Middle Miocene) underthrusting by the colliding southern part of the Banggai-Sula block.

A more or less complete ophiolite sequence can be seen in the East Arm of Sulawesi, with progressively higher units exposed in easterly direction (Figure V.1.8).

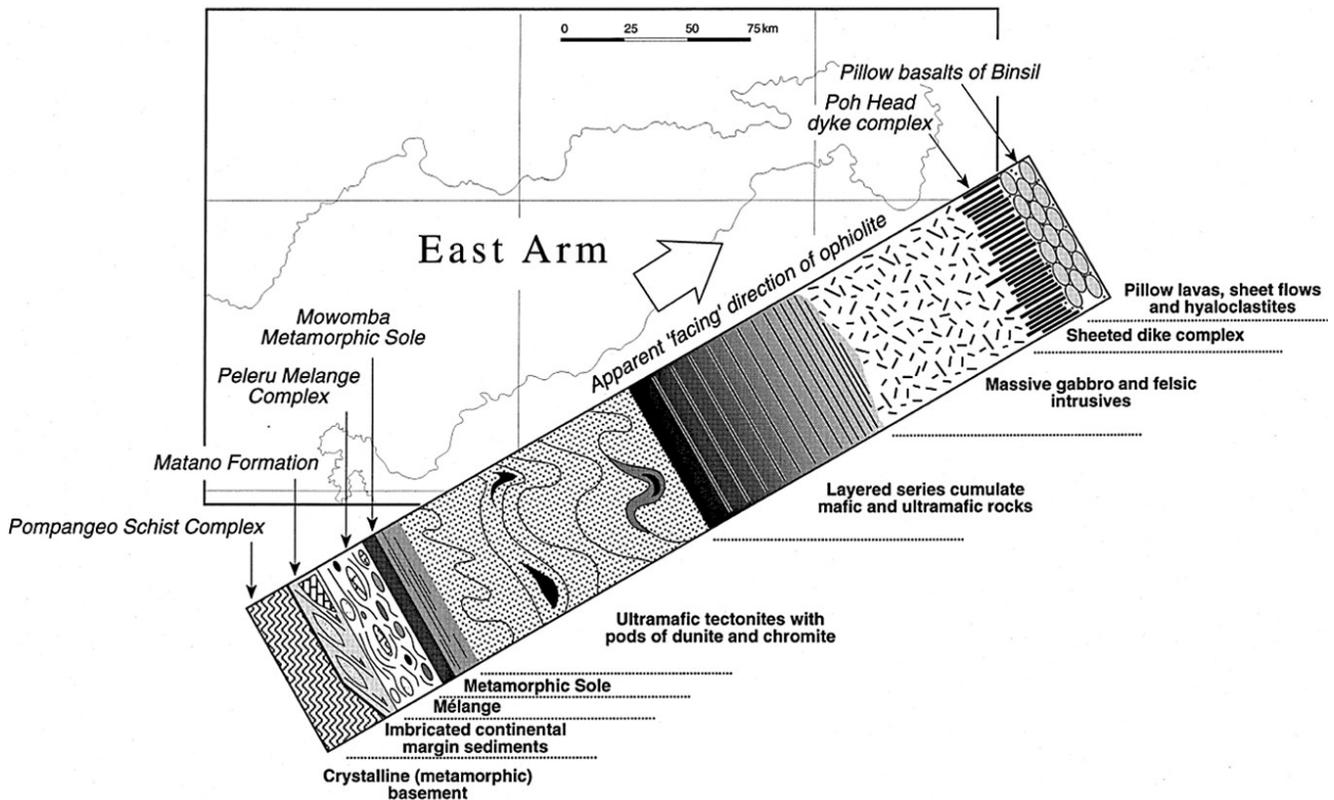


Figure V.1.8. Sequence of lithologies in idealized ophiolite sequence (upper mantle + oceanic crust). In the East Arm of Sulawesi the lowest parts of the ophiolites are exposed in the West, the highest parts in the East, probably reflecting gentle easterly dip of the ophiolite sheet (Parkinson 1998).

Age of East Sulawesi ophiolite uplift

The age of ophiolite obduction onto the East Sulawesi margin is generally believed to be around Late Oligocene time (cooling age of 'East Pompangeo' metamorphic sole ~26-30 Ma; Helmers et al. 1990, Parkinson 1998, Surono 2012).

Further evidence that the East Sulawesi ophiolite complex was uplifted and being eroded by earliest Miocene time was provided conglomeratic limestones from NE part of the SE arm (Bahumpombini/ Bungku area), with larger foraminifera of Early Miocene zone Te5 (*Miogypsina*, *Spiroclypeus*, *Lepidocyclina* (*Eulepidina*)), but also with reworked clasts of Upper Cretaceous *Globobotruncana* pelagic limestone, radiolarian chert and serpentine (Van der Vlerk and Dozy, 1934).

Ophiolitic detritus is also very common in the 'Sulawesi Molasse' of Middle(?) Miocene and younger ages in East Sulawesi and Buton.

The ophiolite terrane in the East Arm of Sulawesi has undergone very recent uplift, as demonstrated by uplifted Late Quaternary coral reef terraces to elevation of 410m in the last ~230,000 years (Sumususastro et al. 1989, Fig. V.1.8.)

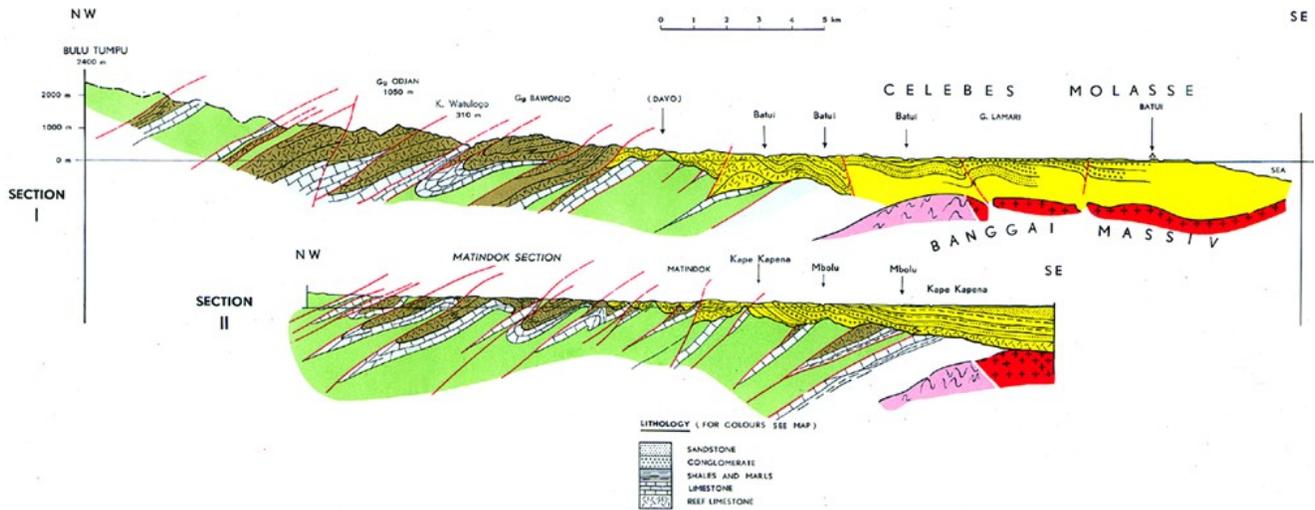


Figure V.1.10. NW-SE sections across southern part of the East Arm of Sulawesi, showing up to 2 km thick, post-orogenic 'Sulawesi Molasse' (yellow), unconformably over imbricated-to-SE collision zone with Banggai-Sula terrane. Green = ophiolite (Kundig 1956).

West Sulawesi foldbelt

A significant feature of West Sulawesi is the Majene- Kalosi foldbelt and its offshore continuation in East Makassar Straits basin (Figures V.1.11, V.1.12, V.1.13). Age of thrusting and uplift is probably latest Miocene (5-10 Ma; Coffield et al. 1993, Fraser et al. 1993, Bergman et al. 1996) or mid- Pliocene (Calvert and Hall 2007), and may or may not be related to the collision of the Banggai-Sula terrane at the Eastern margin of Sulawesi.

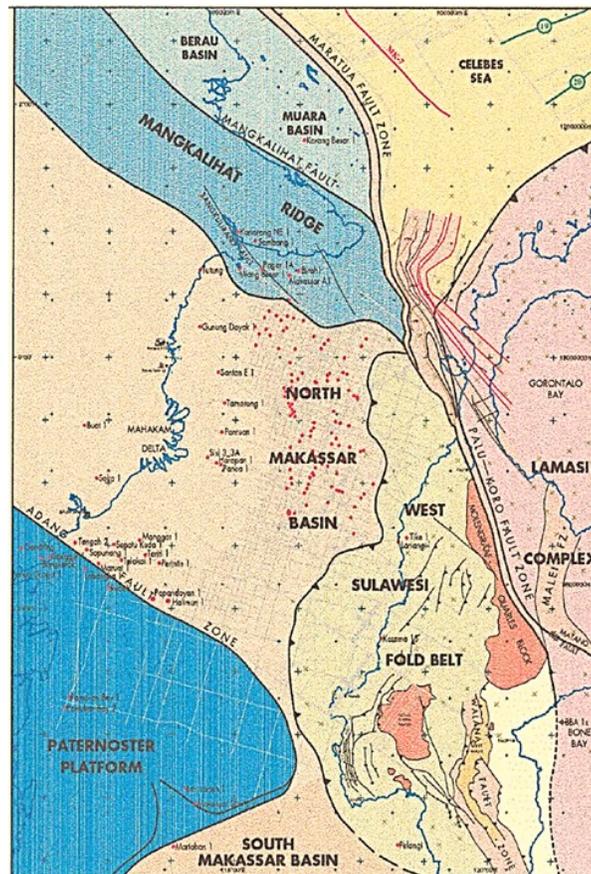


Figure V.1.11. West Sulawesi foldbelt: WNW-directed thrusting (Fraser et al. 1993).

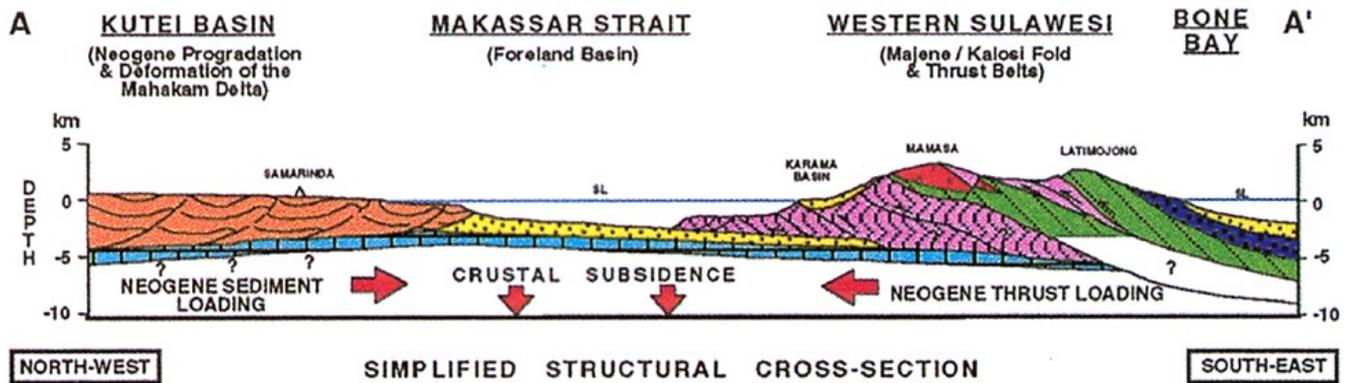


Figure V.1.12. West Sulawesi shown here as a >150 km wide belt of Late Neogene WNW-directed thrusting (onshore Majene-Kalosi foldbelt with offshore continuation along the east margin of North Makassar Straits (Bergman et al. 1996).

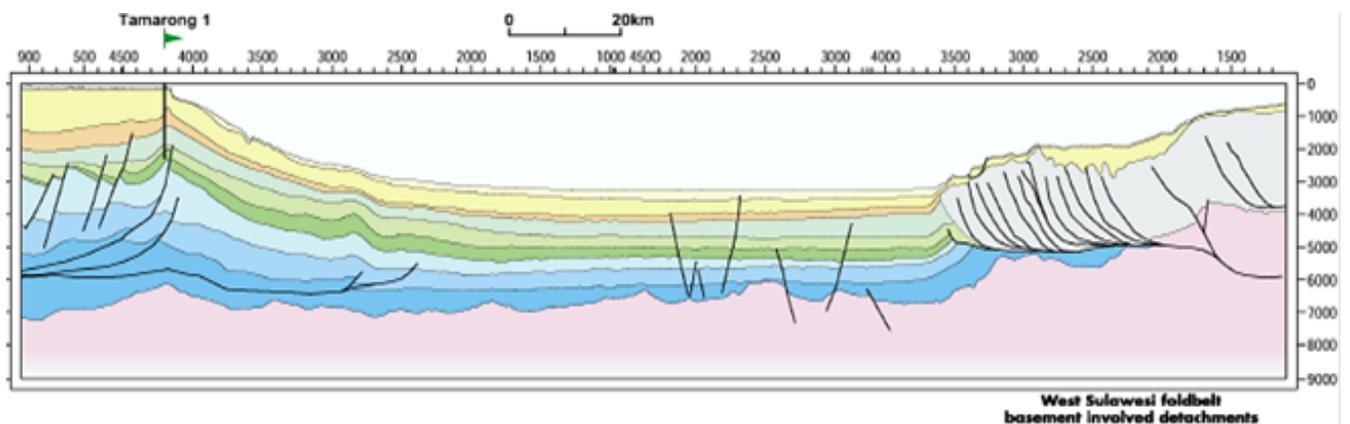


Figure V.1.13. Cross-section across North Makassar Strait basin, with on right side the frontal thrusts of the West Sulawesi foldbelt (Fraser et al. 1993, 2003)

The thrust system continues offshore into Makassar Straits (Figure V.1.13), where much of the North Makassar Straits basin floor was obviously underthrust below West Sulawesi (e.g. Pubellier et al. 2005).

Brief tectonic evolution of Sulawesi

Milsom et al. (2000) noted that the tectonostratigraphic successions of East Sulawesi, Buton, Buru, Seram and the Banda Terrane' of Timor were remarkably similar, suggesting these were all part of one or several related microcontinents that had separated from the NW Australian margin in Latest Triassic- Early Jurassic time and collided with the Eurasian margin/ West Sulawesi to form the Sulawesi orogen in Oligocene time. Subsequent studies by French authors supported similar scenarios (Villeneuve et al. 2002).

In very broad terms the Cenozoic geodynamic evolution of Sulawesi may be described as (e.g. Villeneuve et al. 2001, 2002 and many others):

1. Early Cretaceous subduction and accretion along the eastern Sundaland margin, forming the future basement of West Sulawesi (although thrust slices in Bantimala complex are NE/E- dipping, indicating East-dipping subduction?)
2. An ~Aptian-age collision event with ophiolite obduction terminates subduction; this is probably followed by renewed subduction in Late Cretaceous and possibly Early Paleogene (still along the Sundaland margin).
3. Middle Eocene onset of rifting of Makassar Straits, separating West Sulawesi from the Sundaland margin;
4. Late Oligocene collision of a 'Gondwanan' microcontinental block with the Asian volcanic arc of West Sulawesi, presumably closing a West-dipping subduction system. This block has been called 'Banda Block' or Kolonodale Block' by French workers. It outcrops in the East and SE arms of Sulawesi and its Triassic-Paleogene marine stratigraphic succession is very similar to that of Buru-Seram, the Sinta Ridge and parts of Timor, with which they were probably united before the opening of the Banda Seas.

- 4a. The Kolonodale block was overridden by the large East Sulawesi ophiolite, whose origin (marginal basin or Pacific Ocean), and timing (Early Oligocene?) and place of obduction are still debated;
5. Late Miocene collision ('underthrusting') of Banggai-Sula continental block, another Gondwanan block rifted from the New Guinea (Birds Head?) region (Figure V.1.9). In East Sulawesi this led to major uplift of the East Sulawesi ophiolite complex, and onset of deposition of ?Late Miocene- Pliocene 'Celebes Molasse', which contains erosional products of the ophiolite. In West Sulawesi a significant WNW directed fold-thrust belt system formed, starting in latest Miocene;

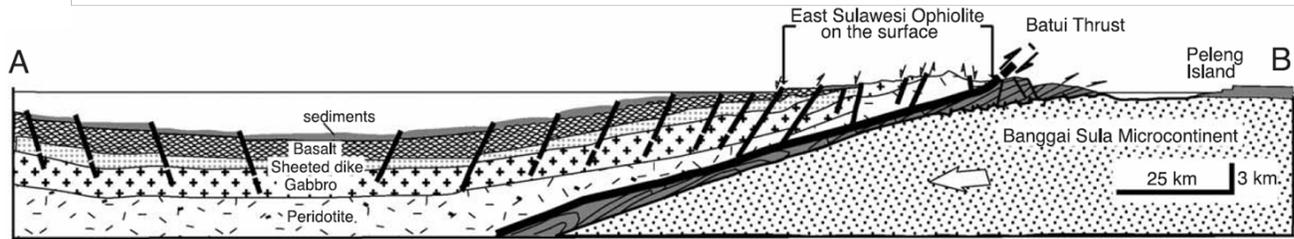


Figure V.1.7. NW-SE cross-section showing Banggai-Sula microcontinent thrust under East Sulawesi Ophiolite (Kadarusman et al. 2004).

6. Fragmentation of the East Sulawesi orogenic belt by Late Miocene and younger post-orogenic extension: (1) rifting in the Bone and Gorontalo/ Tomini Basins, separating West and Borth Sulawesi from East and SE Sulawesi, and (2) margin breakup by rifting/ spreading of the young oceanic North and South Banda Sea basins, which removed multiple Sulawesi margin terranes like Sumba, the Banda Terrane of Timor, Buru-Seram, etc. (e.g. Figure V.1.8.; Milsom et al. 2000, 2001). This was probably driven by slab rollback of the subducting Indian Ocean Plate (Spakman and Hall 2010, Pownall et al. 2016).

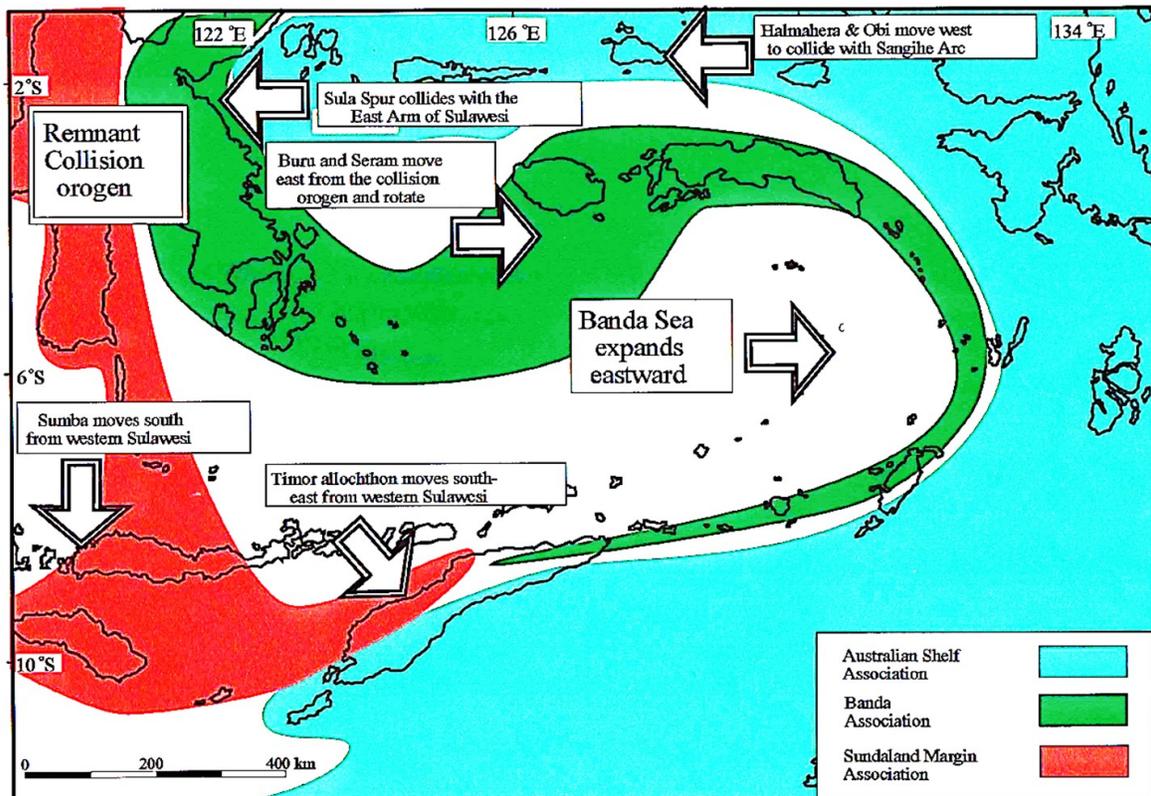


Figure V.1.8. Dispersal of terranes from the East and SE Sulawesi collisional belt during Late Miocene- Early Pliocene Banda Sea opening (Sumba, Timor allochthon, Buru-Seram, etc.; Milsom et al. 2000).

7. Present-day strike-slip faulting and block rotations/ strike-slip faulting, due to continued convergence between the Eurasian and Pacific plates Figure V.1.1).

V.2. Buton, Tukang Besi Islands

Sub-chapter V.2 contains 76 papers on the geology of the Buton and Tukang Besi islands.

Buton and the adjacent Tukang-Besi islands are located SE of the SE arm of Sulawesi and are frequently viewed as one or even two small microcontinental plates that collided with SE Sulawesi in Miocene time. However, Buton and SE Sulawesi have a similar imbricated Late Triassic- Paleogene complex that is overlain by remnants of an obducted ophiolite sheet, and it seems more reasonable to view the geology of Buton as a continuation of SE Sulawesi (Kolonodale Block of Villeneuve et al. 2010; see also papers by Cornee, Martini, Surono, etc.).

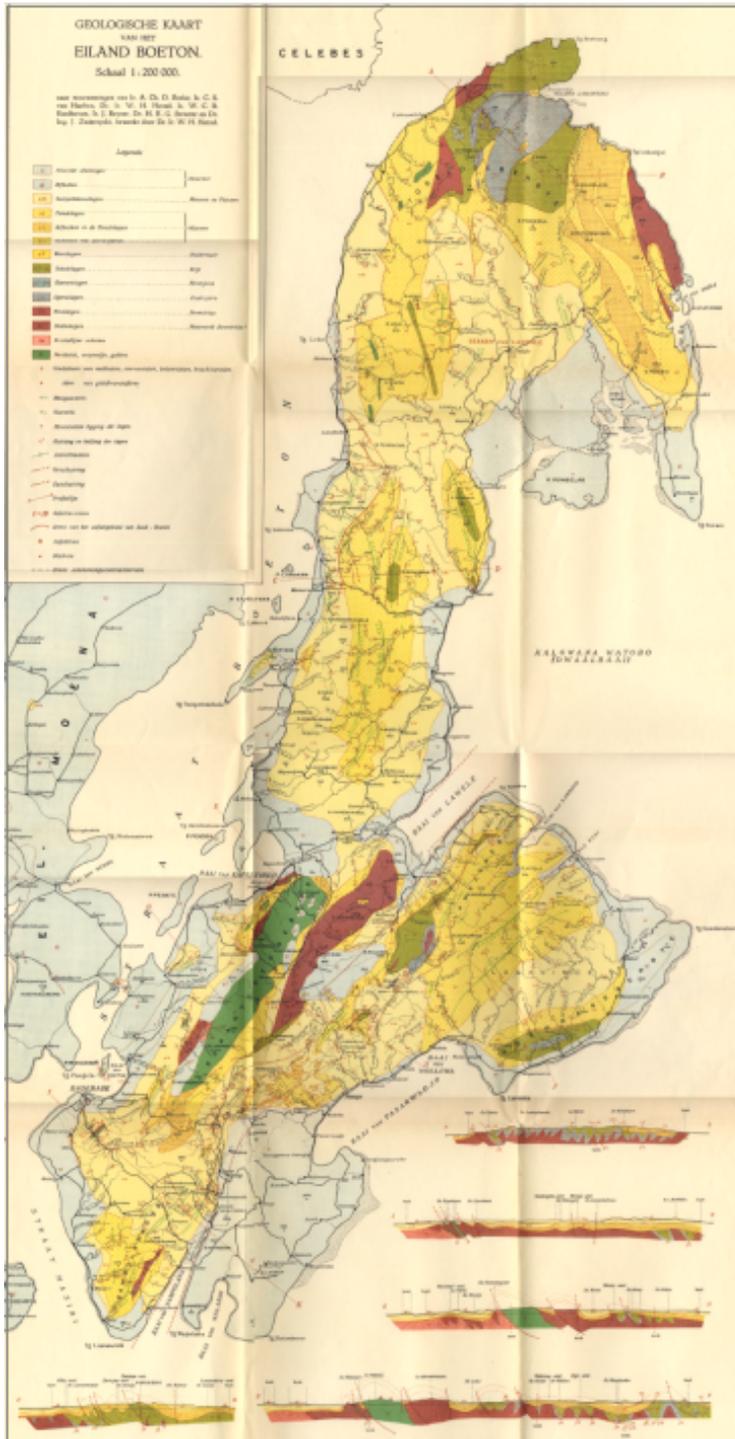


Figure V.2.1. Vintage geologic map of Buton (Hetzel, 1936).

Besides SE Sulawesi, there are also numerous similarities between the tectonostratigraphy of Buton and those of Timor, Seram and Buru ('Banda Association of Milsom et al. 2001). suggesting these may all have been part of a larger plate with similar history with:

- Late Triassic rifting,
- Late Triassic or Early Jurassic breakup (presumably from North Gondwana)
- Jurassic- Middle Eocene drift in an oceanic environment,
- collision with West Sulawesi or the East Sulawesi ophiolite around Oligocene time (Villeneuve et al. 2013)
- partial breakup and dispersal during Late Miocene Banda Sea opening.

Like SE Sulawesi, ophiolitic rocks are present on Buton, but these have no deep roots, and are believed to be relatively thin, isolated overthrust sheets that do not mark any terrane suture (Milsom et al. 1999). Ophiolites and associated metamorphic are imbricated with Triassic and younger pelagic sediments, or overlie them.

The main folding event in Buton is probably around Oligocene time, as also suggested by Villeneuve et al. (2013), based on:

- the youngest folded deep marine deposits are of Middle Eocene age (with planktonic foram *Hantkenina*, and early Middle Eocene radiolaria (Ling and Smith 1995);
- conglomeratic Late Eocene- Oligocene 'Wani Beds' are folded with the underlying Late Triassic- Eocene pelagic limestones (Hetzel 1936) (see also below);
- the oldest post-deformational deposits are the relatively little-deformed basal Tondo Formation conglomerates. A latest Oligocene or earliest Miocene age is shown by larger foraminifera *Spiroclypeus* and *Miogypsinoides* (Hetzel 1936) (not Middle Miocene as suggested by Wiryosujono and Hainim, 1978). The post-deformational earliest Miocene Tondo Fm basal conglomerates contain ophiolitic clasts, and thus post-date ophiolite uplift.

The cross-section of Figure V.2.2. illustrates the deformational style of Buton, and brackets the age of main folding between Middle Eocene and earliest Miocene: intensely folded Late Triassic- Middle Eocene marine pelagic sediments, unconformably overlain by relatively little deformed (latest Oligocene?-) Miocene and younger marine sediments.

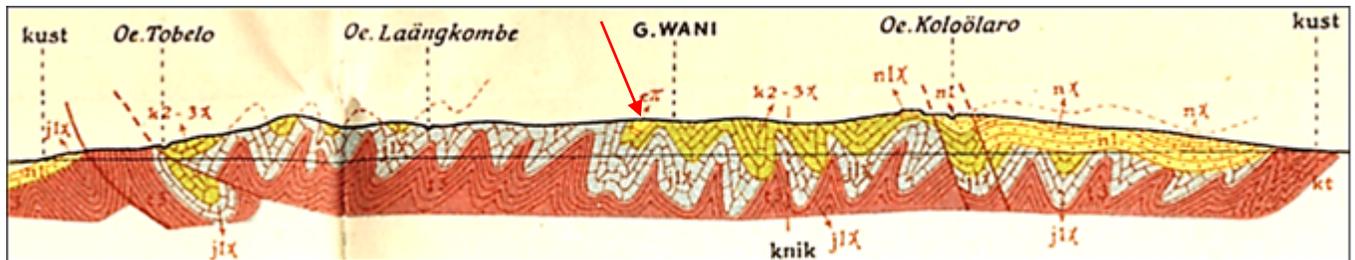


Figure V.2.2. W-E cross-section through Tobelo Mts of North Buton, showing west-dipping, isoclinally folded, Late Triassic-Eocene series, unconformably overlain by Miocene- Pliocene Tondo Fm clastics (light red: Triassic Winto clastics and carbonates; blue-grey Jurassic; Ogena and Rumu Fms; light green: Cretaceous-Middle Eocene pelagic carbonates of Tobelo Fm; yellow: Miocene- younger Tondo Fm marls and clastics). Red arrow points to Eocene Wani Beds (Hetzel, 1936).

'Wani Beds' of Hetzel (1936)

The Late Eocene Wani Beds on Buton (Hetzel 1936; red arrow on Fig. V.2.2) are sandstones and polymict conglomerates that are only known from a few small outcrops in the Tobelo Mountains of North Buton, but they appear to contain critical information on the Paleogene deformational history of Buton. If the observations below (from Hetzel) are correct they signify a Late Eocene uplift/ erosion event that terminated >170 million years of pelagic sedimentation on the Buton terrane, but underwent a second intense folding episode in the Oligocene:

1. they contain a shallow marine Late Eocene larger foraminifera assemblage (Tb; *Nummulites*, *Asterocyclina*, *Lepidocyclina boetonensis*, *Biplanispira*; identified by Van der Vlerk in 1928 and later also by Tan Sin Hok 1936, 1937);
2. they contain reworked clasts of Upper Cretaceous *Globotruncana* limestone and serpentinite, suggesting uplift and erosion of older pelagic sediments and ophiolites;.
3. the Wani Beds also appear to tightly folded with the Mesozoic beds, and therefore appear to predate the main fold-thrust event of Buton (as marked by the unconformity at the base of the post-folding Tondo Beds,

which have basal conglomerates and limestone with *Spiroclypeus* and *Miogypsinoides* (Hetzel 1936), demonstrating a latest Oligocene- earliest Miocene (Te4?) age for the oldest post-collisional beds.

Late Miocene subsidence and Plio-Pleistocene uplift

Miocene and younger deformation on Buton is mainly extensional (Milsom et al. 1999). Fortuin et al. (1990) recorded rapid Late Miocene- Early Pliocene subsidence (bathyal Sampolakosa Fm marls; reflecting Banda Sea extension?), followed by onset of uplift in Late Pliocene (3.5 Ma).

The ongoing young uplift of Buton is demonstrated by multiple uplifted Quaternary reefal limestones up to 700m elevation (e.g. Verbeek 1908, Verstappen 1957; Figure V.2.3).

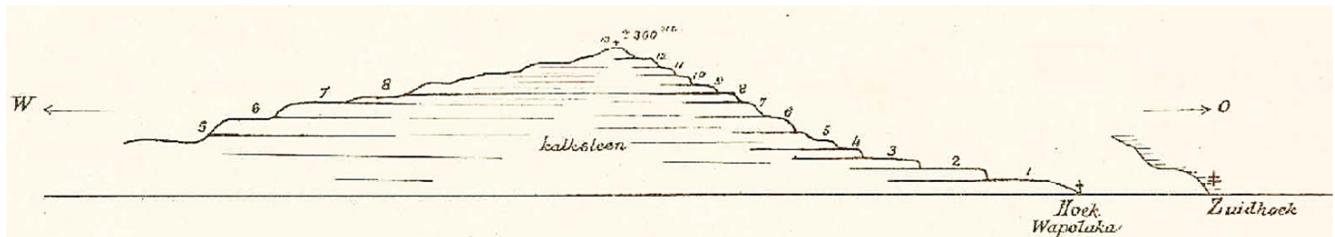


Fig. 25. De hoek Wapolaka (Zuidkust van Boeton) van het Zuiden gezien, met 13 kalkterrassen

Figure V.2.3. View of Wapaloka Island from the sea along South coast of Buton, with 13 Quaternary reefal limestone terraces up to 360m elevation (Verbeek 1908).

Buton asphalt

Buton has been known for its Late Triassic oil shales (Winto Formation marine source rocks) and migrated, biodegraded oil in Miocene tar sands, which was sourced from the Triassic. These asphaltic deposits have been mined intermittently since the 1920's. The most detailed description of the geology of the Buton asphalt deposits is by Hetzel (1936).

The Late Triassic Winto Formation has TOC's up to 16% (Mujito et al. 1998) and is obviously a good oil source rock. However, the five oil exploration wells drilled on and around Buton between 1976 and 2012 were unsuccessful.

Tukang Besi islands

The Tukang Besi islands SE of Buton are often viewed as part of a tectonic terrane that collided with Buton in Pliocene time (e.g. Mubroto and Ali 1998). However, the geological knowledge of these low-lying islands (elevations up to 275m) appears to be limited to observations of an uplifted core of late Neogene *Globigerina* limestones, surrounded by raised coral reef terraces (Hetzel 1930).

The geologic nature and older history of these islands therefore remains mostly unknown, and does not support or contradict any tectonic model.

V. SULAWESI - BUTON

V.1. Sulawesi

Abendanon, E.C. (1911)- De tektoniek van Midden Celebes. Handelingen XIII Nederlandsch Natuur-Geneeskundig Congres, Groningen 1911, Kleynenberg, Haarlem, p. 389-406.

(online read only at: <http://babel.hathitrust.org/cgi/pt?id=uc1.b3093404;view=1up;seq=999>)

(*'The tectonics of Central Sulawesi'. First summary of geology and tectonics of C Sulawesi after initial reconnaissance of Sarasin cousins. C Sulawesi mainly volcanics and metamorphic rocks. Presence of major faults*)

Abendanon, E.C. (1912)- Zur Umrissform der insel Celebes. Zeitschrift Deutschen Geologischen Gesellschaft, Berlin, 64, Monatsberichte 5, p. 266-277.

(online at: <https://www.biodiversitylibrary.org/item/150869#page/1036/mode/1up>)

(*'On the outline of Sulawesi'. Early interpretation of tectonic zones and fault patterns of Sulawesi; partly critique of papers by Ahlburg and Von Staff*)

Abendanon, E.C. (1912)- Eine Nachschrift „Zur Umrissform von Celebes". Zeitschrift Deutschen Geologischen Gesellschaft 64, Monatsberichte 11, p. 512-516.

(online at: <https://www.biodiversitylibrary.org/item/150869#page/1288/mode/1up>)

(*Follow-up of Abendanon (1912) paper on outline of Sulawesi. No figures*)

Abendanon, E.C. (1915)- Celebes uit, of in de Tethys? Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap 32, p. 358-365.

(online at: <https://resolver.kb.nl/resolve?urn=MMUBA13:001661001:pdf>)

(*Scathing critique of observations and conclusions of Waterschoot van der Gracht (1915) paper on C Sulawesi, based on his 11 days of geological fieldwork and literature study. Eocene Nummulites limestones overlie purple-red globigerinid-bearing clay-shales, not interbedded with but them. Red shales likely of Late Cretaceous age, not Eocene. Etc. etc.*)

Abendanon, E.C. (1915)- Midden Celebes Expeditie- Geologische en geographische doorkruisingen van Midden-Celebes (1909-1910). E.J. Brill, Leiden, vol. I, p. 1-451.

(online at: <https://resolver.kb.nl/resolve?urn=MMKB02:100003010:pdf>)

(*'Geologic and geographic traverses of Central Sulawesi (1909-1910)'. First of 4 volumes + Atlas of classic first geological reconnaissance traverses of C Sulawesi, sponsored by Royal Dutch Geographical Society (KNAG). With 7 maps and 22 cross-sections in Atlas volume. Vol. I with reports of rock observations on 1909 traverses of Latimojong Mts, Saadang, Masupu and Mamasa Rivers, and Rante Pao- Palopo. Metamorphic rocks, M Eocene Nummulites limestones volcanics, etc.*)

Abendanon, E.C. (1915)- Midden Celebes Expeditie- Geologische en geographische doorkruisingen van Midden-Celebes (1909-1910). E.J. Brill, Leiden, vol. II, p. 453-944.

(online at: <https://www.delpher.nl/nl/boeken/view?identificer=MMUBL07:000004749:00015>)

(*Continuation of 1909- 1910 fieldwork report, with traverses of Malili River, Matana Lake, Kolonodale (areas with widespread 'peridotite plate', ~1000m thick, overlying Mesozoic?, also gabbro, some radiolarite, etc.). Also Poso Depression (metamorphics, incl. glaucophane schist), Koro to Lariang (common metamorphics, volcanics), Sarasin graben, Pare Pare, Donggala, etc. Folded schist in C Sulawesi commonly steeply dipping and strike in E-W direction. Page 823: Post-Eocene folding followed by Oligocene penneplanisation, followed by Neogene folding and uplift up to 2000m. With 6 maps and 21 cross-sections in Atlas volume)*

Abendanon, E.C. (1917)- Midden Celebes Expeditie- Geologische en geographische doorkruisingen van Midden-Celebes (1909-1910). E.J. Brill, Leiden, vol. III, p. 953-1381.

(online at: <https://resolver.kb.nl/resolve?urn=MMKB02:200000040:pdf>)

(*Volume with reports on palaeontology:(1) brief note by G.J. Hinde on poorly preserved Late Mesozoic radiolaria ('remnescent of radiolarian cherts from U Kapuas region of N Kalimantan'; 'probably not older than Jurassic') and small foraminifera, (2) G.F. Dollfus on identifications of Cretaceous - Tertiary fossils (incl.*

M Eocene larger foraminifera Nummulites, Alveolina, Orthophragmina (= Discocyclina), Pellatispira and molluscs). Also extensive report on petrography of igneous and metamorphic rocks by W.F. Gisolf)

Abendanon, E.C. (1917)- Midden Celebes Expeditie- Geologische en geographische doorkruisingen van Midden-Celebes (1909-1910). E.J. Brill, Leiden, vol. IV, p. 1383-1902.

(online at: <https://www.delpher.nl/nl/boeken/>)

('Synthesis volume' on rock types and stratigraphy (incl. gneiss, thick series of ?Precambrian schists, >1000m thick ?Triassic peridotites with 'shell' of associated basic igneous gabbro, diabase, tuffs and deep marine red radiolarite, U Cretaceous claystones, granite laccoliths, M Eocene clastics with coal and Nummulites limestone, E Tertiary tuffs, E Miocene reefal limestones, Mio-Pliocene volcanics, etc.), and tectonics of Sulawesi. Final chapters on Recent freshwater molluscs and fishes, economic geology and historic maps)

Abendanon, E.C. (1916-18)- Voyages géologiques et géographiques à travers la Celebes centrale. Brill, Leiden. 3 volumes + Atlas, p. 1-1549.

(vol. 3 online at: <https://www.delpher.nl/nl/boeken/view?identifiser=MMKB31:044099000:00001>)

('Geologic and geographic travels across Central Sulawesi'. French translation of Dutch Abendanon books, above)

Abendanon, E.C. (1916)- De oude beddingen der Beneden-Sadang River. Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap 33, 3, p. 429-449.

(online at: <https://www.delpher.nl/nl/tijdschriften/view?identifiser=MMUBA13:001662001:00006>)

('The old courses of the Lower Sadang River'. Sadang River in SW Sulawesi now drains W into Makassar Straits, but river shifted 25 km N from old Sadang delta at Jampua 50 years ago. Diversion appears to point to ~5m of uplift in last 50 years)

Abendanon, E.C. (1916)- Schetskaart van Midden-Celebes. Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap 33, 2p.

(online at: <https://www.delpher.nl/nl/tijdschriften/view?identifiser=MMUBA13:001662001:00006>)

('Overview map of Central Sulawesi'. Also reprint of map IX in Abendanon (1915-1917))

Abendanon, E.C. (1916)- De geomorphologische beteekenis der basische stollingsgesteenten in het middendeel van den Ned.- Ind Archipel. Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap 33, 5, p. 742-749.

(online at: <https://resolver.kb.nl/resolve?urn=MMUBA13:001662001:pdf>)

('The geomorphologic meaning of the basic igneous rocks in the central part of the Netherlands Indies archipelago'. The 7000 km² large peridotite massif of Verbeek Mountains in C Sulawesi enveloped by gabbroid rocks, then diabase, diabase breccias and diabase tuffs (this description of peridotite-gabbro-basalt succession is an interesting early observation of the now well-known upper mantle- oceanic crust sequence; HvG). Assumes pre-Triassic age. Similar relationships described from 5 other of peridotite cores with gabbro-diabase envelopes: Halmahera-Waigeo, Obi, Ambon- East Ceram, Timor-Moa and Sumba (latter problematic?))

Abendanon, E.C. (1916)- Een palaeogeographische gevolgtrekking in verband tot de kristallijne schistenformatie van Midden Celebes. Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie 3 (Molengraaff volume), p. 171-190.

(online at: <https://ia601908.us.archive.org/30/items/verhandelingsva3191geol/verhandelingsva3191geol.pdf>)

('A paleogeographic conclusion from the crystalline schist formation of Central Sulawesi'. C Sulawesi belt of metamorphic rocks between Bone Gulf and Tomini Bay interpreted as part of larger Precambrian Asian-Australian continent, with proposed name of 'Aequinoctia'. Started to break up in Permo-Carboniferous)

Abendanon, E.C. (1917)- Historische geologie van Midden-Celebes. Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap (KNAG) 34, p. 440-456 and p. 547-564.

('Historical geology of Central Sulawesi'. Write-up of presentation on geology of Central Sulawesi for KNAG)

Abendanon, E.C. (1918)- Ontdekking van belangrijke delfstoffen-afzettingen in Ned.-Indie (Midden-Celebes) op grond van een geologischen verkenningstocht. De Ingenieur, Delft, 1918, 33, 7, p. 107-121.

(reprint online at: <https://resolver.kb.nl/resolve?urn=MMKB31:037072000:pdf>)
(*'Discovery of important mineral deposits in the Netherlands Indies (Central Sulawesi) based on a geological reconnaissance trip'. First report on presence of lateritic iron, nickel and chrome deposits associated with peridotites in the 'Verbeek Mountains' near Matano and Towuti lakes*)

Abendanon, E.C. (1918)- De ijzer-, nikkel- en chroomertsen op Midden-Celebes. Voordracht 'Nederlandsche Afdeeling Maatschappij van Nijverheid en Landbouw, The Hague, November 1918, Reprint from 'De Indische Mercur' 1918, De Bussy, Amsterdam, p. 1-64.

(read online at: <https://uvaerfgoed.nl/beeldbank/en/xview/?identificer=hdl:11245/3.31308>)

(*'The iron, nickel and chromium ores in Central Sulawesi'. Extensive documentation of a presentation on the occurrences, chemistry and mining feasibility of nickel-iron-chromium ores associated with peridotites-serpentinites in Central Sulawesi, held in The Hague in November 1918*)

Abendanon, E.C. (1919)- Midden-Celebes, een antikritiek. Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap 36, p. 49-97.

(online at: <https://resolver.kb.nl/resolve?urn=MMUBA13:001665001:pdf>)

(*'Central Sulawesi, a reply'. Reply to extensive critical discussion of Abendanon 1916-1918 Sulawesi volumes by Wing Easton (1918), 'Rustig of dansend Celebes'*)

Abendanon, E.C. (1920)- Een jong-palaeozoisch en een devonisch fossiel van Celebes? De Ingenieur, Jaargang 35, No. 1920-5 (31 January 1920), p. 79-80.

(online at: <https://www.delpher.nl/nl/tijdschriften/> Etc.)

(*'A Late Paleozoic and a Devonian fossil from Sulawesi?' First letter to the journal editor, questioning two communications by Brouwer (1919) reporting occurrences of a Permian Popanoceras ammonite and a Devonian Spirifer brachiopod, from an unknown location believed to be in Kalosi region of C Sulawesi). Abendanon questions the Sulawesi origin of these fossils, partly because he visited the region and never came across Paleozoic deposits*)

Abendanon, E.C. (1921)- Een jong-palaeozoisch en een devonisch fossiel van Celebes? De Ingenieur, Jaargang 36, No. 1921-5 (29 Januari 1921), p. 102-103.

(online at: <https://www.delpher.nl/nl/tijdschriften/> Etc.)

(*'A Late Paleozoic and a Devonian fossil from Sulawesi?' Follow-up letter to Abendanon (1920) critique of Brouwer(1919) report of Paleozoic/Devonian fossils from Sulawesi*)

Abendanon, E.C. & S.J. Vermaes (1915)- Nota's betreffende het voorkomen van nikkel- en ijzerertsen in het Verbeek-Gebergte tusschen Midden-Celebes en het Zuidoostelijke Schiereiland. The Hague, p. 1-45.

(read online at: <https://uvaerfgoed.nl/beeldbank/xview?identificer=hdl:11245/3.34859>)

(*'Reports on the occurrences of nickel and iron ores in the Verbeek Mountains between Central Celebes and the SE Peninsula'. Report by Abendanon on geology and by Vermaes on chemical analyses. Results suggest presence of exploitable nickel and iron ore deposits in drainage area of the Malili River. With one map*)

Adam, J.W.H. (1922)- Over de resultaten eener proefontginning van nikkelertsafzettingen nabij Soroako (Celebes). Jaarboek Mijnwezen Nederlandsch Oost-Indie 49 (1920), Verhandelingen 1, p. 201-249.

(*Results of test exploitation of nickel ore deposits near Soroako on S side of Matano lake, central East Sulawesi. Nickel ore on weathered surface of large peridotite body (mainly dunite). Concentrations of nickel ore typically 3-4% Ni, some over 7%, not as high as New Caledonia*)

Adam, M., A. Jaya, M. Mawaleda & I. Nur (2024)- Geology and characteristics of epithermal gold mineralization at the Motongkad Prospect, North Sulawesi, Indonesia. Gospodarka Surowcami Mineralnymi (Mineral resources management; Krakow, Poland) 40, 1, p. 213-232.

(online at: <https://gsm.min-pan.krakow.pl/pdf-175245-107427?filename=Geology-and-characteristi.pdf>)

(*Epithermal gold mineralization in Motongkad prospect, East Bolaang Mongondow Regency. Hosted in M Miocene andesitic-basaltic breccia, lava and tuff, intruded by andesite dikes. Fine quartz veins with gold, silver and pyrite. Part of Tertiary W Sulawesi and Quaternary Minahasa-Sangihe volcanic arc*)

Adhitiya, R., S.S. Angkasa, V. Oryzavica, A.R. Parinduri, D. Wirasatia & R. Adiarsa (2010)- Re-appraisal, tectonic and sedimentary control of Bone Basin and implication to Cenozoic multi hydrocarbon play. Proc. 39th Annual Conv. Indonesian Association Geologists (IAGI), Lombok, PIT-IAGI-2010-088, p. 1-12. *(In Indonesian)*

(online at: www.iagi.or.id/web/digital/12/2010_IAGI_Lombok_Re-Appraisal,-Tectonic-and-Sedimentary.pdf)
(Literature summary of S Sulawesi Bone Basin, borrowing heavily from Yulihanto 2004)

Advokaat, E.L. (2015)- Neogene extension and exhumation in NW Sulawesi. Ph.D. Thesis Royal Holloway University of London, p. 1-347. *(Unpublished)*

Advokaat, E., R. Hall, L. White, R.A. Armstrong, B.P. Kohn & M. BouDagher-Fadel (2014)- Neogene extension and exhumation in NW Sulawesi. American Geophysical Union (AGU), Fall Meeting, San Francisco, T43A-4701, 1p. *(Poster + Abstract)* *(online at:*

www.researchgate.net/publication/269722353_Neogene_Extension_and_exhumation_in_NW_Sulawesi)

(Crustal extension important in Neogene development of Sulawesi. North Arm with Eocene- Lower Miocene basalts intercalated with radiolarian chert and volcanoclastics, intruded by granitoids with zircon ages from ~9.4- 8.2 Ma. Beneath these rocks is Malino Metamorphic core complex quartzo-feldspathic schist-gneiss with zircon rim ages of ~15.4 Ma, surrounded by discontinuous greenschist carapace, intruded by granitoids with ages of 4.9- 3.8 Ma. Late stage exhumation by high angle oblique normal faults between ~3.3 and 1.4 Ma. E Pliocene- E Pleistocene sediments crosscut by normal faults. Two phases of extension in N Sulawesi: M Miocene and Late Pliocene-Pleistocene)

Advokaat, E., R. Hall, L. White, I.M. Watkinson, A. Rudyawan & M.K. BouDagher-Fadel (2017)- Miocene to Recent extension in NW Sulawesi, Indonesia. J. Asian Earth Sciences 147, p. 378-401.

(online at: https://www.academia.edu/76593139/Miocene_to_recent_extension_in_NW_Sulawesi_Indonesia)

(Malino Metamorphic Complex (MMC) in W part of N Arm of Sulawesi previously thought to be metamorphic complex exhumed in E-M Miocene. New data suggest MMC metamorphic core complex underwent E-M Miocene extension, but no exhumation at this time: (1) Pliocene undeformed granitoids intrude MMC indicating complex still at depth and (2) Pliocene- Pleistocene cover sequences do not contain metamorphic detritus. Second phase of extensional uplift with brittle faulting from Late Miocene-Pliocene onwards, with MMC exhumation (synchronous exhumation of adjacent Palu Metamorphic Complex in W Sulawesi, and rapid offshore subsidence in Gorontalo Bay). Linked to N-ward slab rollback of S-subducting Celebes Sea since Pliocene, and ongoing at present day)

Aernout, W.A.J. (1927)- Enkele opmerkingen over de ertsmijn "Paleleh". De Mijningenieur 8, 9, p. 135-141. *(Some remarks on the ore mine 'Paleleh', North Sulawesi)*

Agard, P., P. Yamato, L. Jolivet & E. Burov (2009)- Exhumation of oceanic blueschists and eclogites in subduction zones: timing and mechanisms. Earth-Science Reviews 92, p. 53-79.

(Review of buoyancy-driven exhumation of continental rocks that converted to blueschist-eclogite in subduction zone exhumation. With brief discussion of Sulawesi Cretaceous Bantimala Complex, which represents exhumed wedge of Cretaceous subduction and is mainly made of mafic bodies and volcanoclastics, with eclogite blocks embedded in serpentinites. Ultramafic units occupy internal position)

Ahlburg, J. (1910)- Uber den geologischen Aufbau von Nordcelebes. Zeitschrift Deutschen Geologischen Gesellschaft, Berlin, 62, Monatsberichte 3, p. 191-202.

(online at: <https://archive.org/details/zeitschriftder621910deut>)

(On the geological structure of North Sulawesi)

Ahlburg, J. (1910)- Der Vulkan Soputan in der Minahassa (Nordcelebes). Zeitschrift Deutschen Geologischen Gesellschaft, Berlin, 62, p. 665-668.

(online at: https://www.zobodat.at/pdf/Z-dtsch-Geol-Ges_62_0665-0668.pdf)

(‘The Soputan volcano in the Minahassa (North Sulawesi)’. Mainly reaction to critical comments by Wichmann. Ahlburg climbed Soputan in June 1909, observing changes in top of volcano after 1838 eruption. No figures)

Ahlburg, J. (1911)- Zur Umrissform der Insel Celebes. Einige Bemerkungen zu dem gleichlautenden Aufsatz des Herrn Von Staff. Zeitschrift Deutschen Geologischen Gesellschaft, Berlin, 63, p. 399-405.

(online at: <https://www.biodiversitylibrary.org/item/182872#page/1097/mode/1up>)

(‘On the outline of Sulawesi- some remarks on the paper of Mr. Von Staff of the same title’. Commentary on by Von Staff (1911) paper on tectonic zones and fault patterns of Sulawesi. No figures (see also Abendanon 1912))

Ahlburg, J. (1911)- Nochmals der Vulkan Soputan in der Minahassa. Zeitschrift Deutschen Geologischen Gesellschaft, Berlin, 63, p. 505-507.

(online at: https://www.zobodat.at/pdf/Z-dtsch-Geol-Ges_63_0505-0507.pdf)

(‘Once more the Soputan volcano in the Minahassa (North Sulawesi)’. Presumably response to Wichmann (1919 critique. No figures)

Ahlburg, J. (1913)- Versuch einer geologischen Darstellung der Insel Celebes. Geologische Palaeontologische Abhandlungen, Neue Folge 12, 1, p. 3-172.

(online at: <https://archive.org/details/geologischeundpa12jena/page/n9/mode/2up>)

(also online at: www.zobodat.at/pdf/Geol-pal%C3%A6ontol-Abh_NF_12_0003-0172.pdf)

(‘Attempt of a geological description of Sulawesi island’. Early overview of Sulawesi geology, partly based on observations on North arm along Tomini Bay in 1909, partly compilation of published data. (S Sulawesi part criticized by Van Waterschoot van der Gracht 1915))

Ahmad, W. (1978)- Geology along the Matano Fault Zone, East Sulawesi. In: S. Wiryosujono & A. Sudradjat (eds.) Proc. Regional Conference Geology and Mineral Resources of SE Asia (GEOSEA), Jakarta 1975, Indonesian Association Geologists (IAGI), p. 143-150.

(170km long, WNW-ESE trending Matano Fault Zone in N part of SE Arm of Sulawesi. Lake Matano graben-like structure between overstepping fault segments. Observed left-lateral offsets of old geologic contacts ~20km; several young stream offsets of 200-600m)

Akbar, K., A.S. Subandrio & Masri (2023)- Studi mineralisasi kromit podiform pada kompleks ofiolit di daerah Tapunopaka, Konawe Utara, Sulawesi Tenggara. Ophiolite: Jurnal Geologi Terapan 5, 1, p. 15-21.

(online at: <https://ophiolite.uho.ac.id/index.php/journal/article/view/7/4>)

(‘Study of podiform chromite mineralization in the ophiolite complex of the Tapunopaka area, North Konawe, SE Sulawesi’. Chromite mineralization in dunite and harzburgite of E Sulawesi Ophiolite complex)

Alya, C.B.R., Rendy, D. Syavitri, Y. Sutadiwiria, A. Livsey & S. Reno (2023)- Paleogene calcareous nannofossil chronostratigraphy at “CB” well, South Makassar Basin. Conference Paper?, p. 1-9.

(online at: https://repository.karyailmiah.trisakti.ac.id/documents/repository/artikel_yarra-sutadiwira-paleogene-calcareous-nannofossil-chronostratigraphy-at-cb-well-south-makassar-basin.pdf)

(Trisakti University paper on nannofossils in Balangbaru and Toraja Fms of 9-2286m interval in ‘CB’ well on Tanakeke Island, off S Sulawesi coast. Balangbaru Fm (Maastrichtian) and Toraja Fm synrift clastics, coals and limestones (M Eocene (Ypresian) to M Oligocene; NP16-NP23e; ~1400m thick) identified. Paleocene missing)

Andi Mangga, S. (2004)- Tinjauan lingkungan tektonik batupasir Formasi Kalumpang di daerah Kalumpang, Kabupaten Mamuju, Sulawesi Selatan. Jurnal Sumber Daya Geologi (JSDG) 14, 2 (146), p. 26-36.

(‘Observations on tectonic setting of the Kalumpang Fm sandstone in the Kalumpang area, Mamuju District, S Sulawesi’. Eocene Kalumpang Fm clastics at Karama River, W Sulawesi, quartz sandstone and claystone with minor coal and limestone, with clasts derived from metamorphic, igneous and sedimentary terranes (‘quartzose recycled orogen’))

Andi Mangga, S., M. Heri H.Z. & T. Sihombing (2005)- Tinjauan geologi dan potensi batubara daerah Sulawesi Selatan. Jurnal Sumber Daya Geologi (JSDG) 15, 1 (148), p. 124-142.

('Observations on the geology and coal potential of the South Sulawesi area'. Tertiary basins of S Sulawesi Makassar Straits, Lariang, Karama Makassar and Bone Basins. Formed due to rifting between E Eocene and E Miocene. coal deposits in M-L Eocene of Mamuju (NW) and Enrekang (NE) and E-M Miocene in Barru-Bone Block (S))

Andi Mangga, S., T. Sihombing & M.H.Z. Heri (2004)- Tinjauan lingkungan tektonik batupasir Formasi Kalumpang di daerah Kalumpang, Kabupaten Mamuju, Sulawesi Selatan. *Jurnal Sumber Daya Geologi (JSDG)* 14, 2, p. 26-36.

('Overview of the tectonic environment of the Kalumpang Formation sandstone in the Kalumpang area, Mamuju Regency, South Sulawesi')

Andreason, M.W., A.F. Chatfield, J.A. Curiale, M.V. Filewicz, E.D. Lumadyo et al. (2000)- Exploration in the gravity collapse rifts of the Salayar Basin, Indonesia. AAPG 2000 Annual Meeting (*Abstract only*)

(Salayar Basin offshore SW Sulawesi (S end Makassar Straits) gravity collapse rift formed in M Cretaceous along SE Sunda shield margin. Salayar and SE Sunda margin basins differ from typical Indonesian back-arc basins due to Cretaceous main rift event and crustal thickening prior to Paleocene-Eocene source deposition. Sequence of events: (1) E Cretaceous accretion, thrusting, granite intrusion, low-angle subduction; (2) Mid-Cretaceous collapse due to Australian plate roll-back, deposition of deepwater flysch; (3) Late Cretaceous isostatic adjustment of rift blocks; (4) Paleocene-M Eocene rifting, deposition in alluvial, lacustrine, and fluvio-deltaic environments; (5) Late Eocene- Late Oligocene post-rift quiescence, carbonate platform development on basin margins, deepwater marls- shales in basin center; (6) Late Oligocene- M Miocene inversion; (7) M Miocene- present relative tectonic quiescence, sediment starved conditions, infill of lows)

Andreuttiova, L., (2015)- The origin of Colo Volcano: implications for deep melting and adakite formation. M.Sc. Thesis, The University of Edingburgh, p. 1-62. (*Unpublished*)

Anggayana, K., T. Darijanto & S. Widodo (2003)- Studi mineral pirit sebagai salah satu sumber sulfur pada batubara: kasus batubara dari Kabupaten Barru Sulawesi Selatan. *Jurnal Teknologi Mineral (JTM)*, (ITB, 10, 1, p. 3-14. (*online at:*

https://www.researchgate.net/publication/370338793_Studi_pirit_sebagai_sumber_sulfur_pada_batubara)
('Study of pyrite minerals as main source of sulfur in coal: case from the Barru Regency, South Sulawesi'. Barru region coals rel. poor quality, with high sulfur and ash. Sulfur mainly as framboidal pyrite. No location details)

Anonymous (1920)- Uitkomsten van mijnbouwkundige onderzoeken in een gedeelte van Midden-Celebes (Sasak). Verslagen Mededeelingen Indische Delfstoffen en hare Toepassingen, Dienst Mijneuzen Nederlandsch Oost-Indie, 12, p. 1-64 + plates.

(online at: <https://resolver.kb.nl/resolve?urn=MMKB24:078904000:pdf>)

('Results of mining investigations in a part of Central Sulawesi (Sasak)'. Report on survey of copper and iron deposits in C Sulawesi between 1911-1917 by Bureau of Mines mining engineers Van der Kloes, Reijzer, Macke and Wolvekamp. Surveys of terrains Sasak, Masupu and Bobokan in Toraja region did not result in identification of commercial deposits. With Geological sketch map of Tae-Toradja lands + detail maps)

Anshariah, A.M. Imran, U.R. Irfan, A. Nawir & A.A. Budiman (2018)- Characterization and reconstruction of deposit facies of Mallawa Coal Formation of South Sulawesi based on proximate and petrography analysis. *Int. Conf. Industrial Technology for Sustainable Development (Icon-ITSD)*, Makassar 2017, IOP Conference Series: Earth and Environmental Science 175, 012019, p. 1-9.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/175/1/012019/pdf>)

(Coal of Eocene Mallawa Fm in S Sulawesi distributed across Maros, Pangkep, Barru, Soppeng and Bone Municipalities. Generally rel. thin seams and high sulfur content (>2%))

Anshariah, A.M. Imran, S. Widodo & U.R. Irfan (2021)- The influence of intrusion on change characteristic of coal in Mallawa Formation of South Sulawesi Province. *Proc. 3rd Int. Conf. Global Issue for Infrastructure, Environment, and Socio-Economic Development (GIESED 2020, Makassar)*, IOP Conference Series: Earth and Environmental Science 921, 012054, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/921/1/012054/pdf>)
(Samples of coal from Eocene Mallawa Fm coal in Maros District of SW Sulawesi, Lanne District (Pangkep Regency) and Massenrengpulu Region (Bone Regency). Rel. high ash and moisture contents)

Apandi, T. (1977)- Geologic map of the Kotamobagu quadrangle, North Sulawesi, 1:250,000. Geological Research Development Centre (GRDC), Bandung.
(See also 2nd edition by Apandi & Bachri (1997), below)

Apandi, T. & S. Bachri (1997)- Geologic map of the Kotamobagu quadrangle, North Sulawesi, 1:250,000. Geological Research Development Centre (GRDC), Bandung, 2n Ed.
(Geologic map in eastern half of Sulawesi North Arm. Part of volcanic arc, above double subduction zone: Celebes Sea subduction from North (active since E Tertiary) and E Sangihe subduction zone to E (active since E Quaternary). Oldest rock Eocene (and older?) Tinombo Fm deep marine clastics, chert and red limestone with pillow basalts (50 Ma radiometric age reported in Villeneuve et al. 1990). Overlain by Miocene and younger clastics and volcanics and E-M Miocene limestones. Widespread Late Miocene Bone diorite/ granite intrusions. With E-W trending normal faults and NNW-SSE (right lateral) and NNE-SSW (left-lateral) strike slip faults. More than one compressional tectonic episodes: older isoclinal folding and younger open folding)

Ardiansyah, M., M. Farida & U.R. Irvan (2015)- Studi provenance batupasir Formasi Walanae daerah Lalebata Kecamatan Lumary Kabupaten Bone Provinsi Sulawesi Selatan. J. Penelitian Geosains (Hasanuddin University) 11, 1, p. 13-18.
(online at: <https://journal.unhas.ac.id/index.php/jpg/article/view/802/556>)
(Provenance of sandstones of Walanae Fm from S Sulawesi. "Walanae sandstone derived from surrounding formations" (result perhaps not unexpected. no age of formation mentioned, no location maps; JTvG))

Ardiansyah, R., I. Kusuma, H. Kamaruddin, R.R. Wibawa & M.R. Kamil (2015)- Geological prospect, resource and ore reserve estimation in Pomalaa, Kolaka, Southeast Sulawesi, Indonesia. In: N.I. Basuki (ed.) Proc. Indonesian Soc. Economic Geologists (MGEI) 7th Annual Conv., Balikpapan, p. 67-76.
(Pomalaa nickel mine in SE Sulawesi in nickel laterite derived from ultramafic rocks (harzburgite, dunite, etc.) of E Sulawesi ophiolite. Slopes between 3°-15° produce ~2- 7 m thick nickel saprolite zone, with Ni grade of 1.8-2.2%)

Ardianto P. & N. Azman (1990)- Kajian geologi daerah Sulawesi Tenggara dalam kaitannya dengan prospek hidrokarbon. Proc. 19th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 1, p. 136-148.
(online at: [https://www.iagi.or.id/web/digital/47/19th-\(11-13-Des-1990\)-Book-I-144-156.pdf](https://www.iagi.or.id/web/digital/47/19th-(11-13-Des-1990)-Book-I-144-156.pdf))
(Study of the geology of the Southeast Sulawesi region in relation to hydrocarbons prospectivity'. Tertiary section above metamorphics-ophiolite starts with 'Langkawala Fm' Eocene conglomeratic sandstones?. Not much detail)

Arifin, Y.I., J. Rauf, N. Akase, F.R. Djibran, Nurfaika, A. Lakilo, M. Jahja & M. Sakakibara (2025)- Integrated geological mapping and spatial distribution of heavy metal contamination with geoaccumulation index assessment in Juriya's artisanal gold mining region, Gorontalo, Indonesia. J. Hazardous Materials Advances 19, 100861, p. 1-16.
(online at: <https://www.sciencedirect.com/science/article/pii/S2772416625002724>)
(Juriya artisanal gold mining area in Bilato District, Gorontalo Regency, N Sulawesi. Geology mainly Andesite Unit (Eocene-Oligocene) and Diorite Unit (M-L Miocene). High risks of mercury and other metals contamination from use of mercury in widespread artisanal gold mining processes, as well as environmental degradation)

Arisona, N.K. Praja, Eldin, Masri, Muliddin, A. Okto, Hasria & Bahdad (2024)- Mikrofasies batugamping Formasi Tokala daerah Ululere dan sekitarnya, Kabupaten Morowali Sulawesi Tengah. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 25, 1, p. 19-30.
(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/786>)

(‘Limestone mikrofacies of the Tokala Formation in the Ululere area and surroundings, Morowali Regency, Central Sulawesi’. Study of ‘Tokala Limestone’ facies (supposedly of Triassic- Jurassic age, but describe thin sections with planktonic foram Globotruncana, which would mean Upper Cretaceous, but illustrations too poor to verify anything- JTvG))

Arosi, H.A.H. (2016)- Regional versus global controls on the diagenesis and reservoir quality of Tertiary carbonate platforms. Ph.D. Thesis, Curtin University, Perth, p. 1-262.
(online at: <https://espace.curtin.edu.au/handle/20.500.11937/66684>)
(Influence of regional versus global controls on diagenesis and reservoir quality of Tertiary carbonate platforms, in particular Cenozoic syntectonic Tonasa Fm in SW Sulawesi. Thesis collection of 4 papers and supervised by Moyra Wilson. Equatorial Tonasa carbonate platform up to 600m thick and affected by block faulting, tilt-block rotation, differential uplift, subsidence and volcanic activity throughout M Eocene- E-M Miocene history)

Arosi, H.A. & M.E.J. Wilson (2015)- Diagenesis and fracturing of a large-scale, syntectonic carbonate platform. *Sedimentary Geology* 326, p. 109-134.
(online at: https://www.researchgate.net/publication/280580950_Diagenesis_and_fracturing_of_a_large-scale_syntectonic_carbonate_platform)
(Tonasa Limestone Fm of SW Sulawesi developed in extensional regime, with block faulting, tilt-block rotation, differential uplift and subsidence throughout Eocene- E Miocene history. Carbonate alteration in shallow to deeper burial depths by fluids with predominantly marine precursor origins)

Aryani, S.C. & R.Sinaga (2010)- Potential prospect of Au-base metal mineralization in Esang, Mamasa, West Sulawesi, Indonesia. Proc. 39th Annual Conv. Indonesian Association Geologists (IAGI), Lombok, p. 1-7.
(online at: https://www.iagi.or.id/web/digital/12/2010_IAGI_Lombok_Potential-Prospect-of-Au-Base.pdf)
(Esang gold and base metal mineralization in W Sulawesi hosted in Cretaceous Latimojong Fm metasediments and Miocene- Pliocene andesite lava of Talaya Fm)

Ascaria, N.A. (1997)- Carbonate facies development and sediment evolution of the Miocene Tacipi Formation, South Sulawesi, Indonesia. Ph.D. Thesis, University of London, p. 1-397. *(Unpublished)*
(Tacipi Fm 300m thick Middle-Late Miocene reefal limestones, outcrops over 1500 km² in eastern S Sulawesi. Tectonic activity controlled facies development in M-L Miocene)

Ascaria, N.A. (1998)- Control on carbonate sedimentation of Tacipi Formation, South Sulawesi, Indonesia. *Berita Sedimentologi* 10, p. 16-17.
(online at: <https://journal.iagi.or.id/index.php/FOSI/article/view/277>)
(Brief summary of M Miocene- E Pliocene Tacipi Fm limestones of SW Sulawesi deposited in intra-arc or forearc setting. 300-700m thick, outcrops in area of 1500 km², also in Sengkang basin subsurface (economic gas reservoir). Outcrops in N isolated knoll reefs with deeper water M Miocene shallowing upward into Late Miocene reef complexes. In S Bone region M Miocene shallow marine carbonates. Tectonic control on facies distribution)

Ascaria, N.A. & N.A. Harbury (1997)- Tacipi Limestone facies distribution and sequence development, Mio-Pliocene, South Sulawesi, Indonesia. *Berita Sedimentologi* 5, p. 1-3. *(Extended Abstract)*
(online at: <https://journal.iagi.or.id/index.php/FOSI/article/view/302/271>)
(S Sulawesi was fore-arc region of Sundaland in Late Cretaceous with the deposition of deep marine siliciclastics. This evolved into back arc setting in Eocene, and a thick succession of acidic and basic volcanics developed from Eocene- E Miocene. Following this volcanic phase carbonate sedimentation dominated in M Miocene- E Pliocene (Tacipi and Walanae Fms).

Ascaria, N.A., N.A. Harbury & M.E.J. Wilson (1997)- Hydrocarbon potential and development of Miocene knoll-reefs, South Sulawesi. In: J.V.C. Howes & R.A. Noble (eds.) Proc. Conference Petroleum Systems of SE Asia and Australasia, Jakarta 1997, Indonesian Petroleum Association (IPA), p. 569-584.

(Taciapi Fm M Miocene (Tf2-3)- E Pliocene (Tg) intra-arc or forearc carbonates. Thickness 300-700m. Subcrops in Sengkang Basin form economic gas reservoirs. Dominant lithologies reef facies, packstones and wackestones. Northern outcrops (N Bone Region) isolated knoll-reefs, displaying N-S trend, surrounded by deeper-water facies. Buildups composed of deeper-water M Miocene facies at base and shallow upwards into Late Miocene reef complexes. Differential subsidence resulted in variations in time of drowning of reefs. Fine grained clastics and volcanoclastics cover reefs and act as seals)

Asfar, S., A. Maulana, U.R. Irfan & Sufriadin (2023)- Laterite profile study of highly weathered ultramafic rocks from the southern part of Southeast Sulawesi. Proc. 4th Int. Conference Global issues for infrastructure, environment and socio-economic development (GIESED), Makassar 2021, IOP Conference Series: Earth and Environmental Science 1134, 012043, p. 1-11.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1134/1/012043/pdf>)

(7 types of laterite weathering profiles over Cretaceous ultramafic rocks in S Konawe Regency in southernmost SE Arm of Sulawesi)

Ashton, P.R. (1976)- Miocene algal reef mounds, Sengkang province, Sulawesi. Proc. Carbonate Seminar, Jakarta 1976, Indonesian Petroleum Association (IPA), p. 122. *(Abstract only)*

(S edge of Sengkang Basin, S Sulawesi, well exposed outcrops of algal reef limestone. Numerous discrete bioherms, rooted in U Miocene limestone platform and covered by U Miocene- Pliocene pelagic calcareous mudstones. Bioherms mainly of calcareous algae; corals significant only at base)

Asmariyadi, R. Langkoke, A. Maulana, I. Nur & W. Astaman (2012)- Ore characteristics and fluid inclusion of the base metal vein deposit in Moncong Bincanai Area, Gowa, South Sulawesi, Indonesia. Jurnal Geologi Indonesia 7, 4, p. 189-197.

(online at: <http://jgi.bgl.esdm.go.id/index.php/JGI/article/view/43/32>)

(Moncong Bincanai mineralization veins in basalt, consisting of galena, sphalerite, chalcopyrite, and pyrite, with Pb 47.9%, Cu 1.3%, Zn 1.0%, and Fe 9.5%. Fluid inclusion microthermometry indicate formation T of ~250°C. Categorized as low-sulfidation epithermal deposits, formed at 410-440m below paleosurface)

Asyiah, S., M.R. Suwondo & R. Waren (2010)- Eocene- Miocene plate tectonic habitats and structural style of Gorontalo Basin, Sulawesi. Proc. 39th Annual Conv. Indonesian Association Geologists (IAGI), Lombok, PIT-IAGI-2010-006, p. 1-13. *(English title but all in Indonesian)*

(online at: https://www.iagi.or.id/web/digital/12/2010_IAGI_Lombok_Eocene-Miocene-Plate.pdf)

(Tectonic reconstruction of Gorontalo Basin)

Audley-Charles, M.G. (1974)- Sulawesi. In: Mesozoic-Cainozoic orogenic belts, Geological Society, London, Special Publ. 4, p. 365-378.

(online at: http://searg.rhul.ac.uk/pubs/audley-charles_1974%20Sulawesi.pdf)

(Elegant, but now somewhat dated overview of Sulawesi geology)

Avicenna, M.F., Sufriadin, A.A. Budiman & S. Widodo (2019)- Analisis mineralogi dan kualitas batubara Desa Kadingeh, Kecamatan Baraka, Kabupaten Enrekang, Sulawesi Selatan. Jurnal Geomine 7, 2, p. 114-123.

(online at: <https://jurnal.teknologiindustriumi.ac.id/index.php/JG/article/view/411/pdf>)

(Mineralogy and coal quality analysis of Kadingeh Village, Baraka District, Enrekang Regency, S Sulawesi. Little or no geology)

Azarine, A., M.A. Azzaman & A. Idrus (2021)- Karakteristik alterasi dan mineralisasi endapan emas tipe Carlin pada Blok Yance dan Leon, Kecamatan Rataotok, Kabupaten Minahasa Tenggara, Provinsi Sulawesi Utara. Jurnal Geomine 9, 3, p. 239-253.

(online at: <https://jurnal.teknologiindustriumi.ac.id/index.php/JG/article/view/1001/pdf>)

(Alteration and mineralization characteristics of Carlin type gold deposits in Blocks Yance and Leon, Rataotok District, SE Minahasa Regency, North Sulawesi'. Study of Yance and Leon prospects near Mesel gold deposit, Rataotok, indicate that limestone and collapse breccia controlled alteration and mineralization in

area. Ore minerals in Yance Block pyrite, arsenopyrite, realgar, hematite, goethite;etc.; in Leon Block pyrite and hematite)

Azhim, M.F., I.M.D. Widiastawan, N. Soraya, T.S. Dewi & T. Semedie (2022)- Geochemical and physical characteristics of nickel-cobalt laterite deposits on Maniang Island, Kolaka, Southeast Sulawesi. Proc. 51st Annual Conv. Indonesian Association Geologists (IAGI), Makassar 2022, p. 1-7.

(online at: <https://www.iagi.or.id/web/digital/71/PITIAGI-22-P-Abs-045.pdf>)

(Maniang Island located on edge of Ophiolite Belt of SE arm of Sulawesi. Ni-Co-Fe laterite with average thickness of top soil 3m, limonite 14 m, saprolite 15 m on top of peridotite-serpentinite bedrock)

Aziz, F. (1993)- Fosil fauna Sulawesi dan Batas Wallace. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 3, 21, p. 2-9.

(*Fossil faunas of Sulawesi and the Wallace Line'. Makassar Straits believed to be major faunal boundary between Asian and Australian faunas, but presence of Asian elements like Celebochoerus, Elephas, Stegodon and Geochelone in Late Pliocene- Pleistocene Walanae Fm of SW Sulawesi shows some animals were able to cross Wallace Line*)

Aziz, F. (1994)- Vertebrate faunal evolution of Sulawesi during the Late Neogene. In: R. Tsuchi (ed.) Pacific Neogene events in time and space, Contributions to the West Pacific, IGCP-246, Shizuoka University, Japan, p. 79-85.

Aziz, F., G.D. van den Bergh et al. (1995)- The geology and stratigraphy of the vertebrate-bearing deposits in the Sengkang Basin: the terrestrial faunal evolution of South Sulawesi during the Late Pliocene and Quaternary. Geological Research Development Centre (GRDC), Bandung, Special Publ. 18, p. 1-112.

(*At least three immigrations of large-sized terrestrial mammals into S Sulawesi in Late Pliocene-Quaternary. Vertebrate fauna localities in Walanae Depression/rift. East Walanae fault initiated as late M-early Late Miocene normal fault, but in Late Pliocene- Early Pleistocene compressional or left lateral strike slip faulting*)

Aziz, M.C.A. & K.A.M. Syihab (1993)- Arah pengendapan batuan Tersier, daerah Silea, Kecamatan Sampara, Kabupaten Kendari, Sulawesi Selatan. Proc. 22nd Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 2, p. 1141-1150.

(online at: [https://www.iagi.or.id/web/digital/53/22nd-Volume-2-\(6-9-Des-1993\)-539-548.pdf](https://www.iagi.or.id/web/digital/53/22nd-Volume-2-(6-9-Des-1993)-539-548.pdf))

(*Aspects of the deposition of Tertiary rocks in the Silea area, Sampara, Kendari district, S Sulawesi*)

Azzaman, M.A., A. Idrus & A.D. Titisari (2021)- Geology, hydrothermal alteration and mineralization of the Carlin-type gold deposit at South Rataotok, Southeast Minahasa Regency, North Sulawesi Province, Indonesia. Proc. Int. Conf. Ocean and Earth Sciences, Jakarta 2020, IOP Conference Series: Earth and Environmental Science 789, 012076, p. 1-9.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/789/1/012076/pdf>)

(*S Rataotok area in N Sulawesi was once gold-producing region. Includes Mesel Carlin-type gold deposit, hosted by E-M Miocene limestone. Remaining prospectivity*)

Bachri, S. (2006)- Stratigrafi lajur vulkano-plutonik daerah Gorontalo, Sulawesi. Jurnal Sumber Daya Geologi (JSDG) 16, 2 (152), p. 94-106.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/356>)

(*Stratigraphy of the volcanic-plutonic belt of the Gorontalo area', N Sulawesi. N Sulawesi mainly Eocene-Pliocene volcanics and Neogene plutonics. Oldest unit Eocene-E Miocene Tinombo Fm, in volcanic and sedimentary facies. Overlain by M Miocene-E Pliocene marine volcanics and sediments, intruded by Bone Diorite. M Pliocene acid- intermediate volcanic rocks. Late Pliocene-E Pliocene molasse with tuffs and acidic-intermediate Pinogu Volcanics with Bumbulan Granodiorite. Plio-Pleistocene reef limestone in S coast area*)

Bachri, S. (2011)- Structural pattern and stress system evolution during Neogene- Pleistocene times in the central part of the North Arm of Sulawesi. Jurnal Sumber Daya Geologi (JSDG) 21, 3, p. 127-135.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/140/137>)

(Five main trends of lineaments and faults, reflecting changes in stress system evolution during Neogene-Pleistocene, related to S-ward subduction of N Sulawesi Sea (Celebes Sea), which in Pleistocene weakened as Sangihe subduction in Molucca Sea to E commenced, resulting in change of stress field orientation)

Bachri, S. & Baharuddin (2001)- Geological map of the Majene-Malunda Quadrangle, Sulawesi, scale 1: 100,000. Geological Research Development Centre (GRDC), Bandung.

Bachri, S., E. Partoyo, D. Sukarna, Surono & J.B. Supandjono (1997)- Geologi daerah Gorontalo, Sulawesi Utara. Kumpulan Makalah Hasil Penelitian dan Pemetaan Pusat Penelitian dan Pengembangan Geologi (Collection of Research Papers and Mapping Results of the Geological Research and Development Center-GRDC) 1996/1997, p. 18-30.

(‘Geology of the Gorontalo area, North Sulawesi’. In GRDC annual report)

Bachri, S. & Sidarto & (2013)- Tektonik Sulawesi. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 303-324.

(‘Tectonics of Sulawesi’. Chapter 13 in Geology of Sulawesi book. Brief review of regional tectonics of Sulawesi. No plate reconstruction)

Bachri, S., Sukido & N. Ratman (1994)- Geological map of the Tilamuta Quadrangle, Sulawesi, 1: 250,000. Geological Research Development Centre (GRDC), Bandung.

(Geologic map in western half of North Arm of Sulawesi. Oldest rocks Eocene- E Oligocene Tinambo Fm and gabbro, intruded by Miocene Bone Diorite/ granites. Overlain by Miocene and younger clastics and volcanics)

Baese, R. (2013)- Fluid-rock interaction processes during subduction and exhumation of oceanic crust: constraints from jadeitites in serpentinites, eclogite veins in blueschists and tectonic breccias formed during uplift. Doctoral Thesis Christian-Albrechts University, Kiel, p. 1-129.

(online at: http://macau.uni-kiel.de/receive/dissertation_diss_00010505)

(Including chapters on eclogitisation, geochemistry and petrology of eclogite veins and blueschists and repeated brecciation during exhumation of subducted oceanic crust at Bantimala Complex, SW Sulawesi. Eclogite protoliths mainly Mid-Ocean Ridge Basalts (N-MORB, some Oceanic Island Basalts and formed at depths of >90 km. Blueschists protoliths also similar to N-MORB. Exhumation/ uplift process led to dismembering of subducted crust. High-pressure rocks from slices of dismembered slab incorporated into accretionary wedge sediments during upward motion of continental fragment, resulting in alternating sequence of metamorphic and sedimentary rocks in Bantimala Complex. Brecciation at different levels during exhumation, between 10-80km)

Baese, R. & V. Schenk (2012)- Repeated brittle deformation under blueschist- to subgreenschist-facies conditions during exhumation of subducted oceanic crust (Bantimala Complex, Sulawesi). Proc. European Mineralogical Conference 2012, Frankfurt, EMC2012-463, 1 p. *(Abstract only)*

(online at: <https://meetingorganizer.copernicus.org/EMC2012/EMC2012-463.pdf>)

(Discussion of exhumation of formerly deeply subducted Cretaceous oceanic crust in Bantimala Complex of SW Sulawesi. Evidence for repeated brittle deformation during uplift. Etc.)

Baese, R. & V. Schenk (2013)- Brittle deformation during exhumation of eclogites and blueschist of the Bantimala Complex, Sulawesi: evidence for intra-slab shearing. In: Symposium on tectonics, structural geology and geology of crystalline rocks, Kiel, p. 23. *(Poster Abstract only)*

(online at: <http://oceanrep.geomar.de/14846/1/Baese.pdf>)

Baharuddin & B.H. Harahap (2000)- Tinjauan kembali kerangka stratigrafi dan tektonik daerah Palopo, Sulawesi Selatan. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 10 (110), p. 24-38.

(‘Review of the stratigraphic and tectonic framework of the Palopo area, S Sulawesi’. Palopo area in NE part of S arm of Sulawesi underlain by Latimojong phyllite (>4500m; originated from Cretaceous flysch, overlain by fluvio-deltaic Eocene Toraja Fm (>1500m), U Oligocene- M Miocene Makale Fm carbonates (>1500m) and U Miocene- Pliocene Sekala Fm clastics (1800m). Lamasi Volcanic Complex probably represents oceanic

ophiolitic sequence of gabbro, dikes and pillow lavas and emplaced in M Miocene. Mio-Pliocene non-orogenic volcanism)

Baharuddin & B.H. Harahap (2003)- Lava Tersier dari Bonto Sarong Palopo, Sulawesi: ciri geokimia dan kaitannya dengan evolusi dan tektonika. In: Pros. Forum Penelitian dan Pengembangan Energi dan Sumberdaya Mineral, Badan Litbang Energi Sumberdaya Mineral, p. 377-388.

('Tertiary lavas from Bonto Sarong Palopo, Sulawesi; geochemical characteristics and relationships between its evolution and tectonics')

Baillie, P., H. Darman & T.H. Fraser (2004)- Deformation of Cenozoic basins of Borneo and Sulawesi. In: R.A. Noble et al. (eds.) Proc. Deepwater and Frontier Exploration in Asia and Australasia Symposium, Jakarta, Indonesian Petroleum Association (IPA), p. 443-461.

Baillie, P. & J. Decker (2022)- Enigmatic Sulawesi: the tectonic collage. *Berita Sedimentologi* 48, 1, p. 1-30.

(online at: <https://journal.iagi.or.id/index.php/FOSI/article/view/388/369>)

(Review of Sulawesi's complex collage of disparate tectonic terranes, brought into juxtaposition by variety of very fast tectonic processes)

Bakri, H., A.M. Imran, U.R. Irvan & A. Maulana (2024)- Petrology and geochemistry of intrusive rocks in the Tanjung Area, South Sulawesi, Indonesia: Implications for magma origin, source materials, and geodynamic setting. *Iraqi Geological J.* 57, 1C, p. 165-186.

(online at: <https://igj-iraq.org/igj/index.php/igj/article/view/1989/1894>)

(Tanjung area in Bontocane, southern S Sulawesi is within Biru Intrusive Complex and consists of two suites: (1) M-L Eocene monzonite-tonalite (most of complex) and genetically related to Langi Volcanics (subduction magmatism?), and (2) Late Miocene above clinopyroxene-biotite and syenite-monzonite named Biru Syenite, likely associated with Sopo Volcanics (see also Elburg et al. (2002) on same magmatic rocks) (looks like Iraqi journal printed this paper without needed editing- JTvG))

Bao, H., J.P. Ampuero, L. Meng, E.J. Fielding, C. Liang, W.D. Milliner et al. (2019)- Early and persistent supershear rupture of the 2018 magnitude 7.5 Palu earthquake. *Nature Geoscience* 12, 3, p. 200-205.

(Evidence for early and persistent supershear rupture at sub-Eshelby speed of 2018 magnitude 7.5 Palu earthquake)

Barber, A.J. (1996)- Multiple collisions on the southeastern margin of Sundaland: the tectonic evolution of Sulawesi. *Warta Geologi (Newsletter Geological Society Malaysia)* 22, 4, p. 300-301. *(Abstract only)*

(online at: <https://gsmpubl.files.wordpress.com/2014/09/ngsm1996004.pdf>)

(Sundaland constructed since Late Paleozoic by collisions of continental fragments. In E Cretaceous SE margin of Sundaland lay in Borneo; subduction and accretion added oceanic and micro continental material to this margin. In W Sulawesi oldest basement rocks are ocean floor materials in accretionary complex, with components carried down deep in subduction zone (eclogites, gneisses and glaucophane schists with cooling ages of 132-113 Ma (E Cretaceous). After uplift and erosion, Late Cretaceous subsidence and development of forearc basin over accretionary complex, with deposition of cherts and turbidites. In Eocene area stabilised as part of Sundaland continental margin, with development of rifts. C Sulawesi composed of rocks of oceanic and continental origin now metamorphosed in amphibolite, greenschist and glaucophane schist facies, overlain by melange, then by major ophiolite complex of East Arm. Amphibolite and greenschist facies rocks formed by W-ward subduction of microcontinental fragment and metamorphosed in E Cretaceous, at same time as basement in W Sulawesi. Glaucophane schist metamorphism affects earlier metamorphic rocks and melange, which is overlain to E by high-T metamorphic sole beneath E Sulawesi Ophiolite. Melange formation and metamorphism due to mid-oceanic subduction towards E. Subduction ceased at 28 Ma (Oligocene), when Sundaland ran into subduction zone and ophiolite obducted onto continental margin. W-ward subduction then commenced beneath E margin of ophiolite, terminating in M Miocene when Banggai-Sula microcontinent ran into subduction zone. Banggai-Sula originated as fragment of Australia, separated in Jurassic, carried W along Sorong Fault Zone. Collision zone in E Arm is marked by imbrication of Banggai-Sula continental margin sediments with slices of ophiolite. Metamorphic rocks of C Sulawesi were thrust across W Sulawesi, and uplifted blocks of basement

were thrust W-wards across Eocene-Miocene carbonate platform. Downgoing continental rocks subducted beneath W Sulawesi gave rise to volcanic arc with volcanic rocks geochemical signature of Australian origin)

Bartstra, G.J. (1977)- Walanae Formation and the Walanae terraces in the stratigraphy of South Sulawesi (Celebes, Indonesia). *Quartar* 27, p. 21-30.

(online at: www.quartaer.eu/pdfs/1977/1977_02_bartstra.pdf)

(On Pliocene-Quaternary vertebrate-bearing clastics formation of SW Sulawesi. Paleolithic stone tools first found by Van Heekeren in fluvial terrace deposits probably younger than more cemented and more steeply dipping Pleistocene deposits of U Walanae Fm with *Archidiskodon-Celebochoerus* fauna)

Beaudouin, T. (1998)- Tectonique active et sismotectonique du systeme des failles décrochantes de Sulawesi central. Doct. Thesis, Universite Paris-Sud, p. 1-343. (Unpublished)

(‘Active tectonics and sismotectonics of C Sulawesi fault zones’)

Beaudouin, T., O. Bellier & M. Sebrier (2003)- Champs de contrainte et de deformation deduits de l’analyse des mecanismes au foyer des seismes de la region de Sulawesi (Indonesie): implications geodynamiques. *Bull. Societe Geologique France* 174, 3, p. 305-317.

(online at: <http://documents.irevues.inist.fr/handle/2042/263>)

(‘Present-day stress and deformation field in the Sulawesi region; geodynamic implications’. High seismicity along N Sulawesi trench and Molucca Sea subduction zone, lower activity in C and S Sulawesi. Represents activity of NE, SW and SE arms thrusts and left-lateral C Sulawesi Fault System (Palu-Koro and Matano faults). System connects N Sulawesi subduction zone to Sorong fault through S Sula fault and Tolo thrust in N Banda Sea. Clockwise rotation of Sula block. C Sulawesi fault system fast slipping with low seismicity. Extensional stress in S part Tomini Gulf (9 mm/yr in N36°E direction), possibly back-arc spreading related to N Sulawesi subduction. Batui zone E-M Pliocene collision between NE arm and Banggai-Sula block, remains active, but mainly affected by strike-slip deformation. Tolo thrust off SE arm E coast absorbs N Banda Sea convergence to W. This allows to distinguish a N Banda block in SE Sulawesi. Tolo thrust and Hamilton fault move W at lower rate than Sula block. SW arm of Sulawesi compressional stress regime (Majene-Kalosi thrusts activity) and may represent W- most accommodation of Philippine/Sunda plates motion)

Beets, C. (1950)- On Lower Tertiary Mollusca from SW and Central Celebes. *Leidsche Geologische Mededelingen* 15, p. 282-290.

(online at: www.repository.naturalis.nl/document/549324)

(Sulawesi mollusc material collected by Sax (BPM) in 1931, comparable to material described by Dollfus (1915) from same area. Incl. *Turritella krooni* of probable Eocene age from SW Central Sulawesi and collection of shells from anticline W of Batoekoe-coalfield W of Ujung Lamuru, SW Sulawesi, where 250m thick marl-limestone series contains *Nummulites* and molluscs with similarities to Nanggulan fauna of C Java, incl. *Volutilithes* and *Cardita*)

Bellier, O., T. Beaudouin, M. Sebrier, M. Villeneuve, I. Bahar, E. Putranto, I. Pratomo & D. Seward (1998)- Active faulting in central Sulawesi (eastern Indonesia). In: P. Wilson & G.W. Michel (eds.) The geodynamics of S and SE Asia (GEODYSSSEA) Project. Scientific Technical Report STR/14, Geoforschungszentrum, Potsdam, Germany, p. 276-312.

(Results of GPS, satellite image interpretation, etc. work in 1994-1997 around active faults of C Sulawesi (seismically active Palu-Koro and Matano faults, etc.))

Bellier, O., D.L. Bourles, T. Beaudouin & R. Braucher (1999)- Cosmic Ray Exposure (CDE) dating in a wet tropical domain: late Quaternary fan emplacements in central Sulawesi (Indonesia). *Terra Nova* 11, 4, p. 174-180.

(online at: https://www.academia.edu/17105045/Cosmic_Ray_Exposure_CRE_dating_in_a_wet_tropical_domain_late_Quaternary_fan_emplacements_in_central_Sulawesi_Indonesia?hb-sb-sw=90139184)

(Be-10 concentrations in quartz boulders exposed on late Quaternary alluvial fan surfaces in Sulawesi suggest two fans formed during two distinct major climatic events, with abandonment ages of 11 kyr and 120 kyr)

Bellier, O., M. Sebrier, T. Beaudouin, M. Villeneuve, R. Braucher, D. Bourles, L. Siame, E. Putranto & I. Pratomo (2001)- High slip rate for a low seismicity along the Palu-Koro active fault in Central Sulawesi (Indonesia). *Terra Nova* 13, 6, p. 463-470.

(C Sulawesi with complex left-lateral strike-slip fault zones in triple junction between Pacific, Indo-Australian and Eurasian plates. Low-magnitude shallow earthquakes related to NNW-trending Palu-Koro and WNW-trending Matano fault zones. N-ward increasing complexity of Palu-Koro fault segmentation. Left-lateral displacements of streams. Slip rate 32 ± 45 mm/yr. PKF is fast slipping fault with relatively low seismicity)

Bellier, O., M. Sebrier, D. Seward, T. Beaudouin, M. Villeneuve & E. Putranto (2006)- Fission track and fault kinematics analyses for new insight into the Late Cenozoic tectonic regime changes in West-Central Sulawesi (Indonesia). *Tectonophysics* 413, 3-4, p. 201-220.

(Left-lateral C Sulawesi Fault System composed of NNW Palu-Koro and ESE Matano faults in triple junction of Pacific, Indo-Australian and Eurasian plates. C Sulawesi three tectonic regimes: (1) Late Miocene- E Pliocene (5 Ma) WNW-trending transpression along PKF and compression in Poso area, resulting from collision of Banggai-Sula block with Sulawesi; (2) Pliocene collapse tectonics associated with W-trending extension, with coeval regional cooling and exhumation; (3) Quaternary transtension from C Sulawesi block N motion, and back-arc spreading behind N Sulawesi subduction (Tomini Gulf))

Bellon, H. & C. Rangin (1991)- Geochemistry and isotopic dating of Cenozoic volcanic arc sequences around the Celebes and Sulu Seas. *Proc. Ocean Drilling Program (ODP), Scientific Results*, 124, College Station, p. 321-338.

(online at: www-odp.tamu.edu/publications/124_SR/VOLUME/CHAPTERS/sr124_23.pdf)

(K-Ar ages for >50 igneous rocks from onshore Philippines, N Borneo (Sabah) and N Sulawesi. Ages range from 32 Ma to near 0 Ma. Generally calc-alkaline affinity with some shoshonitic high-K basalts. Two types of island arcs (1) related to progressive closing of Celebes and Sulu marginal basins and (2) arcs of Philippine Sea Plate. Includes radiometric dates of Sabah Dent- Semporna Peninsula (9-13 Ma), Sulu Sea/ Cagayan Ridge (ODP Sites 769/771: ~14-21 Ma), Kinabalu Intrusives (6.4- 6.8 Ma), N Sulawesi (Gorontalo area volcanics: 4.1-8.9 Ma and 18.2-22.3 Ma)

Bergman, S.C., D.Q. Coffield, J.P. Talbot & R.A. Garrard (1996)- Tertiary tectonic and magmatic evolution of western Sulawesi and the Makassar Strait, Indonesia: evidence for a Miocene continent-continent collision. In: R. Hall & D.J. Blundell (eds.) *Tectonic evolution of Southeast Asia*, Geological Society, London, Special Publ. 106, p. 391-429.

(W Sulawesi three Neogene N-S domains, from W to E: (1) active foldbelt with Pliocene- Miocene volcanogenic rocks in W-vergent thrusts, extending into Makassar Strait; (2) deformed submarine Miocene (av. age 8 Ma) arc, built on Oligocene-Eocene clastics and carbonate platform with Mesozoic basement thrust over E margin; (3) accreted pre-Eocene age ophiolite between Latimojong basement block and Bone Bay, obducted in Late Oligocene- Miocene. M Miocene- Pliocene (3-18 Ma) volcano-plutonic complex, with melts sourced from Late Proterozoic- E Paleozoic, tied to continent-continent collision of W-vergent Australian-New Guinea plate subducting under E-most Sundaland. Makassar Strait is foreland basin flanked by Neogene thrust belts, not Paleogene rift. E Sulawesi ophiolite extends into W Sulawesi, suggesting Bone Bay resulted from collapse of over-thickened Miocene orogen)

Berry, R.F. & A.E. Grady (1987)- Mesoscopic structures produced by Plio-Pleistocene wrench faulting in South Sulawesi, Indonesia. *J. Structural Geology* 9, p. 563-571.

(Bantimala and Barru metamorphic complexes of S Sulawesi bounded in W by E-dipping thrust faults. Composed of glaucophane schists, serpentinites, etc., overlain by >750m of Cretaceous clastics. Area dominated by Plio-Pleistocene NNW-striking sinistral wrench faults, result of N-ward movement of Banda Sea microplate with respect to W Indonesia)

Bohnke, M., M. Brocker, A. Maulana, R. Klemd, J. Berndt & H. Baier (2019)- Geochronology and Zr-in-rutile thermometry of high-pressure/low temperature metamorphic rocks from the Bantimala complex, SW Sulawesi, Indonesia. *Lithos* 324-325, p. 340-355.

(online at: www.sciencedirect.com/science/article/pii/S0024493718304419)

(Multipoint Rb-Sr mineral isochrons of high P/ low T eclogites and glaucophane-rich rocks from Bantimala Complex, SW Sulawesi. Narrow range of white mica ages (130-120 Ma = Hauterivian-Barremian), interpreted to postdate peak-HP conditions. Luk Ulo (C Java) ages of ~118 Ma slightly younger (Hoffmann et al. 2019), but may still be in same subduction complex. Rare zircons in glaucophane-rich rocks indicate Late Triassic- E Jurassic protolith ages (~205-185 Ma). Metamorphic zircon rims mostly 135-110 Ma ages. Older zircons (2.55-1.4 Ga, 400-260 Ma) probably from subducted sediments incorporated in mafic melts)

Bothe, A.C.D. (1927)- Voorlopige mededeeling betreffende de geologie van Zuid-Oost Celebes. De Mijnningenieur 8, 6, p. 97-103.

(‘Preliminary note on the geology of SE Sulawesi’. Smaller islands Kabaena and Wawoni very similar to E Sulawesi. Larger islands Buton and Moena very different)

Bothe, A.C.D. & W.H. Hetzel (1932)- De geologie van Laiwoeni, Poleang, Roembia en Kolaka (Z.O. Celebes). Verslag Archief Dienst van den Mijnbouw, Bandung, p. 1-36. *(Unpublished)*

(‘The geology of Laiwuni, Poleang, Rumbia and Kolaka islands (SE Sulawesi)’. Geological Survey Bandung report)

Boudagher-Fadel, M.K. (2002)- The stratigraphical relationship between planktonic and larger benthic foraminifera in Middle Miocene to Lower Pliocene carbonate facies of Sulawesi, Indonesia. *Micropaleontology* 48, 2, p. 153-176. *(online at: www.researchgate.net/publication/232694861_The_stratigraphical_relationship_between_planktonic_Etc.)*

(M Miocene- E Pliocene Tacipi Fm of Bone region of SW Sulawesi up to 300m thick, deposited in broad area of shallow marine carbonates, with deeper water sediments deposited to N. Co-occurrences of planktonic and larger foraminifera: (1) M Miocene N11-N12, and Tf2 with Katacycloclypeus, Lepidocyclina (N); (2) Late Miocene N16-N17 and Tg with Planorbulinella) (samples collected by A.N. Ascaria))

Brocker, M., V. Schenk, E.E. Scherer, J. Soesilo & J. Berndt (2023)- Refining the understanding of Cretaceous subduction zone processes in the central Indonesian region: the Bantimala Complex (SW Sulawesi) revisited. *J. Asian Earth Sciences* 255, 105761, p. 1-18.

(online at: <https://www.sciencedirect.com/science/article/pii/S1367912023002225>)

(Bantimala Complex in SW Sulawesi Cretaceous metamorphics with common HP/LT eclogite and blueschist with lawsonite in highly deformed accretionary wedge. Zircon ages suggest significant protolith age range of metamafics (~369-185 Ma). Rb-Sr ages suggest time of peak HP/LT metamorphism ~132-125 Ma (= ~Hauterivian). Radiometric ages ~137-113 Ma. Mineralogical and age diversity of blocks indicates detachment of fragments from subducting plate at different depths, followed by return flow in subduction channel along different P-T paths. Subduction-related magmatism recorded by zircon age of ~109 Ma for quartz diorite. Detrital zircon ages from melange sandstone indicate 107 Ma max. depositional age and tectonic stacking of Bantimala Complex after partial erosion of already exposed Cretaceous basement. Non-metamorphosed granitoids ~113-115 Ma old (~Aptian))

Broili, F. (1934)- Über mesozoische Lamellibranchiaten- und Brachiopodenführende Schichten von Celebes. *Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie* 10, p. 175-179.

(‘On Mesozoic lamellibranchiates- and brachiopod- bearing beds from Sulawesi’. Appendix in Brouwer (1934). Describing (poor) material collected from several localities in 1929 from Central Sulawesi, possibly of Triassic and Jurassic ages. No figures)

Bromfield, K. & W. Renema (2011)- Comparison of ⁸⁷Sr/⁸⁶Sr isotope and biostratigraphic ages of uplifted fossil reefs in the Indo-Pacific: Indonesia, Papua New Guinea and Fiji. *Australian J. Earth Sciences* 58, p. 61-73.

(Dating of limestones from seven Neogene sites from Indo-Pacific, using foraminifera and ⁸⁷Sr/⁸⁶Sr isotopes: Salayar Lst on Salayar Island, S Sulawesi (Late Miocene-Pliocene/Pleistocene), Yalam Lst in E New Britain, PNG (M Miocene) and Tokelau Lst Gp on Vanua Balevu in Lau Group, Fiji (M-L Miocene). Salayar Lst 50-100m thick, contains Quasirothalia sp. and Calcarina spengleri and has Sr ages 5.8-3.4 Ma)

Brooks, R.R., E.D. Wither & L.Y.T. Westra (1978)- Biogeochemical copper anomalies on Salajar Island, Indonesia. *J. Geochemical Expl.* 10, 2, p. 181-188.

(20 species of plants from Salayar island, SW Sulawesi, have copper values >80 pg/g (max. 600pg/g) in their dried leaves. These values greatly exceed highest values found in other parts of SE Asia outside Salayar)

Brouwer, H.A. (1918)- Studien uber Kontaktmetamorphose in Nederland.-Ostindien. V. Der Granodioritkontakt des Bolio-Hutu-Gebirges sudlich von Sumalatta (Nord-Celebes). *Centralblatt Mineralogie Geologie Palaontologie* 1918, 19-20, p. 297-306.

(‘Studies on contact-metamorphism in the Netherlands East Indies, V. The granodiorite contact of the Bolio-Hutu Mountains South of Sumalatta (North Sulawesi)’. Study of rocks collected by G. Molengraaff in 1901)

Brouwer, H.A. (1919) - Fossilhoudende Palaeozoische afzettingen op Celebes. *De Ingenieur*, Jaargang 34, 1919-45 (8 Nov. 1919), p. 832.

(online at: <https://www.delpher.nl/nl/tijdschriften/> Etc.)

*(‘Fossiliferous Paleozoic beds on Sulawesi’. Brief note on Permian ammonite *Popanoceras timorensis* in collection of Army Colonel G.J. Verstege, who was stationed in Sulawesi from 1906-1910. The fossils reportedly came from “the Sadang and Mato Allo river basins and the mountains in-between, partly found by myself, partly presented by chiefs of Enrekang, Doeri and Maiwa in 1907 and 1910” (Kalosi region). This suggests presence of Late Paleozoic marine sediments in S-C Sulawesi, but localities never verified. (Occurrences questioned by Abendanon (1920, 1921) and Von Koenigswald (1933), who believed they probably came from Timor via a Chinese pharmacy. (however, shouldn’t be dismissed completely?, as Permian brachiopods were also reported from E Sulawesi by Von Loczy 1934 and Kutassy 1934; JTvG))*

Brouwer, H.A. (1919)- Devonische afzettingen in den Oost-Indischen archipel. *De Ingenieur*, Jaargang 34, 1919-48 (29 Nov. 1919), p. 901.

(online at: <https://www.delpher.nl/nl/tijdschriften/> Etc.)

*(‘Devonian deposits in the East Indies Archipelago’. In addition to Permian ammonite in collection of Colonel G.J. Verstege from Kalosi region, C Sulawesi, also a grey limestone with Upper Devonian brachiopod *Spirifer verneuilli* (NB: Permian ammonite and *Spirifer* brachiopod fossils also known from Permian of Timor; JTvG))*

Brouwer, H.A. (1921)- Een jong-Paleozoisch en een Devonisch fossiel van Celebes? *De Ingenieur*, 1921, p. 138-

*(‘A Late Paleozoic and a Devonian fossil from Sulawesi?’. Additional report of Upper Devonian brachiopod *Spirifer verneuilli* from collection of Colonel G.J. Verstege = Abendanon paper?)*

Brouwer, H.A. (1924)- Geologische beschrijving der omgeving van de Tertiaire fossilrijke lagen nabij Patoenoeang Asoe E in Zuid-Celebes. *Jaarboek Mijnwezen Nederlandsch Oost-Indie* 52 (1923), Verhandelingen, p. 151-165.

(‘Geological description in the area of Tertiary fossil-rich beds near Patunuang Asu (S Sulawesi)’. Localities of thin-bedded marine fish-bearing lagoonal limestone in Miocene reefal limestone complex, SW Sulawesi, sampled by Brouwer in July 1923. Eocene- Miocene limestones intruded by basalt-diabase sills (Foraminifera from this locality described by Rutten 1924, crab fossil by Van Straelen 1924, fish fossils by De Beaufort 1926))

Brouwer, H.A. (1930)- Geologische exploratietochten op het eiland Celebes. *Natuurkundige Voordrachten*, Nieuwe Reeks 8, Maatschappij Diligentia, Van Stockum, The Hague, p. 90-97.

(online at: https://natuurwetenschappen-diligentia.nl/wp-content/uploads/2020/02/Diligentia_jaarboek_8.pdf)

(‘Geological exploration traverses on the island of Celebes’. Lecture notes. Brief review of 1929 Sulawesi fieldwork with W.H. Hetzel and H.E.G. Straeter of the Dienst van den Mijnbouw. No figures)

Brouwer, H.A. (1930)- The major tectonic features of Celebes. *Proc. Koninklijke Nederlandse Akademie van Wetenschappen*, Amsterdam, 33, 4, p. 338-343.

(online at: <https://dwc.knaw.nl/DL/publications/PU00015894.pdf>)

(Brief overview of Sulawesi geology, after 1929 expedition. C Sulawesi three zones: (1) eastern zone with abundant imbricated basic-ultrabasic igneous rocks, radiolarian cherts and Mesozoic limestones; (2) central zone dominated by crystalline schists, deformation strike mainly N-S; (3) western zone with abundant granitic rocks and with Mesozoic sediments of different facies from zone 1)

Brouwer, H.A. (1934)- Geologisch onderzoekingen op het eiland Celebes. Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie 10, p. 39-218.
(online at: <https://www.delpher.nl/nl/boeken/view?identificatie=MMKB24:064908000:00001>)
(Report on 1929 geological traverses in Central Sulawesi by Prof. H.A. Brouwer and Mijnbouw geologists W.H. Hetzel and H. Straeter. With appendices on Mesozoic belemnites by E. Stolley, molluscs by F. Broili and Tertiary foraminifera by Van der Vlerk & Dozy. Occurrence of E-M Cretaceous limestone with coral and Orbitolina in isoclinally folded shales-sandstone-radiolarian?chert near Latimojong Mts, SW Sulawesi. At E coast of the northern SE Arm of Sulawesi Early Miocene (Te5) conglomeratic limestone with clasts of underlying, mainly W-SW dipping imbricated series with serpentinite and Cretaceous pelagic limestone with Globotruncana, etc.)

Brouwer, H.A. (1941)- Tektonik und Magma in der Insel Celebes und der Indonesische Gebergstypus. Proc. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam 44, 3, p. 253-261.
(online at: <https://dwc.knaw.nl/DL/publications/PU00017559.pdf>)
(‘Tectonics and magma of Sulawesi island and the Indonesian mountain type’. C Sulawesi 3 N-S trending belts: (1) Eastern belt of ultrabasic rocks overlain by Mesozoic limestones and radiolarites; (2) central belt of regional metamorphic schists, age of which is debatable, and with decreasing metamorphism to East; (3) Western belt with common granodiorite, biotite-rich schist and Cretaceous-Tertiary sediments. No active volcanism in C Sulawesi today, but stopped only in Quaternary)

Brouwer, H.A. (1947)- Geological explorations in Celebes- summary of the results. In: H.A. Brouwer (ed.) Geological Explorations of the Island of Celebes, North Holland Publishing Co., p. 1-64.
(Summary of geology of C Sulawesi, mainly based on work of the 1929 Bandung Geological Survey expedition, results of which were first reported by Brouwer 1934). This summary also incorporates results of petrographic work by Willems (1937), Egeler (1947) and De Roever (1947))

Brouwer, H.A. (1949)- Sur un massif granodioritique et ses phenomenes de contact a l'ouest de Palopo (Celebes). Proc. Koninklijke Nederlandse Akademie van Wetenschappen 52, 6, p. 610-613.
(online at: <https://dwc.knaw.nl/DL/publications/PU00018675.pdf>)
(‘On a granodioritic massif and its contact phenomena W of Palopo, S part of Central Sulawesi’. Granodiorite massif and contact aureole sampled along road Rante Pao and Palopo, 17-28 km E of Rante Pao)

Brouwer, H.A. & L.F. de Beaufort (1922)- Tertiaire afzettingen met fossiele visschen van Z-Celebes. Verslagen Koninklijke Akademie van Wetenschappen, Amsterdam, Wis- en Natuurkundige Afdeeling, 32, p. 33-40.
(‘Tertiary deposits with fish fossils in S Sulawesi’; same as paper below)

Brouwer, H.A. & L.F. de Beaufort (1923)- On Tertiary marine deposits with fossil fishes from South Celebes. Proc. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam, 26, 3-4, p. 159-166.
(online at: <https://dwc.knaw.nl/DL/publications/PU00014925.pdf>)
(English version of paper above. Two fish fossils of probable Miocene age in fine-grained 'lithographic' limestone block from roadcut near Patoenoeng Asoe E, Maros district. Rocks probably lagoonal deposit in Eocene-Miocene reefal limestone complex. Fish identified as Clupea (Sardinella) brouweri n.sp. and Lutjanus)

Bucking, H. (1899)- Beitrage zur Geologie von Celebes. Petermanns Geographische Mitteilungen 45, 11, p. 249-260 and 12, p. 273-280.
(online at: https://zs.thulb.uni-jena.de/receive/jportal_jparticle_00508841)
(‘Contributions to the geology of Celebes’ (Sulawesi). An overview of Sulawesi geology from literature and personal observations during a visit in 1898 in granite areas of Gorontalo, gold mines of Sumalata and Paleleh where gold is in pyrite in quartz veins in volcanic conglomerates, etc. Climbed Soputan volcano (1827m)

Bucking, H. (1899)- Leucitbasalt aus der Gegend von Pangkadjene in Sud-Celebes. Berichte Naturforschenden Gesellschaft Freiburg I. Breisgau, 11, p. 78-84.

(online at: <https://www.biodiversitylibrary.org/item/42626#page/92/mode/1up>)

(*'Leucite basalt from the area of Pajangene in S Sulawesi'. Biotite-leucite basalt collected from outcrop near Kantisang during travels in South Sulawesi in June and August 1898 (rock found earlier in float by Wichmann in 1888 (published 1893), also mentioned by Retgers (1895) and later also described by Iddings & Morley (1915, 1917). According to Bucking basalt is intercalated between Eocene coal-bearing clastics and overlying Late Eocene Nummulites limestones)*)

Bucking, H. (1900)- Cordierit von Nord-Celebes und aus den sog. verglasten Sandsteinen Mitteldeutschlands. Bericht Senckenbergischen Naturforschenden Gesellschaft, Frankfurt am Main 1900, Wissenschaftliche Abhandlungen, p. 1-20.

(online at: <https://ia802705.us.archive.org/25/items/naturundmuseum1900senc/naturundmuseum1900senc.pdf>)

(*'Cordierite from North Sulawesi and the so-called vitrified sandstones of Central Germany'. Cordierite mineral in obsidian-like rock among augite-andesites of Soputan volcano S of Manado in N Sulawesi)*)

Bucking, H. (1904)- Beitrage zur Geologie von Celebes. Sammlungen Geologischen Reichs-Museums Leiden, ser. 1, 7, p. 29-205.

(online at: www.repository.naturalis.nl/document/552426)

(*'Contributions to the geology of Sulawesi', in 6 chapters. Early descriptions of SW Sulawesi igneous, metamorphic, sedimentary rocks. First description of (Bantimala) Cretaceous metamorphic complex in Pangkajene River area: mica-schist, glaucophane schist, etc. associated with serpentinites, and overlain by radiolarian cherts, Eocene coal-bearing clastics and Nummulites limestones and Miocene limestones)*)

Budiman, A.A., K. Anggayana, A.H. Widayat, D. Sasonlo & R. Fakhrudin (2024)- Organic geochemical, petrographic and palynological characterization of claystones of the Palaeogene Toraja Formation, and oil seeps in the Enrekang Sub-basin, south Sulawesi, Indonesia: implications for hydrocarbon source rock potential. Energy Geoscience 5, 3, p. 1-18.

(manuscript online at: <https://www.sciencedirect.com/science/article/pii/S2666759224000027>)

(*Organic geochemistry of 30 claystone samples of Late Eocene- Oligocene Toraja Fm outcrops in Enrekang Basin in N part of S Arm of Sulawesi. With mixed Type II- III kerogen and immature to post-mature (vitrinite reflectance 0.47-4.52 % Ro. Oil seep sample from area presumably from Paleogene source, but more marine than outcrop samples)*)

Budiman, B., I. Hardjana & Hermadi (2011)- The geology and Au-mineralization system in the Totopo West Prospect, Gorontalo, Indonesia. In: N.I. Basuki (ed.) Proc. Conference Sulawesi Minerals Resources 2011, Manado, MGEI/IAGI, p. 189-200.

(see also Budiman et al. (2012), below)

Budiman, B., I. Hardjana & Hermadi (2012)- The geology and Au-mineralization system in the Totopo West Prospect, Gorontalo, Indonesia. Majalah Geologi Indonesia (IAGI) 23, 3, p. 159-170.

(online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/732)

(*Same paper as Budiman et al. 2011). Totopo West gold prospect, W of Gorontalo, probable Miocene andesitic volcanics unconformably overlain by Pliocene-Pleistocene dacitic volcanics, all intruded by contemporaneous diorite and dacite porphyry dykes. Additional exploration required)*)

Burhanuddin, M.S. (2024)- Study on organic matter enrichment and preservation control in carbonate source rock: field analogue from the Mesozoic sedimentary tock in Southeast Arm of Sulawesi. Doct. Science Thesis, Akita University, Japan, p. 1-43.

(online at: <https://air.repo.nii.ac.jp/record/2001469/files/shihakukou1517.pdf>)

(*Study of potential hydrocarbon source rocks in Mesozoic interbedded carbonate-shale intervals of (syn-roft) Triassic-Jurassic Tokala Fm and (drift) Cretaceous Matano Fm outcrops in highly deformed sections in N Konawe and S Bungku areas in SE Arm of Sulawesi. No biostrat validation for ages or formation assignments;*)

used correlations to previous GRDC maps. Tokali Fm samples analyzed mainly shales- calcareous shales. Locally high TOC (>4%) in Tokala Fm. Depositional facies models based on geochem (rather short for a doctoral thesis?; JTvG)

Burhanuddin, M.S., S. Chiyonobu, T. Ando, A. Yusriani, R. Husain & S. Asfar (2024)- Hydrocarbon potential of the Triassic-Jurassic sediments in Southeast Sulawesi, Indonesia, based on lithofacies and geochemical analysis. *Open Journal of Geology* 14, 8, p. 723-745.

(online at: <https://www.scirp.org/journal/paperinformation?paperid=135171>)

(Geochemistry of outcrop samples of Triassic-Jurassic Tokala Fm carbonates- shales in SE Sulawesi. Triassic-Jurassic Tokala Fm limestones overlie synrift Triassic Meluhu Fm and is carbonate platform that may be correlated with Manusela and Saman-Saman Fms in Seram basin and Winto Fm in Buton. Believed to be potential oil source rock, especially in laminated bituminous shale facies (up to 3-4% organic matter), etc. (unfortunately no biostrat support for age, formation assignments and facies interpretations; "foraminifera were diverse, with elongated, oval, and circular shapes"; JTvG)

Burhanuddin, M.S., A. Jaya & A. Maulana (2021)- Biomarker characterization of oil seepages in Tomori Basin, Central Sulawesi, Indonesia. *Proc. 3rd Int. Conference Global Issue for Infrastructure, Environment, and Socio-Economic Development (GIESED 2020, Makassar), IOP Conference Series: Earth and Environmental Science* 921, 012026, p. 1-5.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/921/1/012026/pdf>)

(Onshore oil seepage off NW side of Tomini Bay/Basin at Wosu and Kolo. Wosu Oil analyses suggest anoxic conditions in hypersaline environment. Kolo Oil indicative of terrestrial organic input under oxic conditions)

Buskamal, M.T. Djunaedi & Nur Hasjim (1999)- Biostratigraphic study of Toraja Formation, Kalosi, South Sulawesi. *Proc. 28th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta*, 3, p. 21-34.

(online at: <https://www.iagi.or.id/web/digital/57/3.pdf>)

(In Indonesian. Summary of biostratigraphy of marine Eocene Toraja Fm in area S and SW of Kalosi, in NE part of S Arm of Sulawesi, unconformably over Late Cretaceous Latimojong Fm. M-L Eocene planktonic foram zones P12-P16, nannofossil zones NP14-NP20. Rantepao Limestone Member with Late Eocene (Tb) larger forams Discocyclina, Nummulites, Pellatispira. Palynomorphs Proxapertitus cursus zone)

Caesario, D., N. Nawaleda, B.B. Susetyo & M.I. Bagus (2022)- Bombana gold hunt: geomorphology, geology & land use changes. *Proc. 2nd Int. Conference of Geography (ICGEO 2022), Padang*, p. 1-13.

(online at: <https://eudl.eu/pdf/10.4108/eai.19-11-2022.2332159>)

(Recent gold rush in 2008-2022 in Mekongga and Rumbia Mountain Ranges in SE Sulawesi. Gold is hosted in Cretaceous subduction metamorphics complex, which comprises glaucophane schist (younger phase of metamorphism, caused by deep overthrusting (subduction) from igneous protolith), chlorite schist, mica schist, marble, etc., overlain by M-L Miocene conglomerates and limestones. Quartz veins with economic minerals gold, cinnabar and antimony; gold also in alluvial placers)

Cahyaningsih, C. & Y. Admojo (2021)- Tectonic geomorphic of Sulawesi Island and its implication for future large earthquake. *J. Geoscience Engineering Environment Technology (JGEET)* 6, 4, p. 263-290.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/8558/3861>)

Cakrabuana, W., R.C. Ciputra & H. Syaeful (2021)- Assessing the undiscovered resources of uranium and thorium in Mamuju, West Sulawesi. *Proc. Int. Conference Geological Engineering and Geosciences, Yogyakarta 2021, IOP Conference Series: Earth and Environmental Science* 851, 012041, p. 1-9.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/851/1/012041/pdf>)

(Miocene potassic Adang Volcanic rocks in Mamuju area, SW Sulawesi, contain U and/or Th minerals)

Caldwell, G. & M. Lillie (2004)- Manuel Pinto's inland sea: using palaeoenvironmental techniques to assess historical evidence from Southwest Sulawesi. In: S.G. Keates & J. Pasveer (eds.) *Quaternary Research in Indonesia, Chapter 13, Modern Quaternary Research in Southeast Asia* 18, Balkema, Leiden, p. 259-272.

(Discussion of historical Bugis accounts (La Galigo) suggesting expansion of Tempe, Sidenreng and Buaya lakes in SW Sulawesi and possible seaway across SW Arm of Sulawesi)

Calvert, S.J. (2000)- The Cenozoic geology of the Lariang and Karama regions, Western Sulawesi, Indonesia. Ph.D. Thesis, Royal Holloway, University of London, p. 1-353. *(Unpublished)*

Calvert, S.J. (2000)- The Cenozoic evolution of the Lariang and Karama basins, Sulawesi. Proc. 27th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, p. 505-511.
(W Sulawesi influenced by Paleogene development of Makassar Straits to W and Miocene? collision of continental, ophiolitic and island arc fragments to E (E Sulawesi ophiolite and Buton, Tukang-Besi and Banggai-Sula microcontinents). Ages attributed to collision events Early to Late Miocene. Collisions caused uplift, erosion and deposition of 'Celebes Molasse'. Lariang and Karama basins in central W Sulawesi ~10,000 km²)

Calvert, S.J. & R. Hall (2003)- The Cenozoic geology of the Lariang and Karama regions, Western Sulawesi: new insight into the evolution of the Makassar Straits region. Proc. 29th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, p. 501-517. *(online at: https://www.academia.edu/77328830/The_Cenozoic_Geology_of_the_Lariang_and_Karama_Regions_Western_Sulawesi_New_Insight_into_the_Evolution_of_the_Makassar_Straits_Region)*
(W Sulawesi Lariang and Karama regions oldest sediments ?Paleocene non-marine coals, sandstones, mudstones. Rifting M- Late Eocene. Eocene sediments in graben/half graben in marine and marginal marine environments. Eocene Makassar Straits rift asymmetrical: Kalimantan margin twice width of Sulawesi margin. Start thermal subsidence in Late Eocene. By end-Oligocene most of W Sulawesi shelf carbonate and mudstone deposition. Carbonates- mudstones deposited throughout E Miocene and in places until M or Late Miocene. Little or no evidence of Miocene collisions in W Sulawesi. First evidence of orogenic deformation is Pliocene uplift and erosion, followed by deposition of coarse clastics from orogenic belt to E of study area)

Calvert, S.J. & R. Hall (2006)- The Cenozoic evolution of the Lariang and Karama regions, North Makassar Basin, Western Sulawesi: Indonesia. Proc. Jakarta 2006 International Geoscience Conference Exhib., AAPG/ Indonesian Petroleum Association (IPA), Jakarta06-PG-31, p. 1-5.
(online at: https://earthjay.com/earthquakes/20200818_philippines/calvert_hall_2006%20Lariang-Karama%20basins%20Sulawesi.pdf)
(Brief review of geology of Cenozoic Lariang and Karama basins, W Sulawesi))

Calvert, S.J. & R. Hall (2007)- Cenozoic evolution of the Lariang and Karama regions, North Makassar Basin, western Sulawesi, Indonesia. Petroleum Geoscience 13, p. 353-358. *(online at: https://www.academia.edu/63296053/Cenozoic_evolution_of_the_Lariang_and_Karama_regions_North_Makassar_Basin_western_Sulawesi_Indonesia)*
(Similar to papers above. Main contractional deformation in W Sulawesi is mid-Pliocene, whereas in E Kalimantan it dates from E Miocene)

Camplin, D.J. & R. Hall (2013)- Insights into the structural and stratigraphic development of Bone Gulf, Sulawesi. Proc. 37th Annual Conv. Indonesian Petroleum Association, Jakarta, IPA13-G-079, p. 1-24.
(Bone Bay seismic stratigraphic study. Gulf can be divided into several transtensional sub-basins and highs, which are important strike-slip fault zones trending roughly WNW-ESE. Extension occurred since M Miocene, although may have started in E Miocene)

Camplin, D.J. & R. Hall (2014)- Neogene history of Bone Gulf, Sulawesi, Indonesia. Marine and Petroleum Geology 57, p. 88-108.
(online at: http://searg.rhul.ac.uk/pubs/camplin_hall_2014%20Bone%20Bay%20Sulawesi.pdf)
(Bone Gulf probably underlain by pre-Neogene volcanogenic, sedimentary, metamorphic and ultramafic rocks. Basin initiation probably in Miocene, by extension associated with strike-slip deformation. Main basin trend N-S, divided into several sub-basins. Carbonate deposits formed at margins while deeper marine sediments were

deposited in axial parts. Early Pliocene unconformity marks major uplift of Sulawesi and subsidence of Bone Gulf, causing major influx of clastics from the north. Hydrocarbons indicated by seeps)

Cao, L., C.C. Lu, X. He, N. Rawlinson, T. Hao, S. Widiyantoro, P. Supendi, L. Zhao et al. (2024)- Mantle flow induced by the interplay of downgoing slabs revealed by seismic anisotropy beneath the Sula Block in Eastern Indonesia. *J. of Geophysical Research: Solid Earth* 129, 5, e2023JB028110, p. 1-16.

(online

at:

https://www.researchgate.net/publication/380630229_Mantle_Flow_Induced_by_the_Interplay_of_Downgoing_Slabs_Revealed_by_Seismic_Anisotropy_Beneath_the_Sula_Block_in_Eastern_Indonesia)

(Upper mantle deformation below N Sulawesi, in area of interactions between two active and one extinct subduction zones: (1) N Sulawesi subduction zone with S-ward subduction of Celebes Sea slab to depth of ~250 km, mainly overlying (2) Sangihe slab that subducts W from Molucca Sea and penetrates mantle transition zone; (3) paleo-subducted N-dipping Sula slab, partially underlies Sangihe and Celebes Sea slabs. Extensive Palu-Koro strike-slip fault marks western boundary of underlying active N Sulawesi subduction zone. Typical mantle wedge corner flow within Sangihe subduction system. Etc.)

Carlile, J.C., S. Digidowirogo & K. Darius (1990)- Geological setting, characteristics and regional exploration for gold in the volcanic arcs of North Sulawesi, Indonesia. In: J.E. Hedenquist et al. (eds), *Epithermal Gold Mineralization of the Circum Pacific: Geology, Geochemistry, Origin and Exploration*, J. Geochemical Exploration 35, p. 105-140.

(N Sulawesi significant gold province in series of spatially overlapping Tertiary volcanic arcs. In W rhyodacitic volcanics overlie quartzo-feldspathic metamorphic basement. Oldest rocks in W part (Marisa region, same age as Palu granodiorite, ~31 Ma). In C and E areas submarine basaltic basement overlain by andesitic volcanics, centres of which migrated progressively E from E Miocene to present day. Four categories of gold mineralization: porphyry Cu-Au, Au and base metal breccia and high- and low sulphidation epithermal)

Carlile, J.C. & A.G. Kirkegaard (1985)- Porphyry copper-gold deposits of the Tombulilato district, North Sulawesi, Indonesia: an extension of the Philippine porphyry copper-gold province. In: M.P. Jones (ed.) *Proc. Asian Mining '85 Conference, Manila 1985*, Institute of Mining Metallurgy (IMM), London, p. 351-363.

Caron, M.H. (1939)- De aanrijking van nikkel in den verweeringsbodern van peridotiet gesteenten. *De Ingenieur* 39, M.Mijnbouw, 1, p. 1-12.

(online at: <https://resolver.kb.nl/resolve?urn=dts:2973086:mpeg21:pdf>)

(‘The enrichment of nickel in weathering soils of peridotite rocks’. Extensive summary of a presentation by Prof. M.H. Caron of Delft. Mentions nickel economic feasibility work on nickel deposits in E Sulawesi (Soroako) in 1917-1920s by J.W.A. Adam, Dieckmann, etc.. Later also Koolhoven work at Boeloe Balang. Etc.)

Caron, M.H. (1945)- De lateriet-ijzerertsen van Midden-Celebes. *De Ingenieur* 1945, 13, p.

(‘The laterite iron ores of Central Sulawesi’)

Caron, M.H. (1947)- De oplosbaarheid van nikkel na reductie van garnieriet en ijzerrijke nikkel verbindingen. *De Ingenieur* 59, 32, p. 31-41.

(‘The solubility of nickel after reduction of garnierite and iron-rich nickel compounds’)

Carthaus, E. (1900)- Beobachtungen auf Celebes und Sumatra, briefliche Mitteilungen Sammlungen Geologischen Reichs-Museums Leiden, ser. 1, 6, p. 246-249.

(online at: www.repository.naturalis.nl/record/509505)

(‘Observations on Sulawesi and Sumatra, a brief communication’. Early report with geological observations made by Dr. Emil Carthaus from Tosari during a trip to W Sulawesi in early 1900, incl. leucite-bearing volcanics along coast S of Mamuju, etc. No maps, figures)

C & C Reservoirs (1997)- Kampung Baru Field, East Sengkang Basin, Indonesia. *Digital Analogs, Reservoir Evaluation Report, Far East*, p. 1-15.

(Late Miocene Tacipi Fm gas-bearing (350 GCF) reefal buildup on carbonate platform, encased in deep water shales in SW Sulawesi. Moldic porosity from fresh-water leaching)

Cendrajaya, R.I.M., L.I. Juarsan, Masri, A. Rubaiyn, Syahrul, Neni, S. Ramadani & Hasria (2024)- Petrochemistry of ultramafic rock in Baula-Pomalaa Ophiolite Complex, Southeast Sulawesi, Indonesia. *J. Geoscience Engineering Environment Technology (JGEET)* 9, 1, p. 44-51.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/14491/6288>)

(Baula and Pomalaa Ophiolitic Complexes part of Cretaceous East Sulawesi Ophiolite (ESO). Ultramafic rocks mainly peridotite, mostly serpentized, and different paleo-temperature levels, based on pyroxene thermometer. Different generations of exsolution lamellae indicate magma cooling was gradual. Tectonic setting was ocean floor; magmatism was Mid Oceanic Ridge Basalt)

Chaerul, M., L.O. Ngkoimani & S. Sadri (2017)- Limestone facies and diagenesis on Tondo Formation at Kaisabu Village Bau-Bau City Southeast Sulawesi Province. *J. Geoscience Engineering Environment Technology (JGEET)* 2, 1, p. 9-13.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/14>)

(E-M Miocene Tondo Limestone near Bau Bau composed of wackestone and packstone. Wow.)

Choi, Y. & B. Kim (2023)- Characteristics and controlling factors on nickel laterite deposits in Sulawesi, Indonesia. *Economic and Environmental Geology (Korean Soc. Economic Environmental Geology)* 56, 3, p. 343-363. *(in Korean, with English abstract)*

(online at: <https://www.kseeg.org/journal/view.html?doi=10.9719/EEG.2023.56.3.343>)

(Nickel laterite deposits in Sulawesi formed by lateritization of large East Sulawesi Ophiolite, under active tectonic setting and tropical rainforest climate. Exploration cases for nickel laterite deposits in five regions of Sulawesi reported here. In Morombo and Morowali regions, typical high-grade saprolite-type orebodies with thickness of 10-20m. High grade intervals where joints and garnierite veins are dense)

Choi, Y., I. Lee & I. Moon (2021)- Geochemical and mineralogical characteristics of garnierite from the Morowali Ni-laterite deposit in Sulawesi, Indonesia. *Frontiers in Earth Science* 9, 761748, p. 1-17.

(online at: <https://www.frontiersin.org/articles/10.3389/feart.2021.761748/full>)

(Morowali Ni-laterite deposit in E Sulawesi Ophiolite, developed in laterite profile on weathered serpentized harzburgite. Main Ni-ore is garnierite, concentrated in saprolite horizon. Serpentine-like and talc-like phases)

Cifa, A.A., Y. Sutadiwira, Rendy, A.Y. Puteri, A. H. Yusuf, A. Arifin, R. Ramadana & M. Gamara (2025)- Analysis of depositional environment and geochemical characteristics of source rocks in Mallawa Formation, South Sulawesi Province. *Proc. 1st Int. Conference of Petroleum Mining Geology Geoscience Energy & Environmental Technology (ICPMGET 2024), Jakarta 2024, IOP Conference Series: Earth and Environmental Science* 1451, 012022, p. 1-13.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1451/1/012022/pdf>)

(Trisakti paper on geochemistry of 8 outcrop samples of (Eocene) sandstone-coal sections of Malawa Fm in SW Sulawesi. Coals TOC ~58-60% (seems 'dirty'; JTvG). Vitrinite Reflectance Ro% 0.25-0.31%, which means thermally immature for hydrocarbon generation)

Cipta, A., R. Robiana, J.D. Griffin, N. Horspool, S. Hidayati & P. Cummins (2016)- A probabilistic seismic hazard assessment for Sulawesi, Indonesia. In: P.R. Cummins & I. Meilano (eds.) *Geohazards in Indonesia; Earth science for disaster risk reduction*, Geological Society, London, Special Publ. 441, p. 1-20.

(High seismic activity rates, both along fast-slipping crustal faults (Palu-Koro-Matano Fault) and in regions of distributed deformation, contribute moderate-high earthquake hazard over all but the SW part of Sulawesi)

Cipta, A., A. Rudyanto, H. Afif, R. Robiana, A. Solikhi, A. Omang, Supartoyo & S. Hidayati (2020)- Unearthing the buried Palu-Koro Fault and the pattern of damage caused by the 2018 Sulawesi earthquake using HVSR inversion. In: Y. Dilek et al. (eds.) *Characterization of modern and historical seismic-tsunami events, and their global-societal impacts*, Geological Society, London, Special Publ. 501, p. 185-203.

Ciputra, R.C., F. Pratiwi, A.F. Putra, H. Syaeful, F.D. Indrastomo, T.Ba. Adimedha, Y. Rachael & I G .Sukadana (2025)- Makassar Strait thrust- Mamuju segment (MSTM) perspective on radioactive mineral exploration: A case study in Rantedoda, Mamuju. Indonesian J. on Geoscience (IJOG) 12, 3, p. 383-400.

(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/1152/515>)

(On faulting and radioactive and REE mineralization in onshore SW Sulawesi Mamuja area of M Miocene-Pliocene volcanics)

Cita, A., H. Moechtar, U.M. Lumbanbatu, Subiyanto & S. Poedjoprajitno (eds.) (2014)- Geodinamika Kuarter daerah Sulawesi Utara. Pusat Survei Geologi (Badan Geologi), Bandung, Special Publ., p. 1-275.

(*Quaternary geodynamics of the North Sulawesi region'. Collection of papers on Quaternary of Sulawesi*)

Coffield, D.Q., S.C. Bergman, R.A. Garrard, N. Guritno, N.M. Robinson & J. Talbot (1993)- Tectonic and stratigraphic evolution of the Kalosi PSC area and associated development of a Tertiary petroleum system, South Sulawesi, Indonesia. Proc. 22nd. Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, 1, p. 679-706.

(*S Sulawesi basement imbricated, metamorphic Mesozoic sediments and ophiolites (SE Sundaland Cretaceous accretionary complex). Unconformably overlain by Paleo-Eocene volcanics and Eocene fluvial- lacustrine rocks, associated with extensional faulting. U Eocene- M Miocene Tonasa Fm platform carbonates reflect quiescence. Thick M Miocene- Pliocene N-S trending bimodal volcano- plutonic belt reflects E-M Miocene subduction beneath S Sulawesi and obduction of oceanic crust onto E Sulawesi micro-continent(s), followed by M-L Miocene collision. These are unconformably overlain by latest Miocene- earliest Pliocene Tacipi reef carbonates and Pliocene and younger synorogenic clastics. Continued Pliocene convergence formed W-vergent orogen in S Sulawesi, with thin-skinned thrusting in W and basement-involved thrusting in E. Oils from seeps typed to mature Eocene source rocks*)

Coffield, D.Q., N. Guritno, M.E.J. Wilson & N.A. Ascaria (1997)- Petroleum systems of South Sulawesi, Indonesia (fieldtrip summary). In: J.V.C. Howes & R.A. Noble (eds.) Proc. Int. Conference Petroleum Systems of SE Asia and Australasia, Indonesian Petroleum Association (IPA), Jakarta, p. 1001-1010.

(*S Sulawesi dominated by W-verging Late Miocene- Pliocene foldbelt. Source rocks in deltaic coals of early transgressive sequences. Late Tertiary magmatism and subsequent Pliocene orogenesis resulted in formation of multiple kitchen areas. Potential reservoirs throughout Late Tertiary section, although only Late Miocene- Pliocene (post-magmatic/ pre-orogenic) carbonates proven productive to date in S Sulawesi*)

Coffield, D., N. Guritno, M. Wilson & A. Ascaria (1997)- Petroleum systems of South Sulawesi, Indonesian Petroleum Association (IPA), Fieldtrip guidebook, p. 1-81.

Collins J.S.H. & A.J. Barber (1998)- A new middle Eocene crab, *Lobocarcinus pentanodosus* sp. nov. (Crustacea, Decapoda) from Doi Doi, Barru, South Sulawesi, Indonesia. Bull. Mizunami Fossil Museum, Mizunami City, Japan, 25, p. 97-101.

(*New cancrioid crab fossils from M Eocene of S Sulawesi. This is first record of genus from W Pacific*)

Cool, H. (1910)- Een mijnbouwkundige en geologische onderzoekingsreis in Celebes. Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap (2) 27, p. 112-127.

(online at: <https://resolver.kb.nl/resolve?urn=MMUBA13:001653001:pdf>)

(*'A mining-geological survey trip in Sulawesi'. March-August 1909 trip by Ir. Hugo Cool to N part of SW Arm and part of C Sulawesi with J. de Koning Knijff. Mainly travel report of 1909 survey to Toraja lands; little or no geology. Baroko oil seep W of Kalosi*)

Cornée, J.J., R. Martini, M. Villeneuve, L. Zaninetti, E. Mattioli, R. Rettori, F. Atrops & W. Gunawan (1997)- Jurassic pelagic deposits of East Sulawesi (Kolonodale Area, Indonesia): new biostratigraphic data based on calcareous nannofossils. In: Geoitalia, 1 Forum FIST, 2, p. 97-98 (Abstract)

(online at: <http://archive-ouverte.unige.ch/unige:4764>)

(*E-M Jurassic (Toarcian-Bathonian) calcareous nannoplankton above Late Triassic limestones in dismembered succession in Kolonodale-Beteleme area of W margin of E Sulawesi Zone*)

Cornee, J.J., R. Martini, M. Villeneuve, L. Zaninetti, E. Mattioli, R. Rettori, F. Atrops & W. Gunawan (1999)- Mise en evidence du Jurassique inferieur et moyen dans la ceinture ophiolitique de Sulawesi (Indonesie). Consequences geodynamiques. *Geobios* 32, 3, p. 385-394.

(online at: www.academia.edu/9355841/volution_g%C3%A9odynamique_de_l_\ndon%C3%A9si Etc.)

(*'Evidence of Lower and Middle Jurassic in the Sulawesi ophiolite belt: geodynamic consequences'. ~350m E-M Jurassic deep marine clays and carbonates over Latest Triassic reefal carbonates in E Sulawesi Kolonodale area, indicating major subsidence after Triassic carbonate deposition. Thin E Jurassic limestones with *Involutina liassica*. On W bank of Lambolo Gulf in thin Toarcian shale one ammonite of *Hammatoceras moluccanum* group. Ophiolite overrides rel. thin Late Cretaceous- Paleogene pelagic limestones. Prior to Neogene tectonics, which strongly dismembered E Indonesia, ophiolitic tectonic zone of E Sulawesi probably part of wide paleogeographic block that included some of Banda Sea continental fragments (Buru, Seram, Buton, Sinta Ridge)*)

Cornee, J.J., G. Tronchetti, M. Villeneuve, B. Lathuiliere, M.C. Janin, P. Saint-Marc, W. Gunawan & H. Samodra (1995)- Cretaceous of eastern and southeastern Sulawesi (Indonesia): new micropaleontological and biostratigraphical data. *J. Southeast Asian Earth Sciences* 12, 1, p. 41-52.

(online at: www.academia.edu/6862893/Cretaceous_of_eastern_and_southeastern_Sulawesi_Indonesia Etc.)

(*New outcrops of pelagic carbonates of Albian and Campanian-Maastrichtian age in strongly tectonized areas in E and SE Sulawesi. Species indicate no major difference in facies of E and SE arms of Sulawesi. Similar pelagic facies also in numerous places in E Indonesia and in distal Australian shelf during Late Cretaceous*)

Cornee, J.J., M. Villeneuve, R. Martini, L. Zaninetti, D. Vachard, B. Vrielynck, W. Gunawan, H. Samodra & L. Sarmili (1994)- Une plate-forme carbonatee d'age rhetien au centre-est de Sulawesi (region de Kolonodale, Celebes, Indonesie). *Comptes Rendus Academie Sciences, Paris* 318, Ser. II, p. 809-814.

(online at: <https://archive-ouverte.unige.ch/unige:4767>)

(*'A carbonate platform of Rhaetian age in Central-East Sulawesi (Kolonodale region'. Widespread outcrops of ~150m of white latest Triassic reefal carbonates S and SW of Kolonodale (structurally below E Sulawesi ophiolite terrane?). Limestones range from boundstone to grainstone. Non-skeletal grains mainly peloids and some ooids and intraclasts. Skeletal grains molluscs, green algae (including dasycladaceans), echinoderms and benthic foraminifera (*Aulotortus* spp., *Auloconus*, *Triasina hantkeni*) and locally also brachiopods, coral clusters. Limestones can be correlated with U Triassic limestones of Tokala Mts of Sulawesi East Arm*)

Costa, K.M., J.M. Russell, H. Vogel & S. Bijaksana (2015)- Hydrological connectivity and mixing of Lake Towuti, Indonesia in response to paleoclimatic changes over the last 60,000 years. *Palaeogeogr. Palaeoclim. Palaeoecology* 417, p. 467-475.

(*Sediment geochemistry of cores from Lake Towuti in C Sulawesi records paleoclimate changes over last 60 ka. During Last Glacial Maximum no changes in sediment provenance, despite drier climate, but trace elements suggest decrease in weathering intensity, likely in response to decreased precipitation and temperature*)

Cottam, M.A., R. Hall, M. Forster & M. Boudagher Fadel (2011)- Basement character and basin formation in Gorontalo Bay, Sulawesi, Indonesia: new observations from the Togian Islands. In: R. Hall, M.A. Cottam & M.E.J. Wilson (eds.) *The SE Asian gateway: history and tectonics of Australia-Asia collision*, Geological Society, London, Special Publ. 355, p. 177-202.

(online

at:

https://www.researchgate.net/publication/260451427_Basement_character_and_basin_formation_in_Gorontalo_Bay_Sulawesi_Indonesia_New_observations_from_the_Togian_Islands)

(*Togian islands stratigraphy includes Walea Fm pillow basalts and volcanic breccias of unknown age, overlain by late Middle Miocene Peladan Fm limestone, overlain by Late Miocene- E Pliocene Bongka Fm/ Celebes Molasse and uplifted ?Pleistocene reef terraces. Field relationships indicate latest Miocene- Pliocene age for inception of Gorontalo Bay basin. Young medium-K to shoshonitic volcanism in Togian Islands not due to subduction but reflects crustal thinning and extension in Pliocene- Pleistocene. Extension continuing today. Extension and subsidence driven by rollback of subduction hinge at N Sulawesi Trench.)*

Crotty, K.J. & D.W. Engelhardt (1993)- Larger foraminifera and palynomorphs of the upper Malawa and lower Tonasa Formations, southwestern Sulawesi Island, Indonesia. In: T. Thanasuthipitak (ed.) Int. Symposium Biostratigraphy of mainland Southeast Asia: facies and paleontology (BIOSEA), Chiang Mai 1993, p. 71-82.

(online at: <https://library.dmr.go.th/elib/cgi-bin/opac.exe?op=mmvw&db=Main&skin=S&mmid=12845&bid=2298>)

(SW Sulawesi M Eocene coal-bearing Malawa Fm clastics with pollen *Retitribrevicolporites matamanadensis* and dinoflagellates *Muratodinium fimbriatum* and *Homotryblium floripes*. Overlying clastics/ limestones Late Eocene with *Verrucatosporites usmensis*, *Nummulites javanus* (Ta3?) and *Pellatispira- Biplanispira* (Tb), *Discocyclina* and *Asterocyclina*. Overlain by ~120' thick basal dolomitic member of E Oligocene Tonasa Lst with *Coskinolina*, *Praerhapidionina*, arenaceous foraminifera and miliolids, overlain by thin zone Tc with *Nummulites fichteli* and zone Td with same + *Eulepidina*, *Austrotrillina striata*. Near top of Tonasa quarry, Late Oligocene/ Te1-4 with *Nephrolepidina*, *Spiroclypeus* and *Heterostegina borneensis*. No miogypsinids seen)

Cucci, M.A., R.A. Garrard & M. Golborne (1994)- The Early Tertiary rift basins of offshore South Sulawesi, Indonesia. AAPG Annual Convention, Denver (Abstract)

(Offshore S Sulawesi Paleogene rift system activated and failed twice. Initial rifting Late Paleocene-E Eocene, with N-S oriented sags on Cretaceous platform with Langi Fm volcanics. By M Eocene rifting failed and uplift/ erosion formed major unconformity. Second rift event M Eocene, close to earlier 'sags'. N-S orientation, from off S Sulawesi to near Sabalana Island at intersection with E-W trending Kangean-Lombok rift system. M Eocene terrestrial-lacustrine Malawa/Toraja Fms overlain by fluvio-deltaic deposits. In Late Eocene rifting ceased, leaving extensive shelfal areas isolated from Sulawesi sediment supply. Transgression initiated vast Tonasa/ Makali Fm carbonate platform with localized reefal buildups. Late Miocene carbonates gave way to siliciclastics (Camba Fm), derived from establishment of major magmatic belt. Late Tertiary compressional tectonics inverted many Paleogene rifts to form classic 'Sunda-type' folds)

Cui, H., Y. Wan, X. Wang, J. Huang & Z.T. Jin (2021)- Characteristic of tectonic stress field in source region of 2018 MW7.6 Palu earthquake and Sulawesi area. J. of Earth Science 46, 7, p. 2657-2674. (in Chinese)

Dam, R.A.C., J. Fluin, P. Suparan & S. van der Kaars (2001)- Paleoenvironmental developments in the Lake Tondano area (N-Sulawesi, Indonesia) since 33,000 yr B.P. Palaeogeogr. Palaeoclim. Palaeoecology 171, p. 147-183.

(Lake Tondano at 680m above SL. Lake levels rose and fell. Late Pleistocene phase with lower precipitation and lower temperatures. Ongoing progressive deforestation of Tondano upland)

Damanik, A., M. Wille, Q. Ahmad, S. Chatterjee, S.A. Crowe, K.W. Bauer, M. Grosjean, S.Y. Cahyarini, S. Bijaksana et al. (2024)- Low Mo mobility during the laterization of ultramafic bedrock: Evidence from the East Sulawesi Ophiolite, Indonesia. Chemical Geology 660, 122150, p. 1-11

(online at: <https://www.sciencedirect.com/science/article/pii/S0009254124002304>)

(Molybdenum concentrations in chemically weathered laterite from area S of Lake Matano only slightly higher than in underlying peridotite bedrock)

Darman, H. (2011)- Seismic expression of North Sulawesi subduction zone. Berita Sedimentologi 22, p. 5-8.

(online at: <https://journal.iagi.or.id/index.php/FOSI/article/download/198/168>)

(Seismic lines/ cross sections of recent subduction complex of Sulawesi Sea plate under Sulawesi North Arm)

De Beaufort, L.F. (1926)- On a collection of marine fishes from the Miocene of South Celebes. Jaarboek Mijnwezen Nederlandsch-Indie 54 (1925), Verhandelingen 1, p. 115-148.

(Fish fossils collected by Brouwer in 1923 from lithographic (lagoonal?) platy limestone near Patanuang Asi, Maros district, S Sulawesi Fifteen coastal marine fish species, including herring-like *Sardinella brouweri* and *Lutjanus*. Associated foraminifera identified by Rutten as Early Miocene age. No location or stratigraphy info)

De Beaufort, L.F. (1934)- On a fossil fish from Gimpoe (Central Celebes). Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie, 2, p. 180-181.

(Brief description of fish fossils, probably fresh-water and of Neogene age, collected at Gimpoe basin, C Sulawesi, by Brouwer 1929 expedition. Includes new species Lithopocilu brouweri. No figures)

De Klerk, L.G. (1983)- Zeespiegels, riffen en kustvlakten in Zuidwest-Sulawesi, Indonesia: een morfogenetisch- bodemkundige studie. Ph.D. Thesis University of Utrecht, p. 1-174.
(‘Sea levels, reefs and coastal plains of Southwest Sulawesi, Indonesia: a morphogenetic-pedological study’. On the Holocene evolution of the Spermonde Archipelago coral reefs and adjacent SW Sulawesi coastal region)

De Koning Knijff, J. (1914)- Geologische gegevens omtrent gedeelten der afdelingen Loewoe, Pare Pare en Boni van het Gouvernement Celebes en onderhoorigheden. Jaarboek Mijnwezen Nederlandsch Oost-Indie 41 (1912), Verhandelingen 1, p. 277-312.
(Report on 1909 geological reconnaissance surveys in Luwu, Pare Pare and Bone districts (S and C Sulawesi), compiled by H.A. Brouwer. Not overly useful)

Delisle, G., H. Beiersdorf, S. Neben & D. Steinmann (1998)- The geothermal field of the North Sulawesi accretionary wedge and a model on BSR migration in unstable depositional environments. In: J.P. Henriot et al. (eds.) Gas hydrates: relevance to world margin stability and climate change, Geological Society, London, Special Publ. 137, p. 267-274.
(Distribution of heat flow in N Sulawesi accretionary wedge derived from depths of bottom simulating reflector (BSR) and nine in situ heat flow measurements. High heat flow of ~70-100mWm⁻² near deformation front and systematic decrease to 30mWm⁻² landwards)

De Man, J.G. (1904)- Beschreibung einiger brachyurer Krebse aus post-Tertiaren schichten der Minahassa, Celebes. Sammlungen Geologischen Reichs-Museums Leiden, E.J. Brill, ser. 1, 7, 1, p. 254-278.
*(online at: www.repository.naturalis.nl/document/552414)
(Description of Quaternary brachyurid crab fossils from marls near Kajoe raji, along road from Menado to Kema, N Sulawesi, collected by R. Fennema. Incl. new species Metopoxantho martini and Macrophthalmus granulosus. Associated molluscs described by Schepman 1907)*

De Roever, W.P. (1947)- Igneous and metamorphic rocks in Eastern Central Celebes. In: H.A. Brouwer (ed.) Geological explorations of the island of Celebes, North Holland Publishing Co., Amsterdam, p. 67-173.
(Two main metamorphic facies in eastern C Sulawesi: older epidote-amphibolite facies and younger lawsonite-glaucophane blueschist facies. Many rocks polymetamorphic, affected by both facies. Epidote-amphibole facies over whole region, glaucophane facies in western half of eastern C Sulawesi only (Lake Poso, etc.) (can now be interpreted as exhumed subduction zone?; JTvG))

De Roever, W.P. (1950)- Preliminary notes on glaucophane-bearing and other crystalline schists from Southeast Celebes, and on the origin of glaucophane-bearing rocks. Proc. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam, 53, 9, p. 1455-1465.
*(online at: <https://dwc.knaw.nl/DL/publications/PU00018892.pdf>)
(Petrographic study of 170 crystalline schist samples from SE Sulawesi, collected by Bothe, Hetzel and Straeter. Two metamorphics groups, similar to Kabaena island (De Roever 1953): (1) Rumbia and Mendoke Mts mainly glaucophane-lawsonite schist facies (metamorphism of ‘alpine orogene’; original material of Mesozoic age) and (2) lower La Solo River mainly amphibolite and greenschist-dynamometamorphic facies (probably Paleozoic or older original rock and pre-alpine age metamorphism?). ‘Paired metamorphic belt’ of lawsonite-glaucophane schists-ultrabasites in East, andalusite-cordierite metamorphics- granites on W side of Sulawesi)*

De Roever, W.P. (1951)- Ferrocapholite, the hitherto unknown ferrous analogue of carpholite. Indonesia. American Mineralogist 36, p. 736-745.
(Ferrocapholite new dark green prismatic mineral from cobble of metamorphic vein-quartz collected by Hetzel, W of Tomata, eastern Central Sulawesi (= part of high P/ low T blueschist metamorphic facies; JTvG))

De Roever, W.P. (1953)- Tectonic conclusions from the distribution of the metamorphic facies in the island of Kabaena near Celebes. Proc. 7th Pacific Science Congress, New Zealand 1949, 2, Geology, p. 71-81.

(Metamorphic facies map of Kabaena Island off SE arm of Sulawesi and W of Buton. Peridotites-serpentinities are uppermost tectonic unit. Separated by overthrust fault from underlying metamorphic schists of amphibolite and epidote-amphibolite facies. Below this another overthrust plane. Lowermost tectonic unit ?Mesozoic schists in glaucophane-lawsonite facies, thrust 10's of km; movements directed approximately to N)

De Roever, W.P. (1955)- Genesis of jadeite by low-grade metamorphism (Celebes). American Journal of Science 253, 5, p. 283-298.

(Jadeite-rich pyroxene occurs as zoned crystals in metamorphic quartzite of Salimoeroe and Koesek River regions, Sulawesi (petrographic descriptions in De Roever 1947). Formed by conversion of albite in psammitic sediments as extreme variety of low-grade metamorphism in glaucophane schist facies)

De Roever, W.P. (1956)- Some additional data on the crystalline schists of the Rumbia and Mendoke Mountains (SE Celebes). Verhandelingen Kon. Nederlands Geologisch Mijnbouwkundig Genootschap (KNGMG), Geologische Serie 16 (Brouwer volume), p. 385-394.

(Rumbia and Mendoke Mts in SE Sulawesi up to 1000m high and composed of metamorphic rocks. Two phases of metamorphism: (1) main phase of rel. deep garnet-lawsonite glaucophane schists, (2) younger 'Alpine' lower grade metamorphism, probably accompanied by large scale overthrusting)

De Roever, W.P. & C. Kieft (1971)- Additional data on ferrocapholite from Sulawesi (Celebes), Indonesia. American Mineralogist 56, p. 1976-1982.

(Ferrocapholite from N part of C Sulawesi, resembling actinolite. Most likely product of metamorphism in glaucophane-schist and lawsonite-albite facies)

Dewi, V.K., W. Pusparini, F. Taufik, N.N. Ilmi & A. Gunawan (2019)- Geochemical characteristics of migrated hydrocarbon in the Bone Basin, Bone Gulf, South of Sulawesi, and its implication to the petroleum system. Proc. 43rd Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA19-SG-582, p. 1-13.

(Geochemical analysis of 80 seafloor piston cores in Bone Bay suggests hydrocarbons derived from lacustrine shale source rocks)

Dieckmann, W. (1919)- Nikkelhoudende lateritische ijzerertsen op Celebes. De Ingenieur 34, 43, p. 782-787.

(online at: <https://resolver.kb.nl/resolve?urn=dts:2981064:mpeg21:pdf>)

('Nickel-bearing lateritic iron ores on Sulawesi'. Discussion of possibility of establishing iron industry in Netherlands Indies by German iron ore specialist Walter Dieckmann (died in 1922 in Martapura))

Dieckmann, W. & M.W. Julius (1925)- Algemeene geologie en ertsafzettingen van Zuidoost Celebes. Jaarboek Mijnwezen Nederlandsch-Indie 53 (1924), Verhandelingen, p. 11-65.

('General geology and ore deposits of SE Sulawesi'. Mainly valuation of iron, nickel, chromium deposits in weathered peridotites, conducted from February 1917- October 1922 with J.W.H. Adam, W.C.B. Koolhoven, etc., Widespread peridotites, older intensely folded crystalline schists and overlying Late Mesozoic- E Tertiary limestones with radiolarites (= 'Matano Beds' of Koolhoven (1932). Tertiary overlies both old schists and peridotites and all are folded and faulted. Faults mainly NW-trending. With brief appendix on fossils by Van der Vlerk, reporting three groups of pelagic rocks: red radiolarian chert, red shales with 'Globigerina linneana' (= Late Cretaceous Globotruncana; JTvG) and grey shale with Globigerina bulloides (= basal Tertiary? JTvG). Followed by petrographic descriptions by W.F. Gisolf)

Digdowiro, S., K.Darius, G.P. Mu'min & C. Effendi (1990)- Permasalahan geokimia dalam explorasi mineral: ihwal daerah Bunobogu- Boroko, Sulawesi Utara. Majalah Geologi Indonesia (IAGI) 13, 4, p. 1-18.

('Geochemical problems in mineral exploration: about the Bunobogu-Boroko area, North Sulawesi')

Dill, H.G., A. Fricke, K.H. Henning & H. Gebert (1995)- An APS mineralization in the kaolin deposit Desa Toraget from northern Sulawesi, Indonesia. J. Southeast Asian Earth Sciences 11, 4, p. 289-293.

(Two types of APS (Aluminium-phosphate-sulphate) minerals in Desa Toraget kaolin deposit on Pliocene Tondano Tuff at NE end of N Arm of Sulawesi. Genetic link between epithermal Au mineralization and high sulphidation kaolinitic alteration elsewhere, suggests area may be potential target for Au exploration)

Dirk, M.H.J. (2001)- Petrologi ofiolit lengan tenggara Sulawesi dan potensi sumber daya mineral yang berasosiasi. Geological Research Development Centre (GRDC), Bandung, Special Publ. 28, p. 11-26.
(*'Petrology of ophiolite of the SE arm of Sulawesi and potential of associated minerals'*)

Dirk, M.H.J. (2010)- Ofiolit di jalur Sulawesi Timur, Warta Geologi (Newsletter Geological Society Malaysia) 5, 3, p. 40-43.
(online at: http://www.bgl.esdm.go.id/images/stories/warta_geologi/pdf/warta201003.pdf)
(*'Ophiolite in the East Arm of Sulawesi'. Brief review, in Indonesian/ Malay*)

Djajadihardja, Y.S., A. Taira, H. Tokuyama, K. Aoike, C. Reichert, M. Block, H.U. Schluter & S. Neben (2004)- Evolution of an accretionary complex along the North arm of the island of Sulawesi, Indonesia. Island Arc 13, 1, p. 1-17.
(*Well-developed accretionary prism at S side N Sulawesi Trench, formed as result of clockwise rotation and N ward movement of N Sulawesi arm after M Miocene Bangai-Sula collision in E. Greatest convergence and widest accretionary wedge in W part of trench/wedge. Growth of accretionary prism started at ~5 Ma*)

Djuri, M., Sudjatmiko, S. Bachri & Sukido (1998)- Geologic map of the Majene and western part of the Palopo sheets, Sulawesi, 1:250,000. Geological Research Development Centre (GRDC), Bandung, p.
(*Second edition of 1974 W Sulawesi geologic map between 3-4°S (adjacent to Mandar block). Oldest rocks low-metamorphic Upper Cretaceous clastics, overlain by Eocene limestones-clastics, Oligocene and younger clastics, limestones and volcanics, Miocene- Pliocene granitic intrusives. M Miocene- Pliocene molasse unconformable over older sediments*)

Dollfus, G.F. (1915)- Paleontologie du voyage a l'île de Celebes de M.E.C. Abendanon. In: E.C Abendanon, E.C. (1917) Geologische en geographische doorkruisingen van Midden-Celebes (1909-1910), E.J. Brill, Leiden, 3, p. 959-1016.
(online at: <https://www.delpher.nl/nl/boeken/view?identifier=MMKB24:073693000:00001>)
(*'Paleontology of the voyage to Sulawesi by Abendanon'. Fossils collected by E Abendanon in Central Sulawesi, described by French geologist/paleontologist Gustave F. Dollfus in Paris. Brief descriptions of 'Jurassic' red radiolarian cherts, Upper Cretaceous marls with molluscs (Turritella, Thracia abendanoni, Cytherea verbeeki), hard, dark Eocene Nummulites- Discocyclusina- Pellatispira limestone and Oligocene-Pliocene marine sediments with molluscs*)

Dollfus, G.F. (1919)- L'Oligocene de l'île de Celebes. Compte Rendu sommaire des Seances Societe Geologique de France 1919, p. 13-15.
(online at: <https://babel.hathitrust.org/cgi/pt?id=mdp.39015035493991;view=1up;seq=23>)
(*'The Oligocene of Sulawesi island'. Brief summary. Disagrees with Martin (1917) critique of Dollfus (1917), suggesting Dollfus' Oligocene molluscs from Sulawesi should be Neogene. Occurrence of Tympanotonus (Vicarya) verneuli*)

Dong, M., C.C. Lu, J. Zhang & T. Hao (2022)- Downgoing plate-buoyancy driven retreat of North Sulawesi Trench: transition of a passive margin into a subduction zone. Geophysical Research Letters 49, e2022GL101130, p. 1-10.
(online at: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2022GL101130>)
(*Transition of N Sulawesi passive continental margin at 5–9 Myr system. Initial subduction of N Sulawesi relies on horizontal stress, while trench retreat depends on negative buoyancy of oceanic lithosphere. Sangihe slab from E reduces space available for subduction of C and E sides, slowing down trench retreat. Different trench retreat velocities along N Arm of Sulawesi resulted in clockwise rotation*)

Dong, M., T. Hao, L. Xu, J. Zhang, J. Zhang, C.C. Lu & Q. He (2024)- Subduction without volcanic arc magma: insights from two young subduction zones in the western Pacific. Tectonophysics 874, 8, 230231, p. 1-12.

(online at: https://www.researchgate.net/publication/377970725_Subduction_without_volcanic_arc_magma_Insights_from_two_young_subduction_zones_in_the_western_Pacific)

(North Sulawesi subduction zone deeper than average volcanic sub-arc depth, but, no corresponding volcanoes or arc magmatism along N Sulawesi arm (instead, significant phase of acid-intermediate magmatism during Late Miocene-Pliocene, possibly arising from lithospheric extension. Subducting plate of NSS exhibit shallow below-average sub-arc depth, indicating lower water content. Absence of arc magma in NSS could be explained by the little water influx and shallow water dehydration of subducting slab. Etc.)

Draniswari, W.A., S.I.T. Kusuma, T.B. Adimedha & I Gde Sukadana (2020)- Peran kontaminasi kerak pada diferensiasi magma pembentuk batuan vulkanik Sungai Ampalas, Mamuju, Sulawesi Barat. *Eksplorium* 41, 2, p. 73-86.

(online at: <https://jurnal.batan.go.id/index.php/eksplorium/article/download/6040/pdf>)

(‘Crustal contamination role on magma differentiation of volcanic rocks in Ampalas River, Mamuju, West Sulawesi’. Anomalous radioactivity in volcanic rock boulder in Ampalas River Area)

Du, H., Y. Fang, X. Yin & K. Zhang (2019)- Formation and petroleum characteristics of Bone Basin in Sulawesi area, Indonesia. *Marine Geology Frontiers* 35, 10, p. 49-55. *(in Chinese)*

(online at: <http://en.cgsjournals.com/zgzdcqkw-data/hydzqy/2019/10/PDF/hydzqy-35-10-49.pdf>)

(Bone Basin relatively unexplored Cenozoic rift basin, but high potential for oil-gas deposits)

Efendi, H.A., G.I. Marliyani & S. Pramumijoyo (2021)- Recent faulting along Gorontalo fault based on seismicity data analysis and lineament mapping. Proc. The 2nd Geoscience and Environmental Management Symposium (ICST 2021), Yogyakarta, E3S Web of Conferences 325, 010013, p. 1-5.

(online at: https://www.e3s-conferences.org/articles/e3sconf/pdf/2021/101/e3sconf_icst2021_01013.pdf)

(NW-SE trending Gorontalo Fault in onshore N Sulawesi still active)

Effendi, A.C. (1976)- Geologic map of the Manado quadrangle, North Sulawesi, scale 1:250,000. Geological Research Development Centre (GRDC), Bandung.

(see also Effendi & Bawono, 1997; 2nd Edition)

Effendi, A.C. & S.S. Bawono (1997)- Geologic map of the Manado quadrangle, North Sulawesi, 1:250,000, 2nd Edition, Geological Research Development Centre (GRDC), Bandung.

(Geologic map of NE tip of North Arm of Sulawesi. Common E Miocene- Recent volcanics and volcanoclastics and associated limestones. Volcanic arc formed as response to subduction from N Sulawesi subduction zone and East (E Sangihe subduction zone))

Egeler, C.G. (1947)- Contribution to the petrology of the metamorphic rocks of Western Celebes. In: H.A. Brouwer (ed.) Geological Explorations of the Island of Celebes, North Holland Publishing Co., p. 177-346.

(Also as Doctoral Thesis at University of Amsterdam, 1946, p. 1-165; Promotor H.A. Brouwer)

(Descriptions of metamorphic and igneous rocks from N Part of western Central Sulawesi and S part of Sulawesi 'neck', collected by Brouwer expedition in 1929. Widespread young 'alpine' granodioritic intrusions of W Sulawesi caused intense plutonic contact metamorphism, which was superimposed over older regional metamorphism)

Egeler, C.G. (1949)- On amphibolitic and related rocks from western Celebes and the southern Sierra Nevada, California. Proc. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam, 51, 1, p. 100-105.

(online at: <https://dwc.knaw.nl/DL/publications/PU00018468.pdf>)

(In W Sulawesi widespread young granodioritic intrusions caused intensive plutonic-metamorphism (= contact-metamorphism), superimposed over an older regional metamorphism schists in amphibolite-epidote facies. Similar relationships in Sierra Nevada, California))

Egeler, C.G. (1949)- On metamorphic rocks from the island of Kabaena in the East-Indian Archipelago. Proc. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam, 52, 5, p. 551-562.

(online at: <https://dwc.knaw.nl/DL/publications/PU00018668.pdf>)

(Petrographic descriptions of metamorphic rocks collected by Brouwer in 1929: hornfels, mica-schists, gneiss, amphibolite, amphibolite schist and crystalline limestones. Kabaena high-grade regional metamorphic schists considered to be older than ophiolitic rocks, similar to SE Sulawesi, but not affected by younger glaucophanitic metamorphism as seen in E Sulawesi (but De Roever (1953) did report glaucophane schist from Kabaena; JTvG). No locality maps or geologic context)

Ekram, M.E., M. Campbell, S.H. Kose, C. Plet, R. Hamilton, S. Bijaksana, K. Grice, J. Russell et al. (2024)- A 1 Ma sedimentary ancient DNA (sedaDNA) record of catchment vegetation changes and the developmental history of tropical Lake Towuti (Sulawesi, Indonesia). *Geobiology* 22, 3, e12599, p. 1-21.
(online at: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/gbi.12599>)

Elburg, M. & J. Foden (1998)- Temporal changes in arc magma geochemistry, Northern Sulawesi, Indonesia. *Earth Planetary Science Letters* 163, p. 381-398.
(N Sulawesi Sangihe Arc Late Miocene- Recent volcanics geochemical change through time. Oldest suites mantle source with previous event of melt extraction. Modern lavas, especially volcanic centers far from trench indicate subduction zone component dominated by melt of sedimentary origin. Change from fluid-dominated to melt-dominated subduction zone component may be related to collision between Halmahera and Sangihe arcs. These changes appear superimposed on variable parent magma composition)

Elburg, M. & J. Foden (1999)- Sources for magmatism in Central Sulawesi: geochemical and Sr-Nd-Pb isotopic constraints. *Chemical Geology* 156, p. 67-93. (online at: https://www.academia.edu/3247290/Sources_for_magmatism_in_Central_Sulawesi_geochemical_and_Sr_Nd_Pb_isotopic_constraints?rhid=29234969213&swp=rr-rw-wc-24640566)
(M Miocene- Quaternary magmatism in C West Sulawesi distinct subduction signature. Isotopic signature of lamprophyres interpreted as mixed mantle source with contribution from old sub-continental lithospheric source, from sliver of Australian continent thrust under C Sulawesi. Felsic magmatism likely reflects high degrees of crustal contamination or intracrustal melting)

Elburg, M.A. & J. Foden (1999)- Geochemical response to varying tectonic settings: an example from Southern Sulawesi (Indonesia). *Geochimica Cosmochimica Acta* 63, p. 1155-1172. (online at: [www.academia.edu/3247280/Geochemical_response_to_varying_tectonic_settings_an_example_from Etc.](http://www.academia.edu/3247280/Geochemical_response_to_varying_tectonic_settings_an_example_from_Etc))
(S arm Sulawesi active continental margin from ~60 to 10 Ma, when it collided with Buton microcontinent. Pre-collisional geochemical signature typical of arc volcanics. Syn-collisional samples more enriched isotopic signatures and K-rich, interpreted to reflect larger contribution from subducted sediments, added to mantle wedge as silicic melt. Magmatism that postdates 10 Ma collision reflects melting of subduction-modified mantle with significant contribution from subcontinental lithospheric mantle)

Elburg, M.A., V.S. Kamenetsky, I. Nikogosian, J. Foden & A.V. Sobolev (2006)- Coexisting high- and low-calcium melts identified by mineral and melt inclusion studies of a subduction-influenced syncollisional magma from South Sulawesi, Indonesia. *Journal of Petrology* 47, 12, p. 2433-2462.
(online at: <https://academic.oup.com/petrology/article/47/12/2433/1564500>)
(Mineral and melt inclusions in olivines from Late Miocene (6-9 Ma) mafic silica-undersaturated ultra-potassic volcanic rocks with 'continental' Sr isotopic characteristics from southern W Sulawesi Volcanic Province indicate two distinct melts contributed to petrogenesis. High-CaO melt typical for subduction-related volcanic rocks, low-CaO melt does not have any obvious rock equivalent)

Elburg, M.A., T. Van Leeuwen, J. Foden & Muhardjo (2002)- Origin of geochemical variability by arc-continent collision in the Biru Area, Southern Sulawesi (Indonesia). *Journal of Petrology* 43, 4, p. 581-606.
(online at: <https://academic.oup.com/petrology/article/43/4/581/1473969>)
(Two main Tertiary volcanic episodes in SW Sulawesi: (1) M-L Eocene (~50 Ma) calc-alkaline Langi volcanics, (2) late Early Miocene calc-alkaline and M-L Miocene (15-6.3 Ma) potassic arc volcanics, both presumably related to W-dipping subduction. Also 1.8 Ma volcano farther S, not related to subduction? Miocene volcanics more heterogeneous after Buton microcontinent collision at ~15 Ma. Isotopic ratios more 'continental' 4 My after collision)

Elburg, M., T. van Leeuwen, J. Foden & Muhardjo (2003)- Spatial and temporal isotopic domains of contrasting igneous suites in western and Northern Sulawesi, Indonesia. *Chemical Geology* 199, p. 243-276.
(online at: www.academia.edu/20705903/Spatial_and_temporal_isotopic_domains_of_contrasting_ign_Etc.)
(*Paleocene- Pliocene magmatism in NW Sulawesi progression from Older Series with calc-alkaline/ tholeiitic signatures (51-17 Ma) to Younger Series of mafic-intermediate high-K magmas (~14-5 Ma) and felsic K-rich calc-alkaline magmas (9-2 Ma). Younger felsic magmatism reflects melting of Australian origin continental crust. Geochemical progression similar to C Sulawesi and explained by oceanic plate subduction followed by melting of underthrust sliver of Australian microcontinent, the size of which can be estimated from extent of low-Nd-isotope magma (~4°S to 1°N). Underthrusting must have happened prior to 14 Ma, indicating it cannot be equated to Sulawesi- Sula platform collision at 5 Ma. While subduction beneath W Sulawesi ceased prior to onset of potassic magmatism, it continued in N Sulawesi producing calc-alkaline suites*)

Eltham, J. (1997)- Development of Newmont's Minahasa Gold Mine in Indonesia. Proc. World Gold '97 Conference, Singapore 1997, Australasian Institute of Mining and Metallurgy (AusIMM), p.
(*PT Newmont Minahasa Raya gold mine in Mesel/ Rataotok area in SE Minahasa operational from 1996 until depletion in 2004. Little or no geology*)

Endharto, Mac (2000)- Studi stratigrafi kaitannya dengan perkembangan struktur geologi di Kawasan Latimojong, lengan Barat Sulawesi. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 10, 107, p. 14-45.
(not online at JGSM archive)
(*'Study of stratigraphy and relation to development of geological structures in the Latimojong District, W arm of Sulawesi'*.)

Endharto, M. & Surono (1991)- Preliminary study of Meluhu Complex related to terrane formation in Sulawesi. Proc. 20th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 340-353.
(online at: [https://www.iagi.or.id/web/digital/49/20th-\(10-12-Des-1991\)-23.pdf](https://www.iagi.or.id/web/digital/49/20th-(10-12-Des-1991)-23.pdf))
(*Meluhu complex (microcontinent) of SE Sulawesi is NW-SE trending ~25km wide strip in SE Sulawesi, with Late Triassic-Jurassic fluvial clastics and marine limestone and black shale, separated from neighboring terranes by slivers of ophiolite melange. Review of Sulawesi tectonics and reconstructions of M-L Miocene collisions of Tukang Besi Platform and Banggai Sula with E Sulawesi (Meluhu Complex discussed in more detail in subsequent papers by Surono. Also note surprising younger age interpretation by Fahrudin et al., 2020; JTvG)*)

Endinanda, F. (2022)- Kinematic analysis of Balantak Fault using fault-slip data in Balantak area, Banggai Regency, Central Sulawesi. *Berita Sedimentologi* 48, 1, p. 45-66.
(online at: <https://journal.iagi.or.id/index.php/FOSI/article/view/337/368>)
(*Balantak Fault at E tip of East Arm of Sulawesi is young, WNW-ESE trending right-lateral transpressional strike slip fault with 12-14 km displacement. Located behind Batui thrust front, near terrane boundary between the colliding Banggai-Sula microcontinent and E Sulawesi Ophiolite*)

Erlinghagen, K.P. (1991)- Petrogenese und geodynamische Entwicklung der Subduktions-Metamorphite von Zentral-Sulawesi, Indonesien. *Goettinger Arbeiten zur Geologie Palaeontologie* 52, p. 1-103.
(*'Petrogenesis and geodynamic development of subduction metamorphics of Central Sulawesi'. Originally Doctoral Dissertation at Georg-August Universitat Gottingen, Germany. Metamorphic rocks and minerals from NE of Lake Poso and W-NW of Poso town are high-P metamorphic rocks, formed as result of oblique subduction in WNW-dipping subduction zone. Metamorphic grade increasing P and T from E to W: Lawsonite-blueschist facies of Taripa belt grade W-ward into epidote-blueschist and eclogite facies of Tineba belt. Max. P-T conditions ~11 kbar/ 400-450°C (Taripa) and ~13 kbar/500-570°C (~45 km depth; Tineba). Age of peak metamorphism ~60-65 Ma (Paleocene), followed by rapid cooling in Eocene. K-Ar cooling ages of phengite in garnet-mica schist 38.8 Ma (Late Eocene), silicate marble 50.2 Ma (E Eocene). Late metamorphic overprint of lawsonite-blueschist zone suggested by K-Ar ages around 19 Ma, tied to age of intrusives in W and onset of Banggai-Sula collision*)

Ernowo (2017)- Hydrothermal alteration and gold mineralization of the Awak Mas gold deposit, Sulawesi Island, Indonesia. Ph.D. Thesis, RWTH Aachen University, Aachen, Germany, p.

Ernowo, Harjanto, F.M. Meyer & A. Idrus (2015)- Geology and mineralization of Awak Mas gold deposit and challenges for new exploration targeting in the metamorphic rock terrain of eastern Indonesia. 13th Biennial SGA Meeting, Nancy, France, p. 1-4.

(online at:
https://www.researchgate.net/publication/285701793_Geology_and_mineralization_of_Awak_Mas_gold_deposit_and_challenges_for_new_exploration_targeting_in_the_metamorphic_rock_terrain_of_eastern_Indonesia)
(Recent discovery of gold deposit in Cretaceous Latimojong Fm metamorphic rocks)

Ernowo, E., A. Idrus & F.M. Meyer (2022)- Elemental gains and losses during hydrothermal alteration in Awak Mas gold deposit, Sulawesi Island, Indonesia: Constraints from balanced mineral reactions. Minerals 12, 12, 1630, p. 1-14.

(online at: <https://www.mdpi.com/2075-163X/12/12/1630>)
(On metasomatic alteration in epizonal orogenic Awak Mas gold deposit, Latimojong District, in E part of S Arm of W Sulawesi)

Ernowo, E., F.M. Meyer & A. Idrus (2019)- Hydrothermal alteration and gold mineralization of the Awak Mas metasedimentary rock-hosted gold deposit, Sulawesi, Indonesia. Ore Geology Reviews 113, 103083, p. 1-16.

(Awak Mas epigenetic, orogenic gold deposit in S Arm of Sulawesi, hosted by Cretaceous Latimojong metamorphic complex phyllites and schists, near contact with obducted Lamasi ophiolite. Mineralization formed during Miocene metamorphism, Two types of Au-mineralizing veins: quartz-albite-ankerite and quartz-ankerite-siderite veins. Ore fluids possibly derived from metamorphic dewatering of organic-rich marine sedimentary rocks or input of magmatic hydrothermal fluids)

Ernowo, E., F.M. Meyer & A. Idrus, H. Widyanarko & N.L. Endrasari (2016)- An update of key characteristics of Awak Mas mesothermal gold deposit, Sulawesi Island, Indonesia. Proc. 8th MGEI Annual Convention, Bandung 2016, p. 1-4.

(online at:
https://www.researchgate.net/publication/310802212_An_update_of_key_characteristics_of_Awak_Mas_mesothermal_gold_deposit_Sulawesi_Island_Indonesia)
(Awak Mas gold deposit (Salu Bulu, Tara and Awak Mas gold prospects) located within metamorphic belt of Sulawesi island (part of Cretaceous Latimojong Fm flysch sequence that is locally intruded by diorite dykes. Gold hosted by phyllite and schist))

Evans, M.J. (1991)- Geological field survey of onshore PSC and adjacent areas, Sulawesi, Indonesia, with specific reference to Eocene reservoir quality and distribution. BP Petroleum Development Indonesia Report, p. (Unpublished, but commonly quoted BP geological field survey report of W Sulawesi basins)

Fadhlorrohman, I., A.F. Parma & C. Fitriani (2017)- Geological observation on Kabaena Island, Southeast Sulawesi: an implication of hydrocarbon occurrence in frontier area based on outcrop study. Proc. 41st Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA17-190-SG, p. 1-11.

(Kabaena island off SE Sulawesi contains ultramafic rocks (peridotite), Pompangeo Complex low-medium grade metamorphics (amphibolite, schist) and metamorphosed, fractured Matano Fm pelagic limestone and some black shale. Ultramafic rocks thrust over microcontinental rocks. Gas seepage in Matano meta-limestone unit, tied to strike slip fault (no details). Not much new)

Fadlin, S. Godang, A. Idrus, H.G. Hartono, J.A. Zaenurrohman, S. Iswahyudi, R.M. Asfaro et al. (2024)- The first occurrence of mafic alkaline rock (lamproite) in Mamuju District, West Sulawesi, Indonesia: Implications to the REEs and Critical Elements Enrichment. Preprint, 30p.

(manuscript online at: <https://www.researchsquare.com/article/rs-5266635/v1>)
(Pliocene? mafic alkaline dykes near Mamuju District, W West Sulawesi, identified as as orendite lamproite rocks, related to orogenic lamproite formed during tectonic continental extension (post collision). It contains significant amounts of REE-Zr-Th bearing minerals)

Fahrudin, A., R. Fakhruddin, M. Firdaus & H.M. Saleh (2020)- A new age interpretation for the Meluhu Formation in Toronipa Peninsula, the southeast arm of Sulawesi, Indonesia. *Bull. Geological Society Malaysia* 70, p. 103-118.

(online at: <https://gsm.org.my/products/702001-101860-PDF.pdf>)

(Clastic sediments exposed in Toronipa Peninsula NE of Kendari, SE Sulawesi (near offshore Abuki-1 well in Manui Basin). In 1990s it was included in Toronipa Mb of Meluhu Fm, and suggested to be of Triassic age. New palynological data show M-L Miocene age, as indicated by Florschuetzia group pollen (Florschuetzia trilobata, F. levipoli, F. meridionalis). Wave-dominated estuary depositional model proposed)

Fahrudin, A., E.A. Subroto, V. Susanto, L.D. Santy & R. Adlan (2024)- Karakteristik geokimia dan biomarker rembesan minyak di daerah Torete, Morowali, Sulawesi Tengah. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 25, 4, p. 206-216.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/806/566>)

(‘Geochemical and biomarker characteristics of oil seepages in Torete Area, Morowali, Central Sulawesi’. Two oil seeps in Torete area, Morowali, C Sulawesi (in area of folded Mesozoic sediments of Banggai Basin?). Organic geochemistry suggests carbonate source rocks with organic material from algae or plankton, in anoxic-suboxic depositional environment, and at early mature to mature level. No biomarkers indicative of higher plants (oleanane, bicadinane))

Fakhruddin, R., N.N. Ilmi, E. Sunardi, T. Ramli, A.A. Budiman, I. Nurdiana & D. Fadli Badaruddin (2023)- Sedimentary facies, palynology, and organic geochemistry of Eocene Kalumpang Formation in Lariang and Karama areas, West Sulawesi, Indonesia. *J. Mathematical Fundamental Sciences (ITB)* 54, 2, p. 142-164.

(online at: <https://journals.itb.ac.id/index.php/jmfs/article/view/20338/6496>)

(Kalumpang Fm in W Sulawesi was deposited in delta plain setting in M-L Eocene time (Proxapertites operculatus palynozone). Marginal to early mature for hydrocarbon generation and mainly terrestrial organic material. Common oleanane reflects higher plant angiosperm input. Doda oil seep with more abundant oleananes, suggesting oil originated from more marine facies than sampled deltaic rocks (?))

Fakhruddin, R. & D. Kurniadi (2019)- Age and paleobathymetry of Salodik Group in Poh-Pagimana section, East Arm of Sulawesi based on foraminiferal assemblages. *J. Geoscience Engineering Environment Technology (JGEET)* 4, 1, p. 30-39.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/2751/1577>)

(Planktonic foraminifera from carbonates of imbricated Salodik Group in East Arm of Sulawesi, along road between Poh and Pagimana along S side of Poh Bay. Planktonics suggest ages range from E Eocene- E Pliocene. Benthic forams indicate middle shelf- upper bathyal settings. E-M Eocene sediments overlie E Miocene, showing thrust faulting (part of Batui imbricated thrust complex). Youngest deformed sediments Pliocene age (N20-21), suggesting thrusting continuing into Late Pliocene time. Salodik section at Poh more basinal than age-equivalent carbonates in Tomori/Matindok/Minahaki area. Post-orogenic sediments derived from erosion of obducted ophiolite known as Batui Group//Celebes Molasse, dated as Late Miocene-Pliocene)

Fang, G., J. Zhang, C. Jiang, M. Dong, T. Hao, Z. Li, W.Chu & Y. He (2023)- Dynamic analysis of geophysical characteristics of Una-Una Volcanic Island, Sulawesi, Indonesia. *J. Asian Earth Sciences* 255, 105767, p. 1-11.

(Geophysical setting of Una Una volcano in Tomini Bay, NE Sulawesi. Around 5 Ma, Sula Islands collided with E arm of Sulawesi, causing subduction and retreat of North Sulawesi Trench. Additionally, sinistral strike-slip of ~4 cm/yr initiated at Palu-Koro fault in W Sulawesi Island, leading to formation of isolated Una-Una volcanic island in Tomini Bay. Geophysics suggest crust in N region of Sulawesi Island primarily characterized by brittle deformation, Etc.)

Fang, J., C. Xu, Y. Wen, S. Wang, G. Xu, Y. Zhao & L. Yi (2019)- The 2018 Mw 7.5 Palu Earthquake: a supershear rupture event constrained by InSAR and broadband regional seismograms. *Remote Sensing (MDPI)* 11, 1130, p. 1-15.

(online at: <https://www.mdpi.com/2072-4292/11/11/1330>)

(28 September 2018 Mw 7.5 Palu earthquake occurred near triple junction zone where Philippine Sea, Australian, and Sunda plates converge. Ruptured along steep fault plane (~85°). Supershear event with average rupture speed of 4.1 km/s from hypocenter. Dominated by left-lateral strike slip with some significant normal faulting components (slip maxima is ~3 m))

Farida, M., I. Alimuddin, L. Fauzielly & J. Nugraha (2022)- Identifying the calcareous nannofossils from the Tonasa limestone of the Karama traverse, Jeneponto area, South Sulawesi, Indonesia. AIP Conference Proceedings 2543, 050011, p. 1-6.

(online at: <https://aip.scitation.org/doi/pdf/10.1063/5.0094841>)

(Tonasa Limestone at Karama section, Jeneponto area (Biru area?), S Sulawesi, with nannofossils indicative of upper part of Late Eocene)

Farida, M., I. Alimuddin, A. Maulana & J. Nugraha (2020)- Paleoclimate prediction based on *Discoaster* occurrence in Walanae Sandstone of South Sulawesi. Proc. 2nd Int. Conference of Interdisciplinary Research on Green Environmental Approach for Sustainable Development (ICROEST 2020), Makassar, IOP Conference Series: Earth and Environmental Science 575, 012181, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/575/1/012181>)

(Late Miocene-Pliocene (NN13-NN19) Walanae Fm in Salo Mario (Mario River) section with marine nannofossils dominated by *Discoaster*. No strat column, minimal locality data)

Farida, M., F. Arifin, R. Husain & I. Alimuddin (2013)- Paleoseanografi Formasi Tonasa berdasarkan kandungan foraminifera daerah Barru, Sulawesi Selatan. Proc. Seminar Nasional Kebumihan 6, Teknik Geologi Universitas Gadjah Mada, Yogyakarta 2013, S01, p. 455-466.

(online

at:

https://www.academia.edu/29182432/PALEOSEANOGRAFI_FORMASI_TONASA_BERDASARKAN_K...Etc.)

(*'Paleoceanography of the Tonasa Formation based on foraminifera content in Barru area, South Sulawesi'. (Outcrop sections with M-L Eocene open marine calcareous shales and thin limestones with planktonic foraminifera (P9-P16), smaller benthics and larger forams *Discocyclus* and *Nummulites*)*

Farida, M., M.F. Arifin, A. Tupenalay, H. Pachri & B. Hidayah (2025)- Biostratigraphy of planktonic foraminifera and paleoclimatic implication of Tonasa formation at Karama area, South Sulawesi. Proc. 5th Int. Conference Science and Engineering (EICSE), Gowa 2021, AIP Conference Proceedings 3032, 040006, p.

(*Lower Tonasa Fm in Karama area, S Sulawesi, with planktonic foraminifera of Middle Eocene- Late Eocene age (P13 to P15), and suggesting tropical paleoclimate during that time*)

Farida, M., M.J. Burhan, H. Umar, A.M. Imran, N. Ikhawana & A. Ahmad (2023)- Provenance of Walanae Formation as a parent rock in Bulukumpu area, Bulukumpu Regency, South Sulawesi. Jurnal Ecosolum (UNHAS) 12, 2. p. 178-191.

(online at: <http://dx.doi.org/10.20956/ecosolum.v12i2.31432>)

(*Provenance of immature Pliocene Walanae Fm sandstones in S Sulawesi is 'Magmatic Arc' and 'Recycled Orogen'*)

Farida, M., T. Fitriana & J. Nugraha (2016)- Rekonstruksi batimetri dan iklim purba berdasarkan foraminifera daerah Ralla Barru, Sulawesi Selatan, Indonesia. J. Meteorologi dan Geofisika (JMG) 17, 2, p. 77-88.

(online at: <http://puslitbang.bmkg.go.id/jmg/index.php/jmg/article/view/443/218>)

(*'Reconstructions of bathymetry and paleoclimate based on foraminifera from Ralla area, Barru, S Sulawesi'. Attempt at paleobathymetry analysis of E-M Eocene benthic foraminifera in ~70m thick marl-limestone section (mainly *Cibicides* spp. near base, *Uvigerina-Lenticulina* near top; inner-outer neritic)). Limestones with *Nummulites*, *Asterocyclus*, etc.)*)

Farida, M., A. Imran & F. Arifin (2014)- Lingkungan pengendapan purba satuan napal Formasi Tonasa berdasarkan kandungan foraminifera bentonik, studi kasus: Sungai Camming dan Sungai Palakka Kabupaten Barru, Provinsi Sulawesi Selatan. J. Penelitian Geosains (Hasanuddin University) 10, 2, p. 50-57.

(online at: <http://repository.unhas.ac.id/bitstream/handle/123456789/15298/>)

('Depositional environment of the marl unit of the Tonasa Formation based on benthic foraminifera, case studies: Camming River and Palakka River, Barru District, S Sulawesi'. Mainly middle-outer neritic facies ('30.48- 182.88m'; great precision; JTvG), concluded from nodosarids-dominated benthic foram assemblages in Early-Late Eocene of Tonasa Marls in two outcrop sections)

Farida, M., A. Jaya, A. Ahmad, N. Salsabilah & T. Sato (2023)- Biostratigraphy of calcareous nannofossils and their distribution in Tonasa Formation, Mallasoro area Jeneponto, South Sulawesi. Proc. 5th Int. Conference on Global Issues for Infrastructure, Environment etc., Makassar 2023, IOP Conference Series: Earth and Environmental Science 1272, 012016, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1272/1/012016/pdf>)

(Calcareous nannofossils from Tonasa Fm in southernmost S Sulawesi suggest age of sampled part of Tonasa Fm in Mallasoro area is NP21 to NN1 (E Oligocene - E Miocene/ Rupelian- Aquitanian (Actual base of Tonasa Fm is E Eocene in age, but no nannofossils found in lower part))

Farida, M., A. Jaya, A. Ahmad & J. Nugraha (2024)- The Eocene to Oligocene boundary and paleoclimatic indications based on calcareous nannofossils of Tonasa Formation, South Sulawesi, Indonesia. Fossil Record 27, 1, p. 221-231.

(online at: <https://fr.pensoft.net/article/96985/>)

(Tonasa Fm interbedded marl and limestone in Karama area near SW tip of S Sulawesi with three nannofossil datums: FO Sphenolithus pseudoradians (NP19/NP20), FO Sphenolithus distentus and LO Sphenolithus predistentus (defining zone CP 18), suggesting Late Eocene- M Oligocene age and warm water conditions)

Farida, M., A. Jaya & J. Nugraha (2022)- Calcareous nannofossil biostratigraphy of Tonasa Formation at Barru River Traverse, South Sulawesi, Indonesia. Indonesian J. on Geoscience (IJOG) 9, 3, p. 371-381.

(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/780/379>)

(Calcareous nannofossils from M Eocene- E Miocene marine marls and limestones in 690m thick Barru River section (NP15- NN1 or CP13- CN1a). Highest species diversity in Eocene)

Farida, M., A. Jaya, I. Alimuddin, Syafruddin & A. Ahmad (2022)- Studi iklim Purba Pada Formasi Tonasa berdasarkan foraminifera planktonik lintasan Sungai Palakka dan Karama B, Sulawesi Selatan. Jurnal Meteorologi dan Geofisika 23, 2, p. 99-108.

(online at: https://jmg.bmkg.go.id/jmg/index.php/jmg/article/view/839/pdf_1)

('Paleoclimate study of Tonasa Formation based on planktonic foraminifera at the Palakka River and Karama B traverses, South Sulawesi'. Biostratigraphic analysis of Palakka River (P9- P16, Early- Late Eocene and Karama B (N1- N7, M Oligocene- E Miocene)

Farida, M., A. Jaya & T. Sato (2019)- Calcareous nannofossil assemblages of Tonasa Formation Palakka area, South Sulawesi: implication of paleoenvironmental application. In: 5th Int. Symposium on Material Mechatronics and Energy, Gowa, South Sulawesi, 2018, IOP Conference Series: Materials Science Engineering 619, 012016, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1757-899X/619/1/012016>)

(Calcareous nannofossils in Tonasa Lst along Barru River, S Sulawesi, range from zones NP16-NP24 (or CP14a- CP19a), M Eocene- Oligocene in age)

Farida, M., Pratiwi & R. Husain (2014)- Paleotemperature of Middle Eocene Tonasa Limestone based on foraminifera at Palakka Area South Sulawesi. Int. J. Engineering Science Applications (UNHAS) 1, 1, p. 77-84.

(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/137/93>)

(Interbedded marl/limestone at Palakka section, Barru area (presumably basal Tonasa Lst) with lower M Eocene (P11) planktonic foraminifera and middle? neritic small benthic forams)

Faried, A.P., A Tonggiroh & U.R. Irfan (2025)- Geochemical characterization of bedrock and distribution of enrichment of Rare Earth Elements and Scandium in nickel laterite within the Wulu Area, Central Buton District, Southeast Sulawesi Province. Proc. 1st Int. Conference of Petroleum Mining Geology Geoscience

Energy & Environmental Technology (ICPMGET 2024), Jakarta 2024, IOP Conference Series: Earth and Environmental Science 1451, 012022, p. 1-11.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1451/1/012020/pdf>)

(On presence of REE and scandium in nickel laterites on ultramafic rocks of East Sulawesi Ophiolite in Wulu area of SE Kabaena island (not Buton))

Faturrahman, M.L., D. Novita, A. Cita, Rohman & I. Triguri (2024)- Tectonic geomorphology of ultramafic complex in Asera, North Konawe Regency. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 25, 3, p. 161-168.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/853>)

(Discussion of geomorphology of Cretaceous ophiolites in E Sulawesi)

Faturrahman, M.L., I. Sanjaya, J. Jamal, D.H. Saputro & R. Setiawan (2025)- Tectonic geomorphology analysis in natural hydrogen exploration: a case study from Tanjung Api, Sulawesi. *RISSET Geologi dan Pertambangan* 35, 1, p. 37-48.

(online at: https://jrisetgeotam.brin.go.id/index.php/jrisgeotam/article/view/1357/pdf_1)

(Study of tectonic complexity near Tanjung Api abiogenic H₂ and CH₄ gas seeps associated with East Sulawesi Ophiolite complex. Hydrogen-methane seeps associated with areas of high-very high tectonic activity)

Fauzia, R., R. Sari, A. Mulawardhani, M.I. Novian & T. Sihombing (2012)- Dinamika pengendapan batupasir Formasi Lamusa, Desa Salodik, Kecamatan Luwuk, Kabupaten Banggai, Propinsi Sulawesi Tengah. *Proc. 41st Annual Conv. Indonesian Association Geologists (IAGI)*, Yogyakarta, 2012-GD-36, p. 1-4. (no figures)

(online at: https://www.iagi.or.id/web/digital/9/2012_IAGI_Yogyakarta_Dinamika-Pengendapan-Batupasir-Formasi-Lamusa-Desa-Salodik.pdf)

(Dynamics of Lamusa Formation sandstone deposition, Salodik Village, Banggai District, C Sulawesi'. *E Arm of Sulawesi with U Cretaceous calcareous sst near Salodik village, probably middle-outer neritic facies. (A) with U Cretaceous planktonic foraminifera (Coniacian-Santonian with Marginotruncana spp., Pseudotextularia, Dicarinella concavata, D. asymetrica); (B) turbiditic Turonian-Santonian with Marginotruncana spp., Heterohelix, (C), (D) etc. Also (E) brown carbonate with Late Eocene- Oligocene P18/19 pelagic facies, (F) E-M Eocene conglomeratic limestones with P11-P14 planktonics Morozovella spp., Acarinina, Etc.)*

Ferdian, F. (2017)- Eastern Sulawesi basement: revelation from zircon data. *Proc. Joint Convention HAGI-IAGI-IAFMI-IATMI (JCM 2017)*, Malang, 28, p. 1-3. (Extended Abstract)

(online at: https://www.iagi.or.id/web/digital/5/2017_IAGI_Malang_Eastern-Sulawesi-Basement.pdf)

(Zircon ages from Banggai-Sula and E Sulawesi. Granites from Banggai-Sula region with mainly Permo-Triassic age zircons. One Banggai-Sula granitoid with 23-26 Ma zircons. Banggai and Taliabu metamorphics mainly Proterozoic zircon ages. Sulabesi metasediments with Permo-Triassic zircons. SE Sulawesi Mekongga Fm metamorphics with Mesozoic-Paleozoic and Meso-Paleoproterozoic zircons (Mesozoic protolith age), but youngest zircon ~170 Ma (M Jurassic) (similar distribution in Triassic-Jurassic Meluhu clastics))

Firdaus, M., D. Novitasari, A.J. Widiatama, A. Fachruddin & L.D. Santy (2023)- Provenance and paleoclimate analysis of sandstone from Meluhu Formation in Kendari, Southeast Sulawesi. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 24, 2, p. 97-106.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/776>)

(Petrographic study of Meluhu Fm quartz sandstones in Kendari area of SE Sulawesi. Sandstones classified as greywacke, sublitharenite, lithic arenite, arkose, and subarkose. Origin of rock interpreted as recycled orogenic province, interior craton, and undissected arc. Paleoclimate during formation of siliciclastics was arid to humid (?) (N.B. Meluhu Fm generally considered to be of Triassic age, but Middle- Late Miocene age suggested by Fahrudin et al. (2020); JTVG))

Fitriana, T., M. Aznal, N. Supardi & N.R. Janat (2023)- Paleobatimetri satuan batupasir Formasi Pasangkayu berdasarkan kandungan foraminifera bentonik daerah Ako, Kabupaten Pasangkayu, Provinsi Sulawesi Barat. *Jurnal GEOMining (Teknik Pertambangan Unkhair)* 4, 2, p. 32-39.

(online at: <https://ejournal.unkhair.ac.id/index.php/geomining/article/download/6874/4365>)

(‘Paleobathymetry of the Pasangkayu Formation sandstone unit based on benthic foraminifera content in the Ako area, Pasangkayu Regency, West Sulawesi Province’, Benthic foraminifera in Pasangkayu Sandstone include Lenticulina, Cibicidoides spp and Quinqueloculina, suggesting middle neritic (30-90m) water depth. Age: zone N17-N18 (Late Miocene- E Pliocene))

Frantz, L.A., F.A. Rudzinski, A.M.S. Nugraha, A. Evin, J. Burton, A. Hulme-Beaman & 27(!) others (2018)- Synchronous diversification of Sulawesi’s iconic artiodactyls driven by recent geological events. Proc. Royal Society (London) B 285, 20172566, p. 1-8.

(online at: www.ncbi.nlm.nih.gov/pmc/articles/PMC5904307/pdf/rspb20172566.pdf)

(Paleogeographical reconstructions using genetic and morphometric datasets from Sulawesi’s three largest mammals (babirusa, anoa, Sulawesi warty pig) indicate these likely colonized Sulawesi at different times (14 Ma to 2-3 Ma), and experienced near-synchronous expansion from central part of island at ~1-2 Ma. Endemic fauna of Sulawesi driven by geological events over last few million years)

Frenzel, A. (1881)- Mineralogisches aus dem Ostindischen Archipel, 8. Celebes. Tschermaks Mineralogischen Petrographischen Mitteilungen 3, 4, p. 289-300.

(‘Mineralogic data from the East Indies Archipelago- 8. Celebes’. Petrography of volcanic and other rocks from Sulawesi, collected by a Dr. A.B. Meyer. Incl. lavas from Sangi Islands, North Arm, Togian islands, etc. First(?) description of Eocene Nummulites limestone from mountains near Batubassi, S Sulawesi)

Fornasiero, M. (2001)- Eocene molluscs species known from Nanggulan (Java) newly found in Malawa (Sulawesi). Memorie di Scienze Geologiche, Padova, 53, p. 57-60.

(Eight mollusc species in Malawa, NE of Makassar, SW Sulawesi, also occur in M Eocene of Nanggulan, C Java, and are all Tethyan species not known from Australian Plate. Outcrops believed to be M Miocene chaotic deposits with large olistoliths of M Eocene marls, possibly part of accretionary prism)

Fu, W., M. Yang, X. Huang & Y. Zhang (2014)- Garnierite in a laterite-Ni deposit from Kolonodale area, Sulawesi, Indonesia: a preliminary study on mineralogy. Acta Geologica Sinica 88, Suppl. 2, p. 1451. (Abstract)

Fu, W., J. Yang, M. Yang, B. Pang, X. Liu, H. Niu & X. Huang (2014)- Mineralogical and geochemical characteristics of a serpentinite-derived laterite profile from East Sulawesi, Indonesia: implications for the lateritization process and Ni supergene enrichment in the tropical rainforest. J. Asian Earth Sciences 93, p. 74-88.

(Ni-laterite profile over weathered serpentinite in Kolonodale area of E Sulawesi three lithostratigraphic horizons, from bottom to top: saprolite horizon, limonite horizon and ferruginous cap. Highest concentration of Ni (up to 11.5% NiO) in saprolite horizon)

Fu, W., Y. Zhang, C. Pang, X. Zeng, X. Huang, M. Yang, Ya Shao & H. Lin (2018)- Garnierite mineralization from a serpentinite-derived lateritic regolith, Sulawesi Island, Indonesia: mineralogy, geochemistry and link to hydrologic flow regime. J. Geochemical Exploration 188, p. 240-256.

(online at: <https://core.ac.uk/download/pdf/161348944.pdf>)

(On genesis of garnierite nickel ore, mainly in veins in lower saprolite of serpentinite-derived regolith. Ni preferentially enriched in talc-like phases rather than serpentine-like phases)

Fu, W., Y. Zhou, Y. Chen, Y. Hu, N. Chen, H. Niu et al. (2010)- Geological and geochemical characteristics of laterite nickel deposit and ore genesis; a case study of Kolonodale deposit in Indonesia Sulawesi, Southeast Asia. Earth Science Frontiers (China University of Geosciences, Beijing) 17, 2, p. 127-139.

(online at: <https://www.earthsciencefrontiers.net.cn/EN/abstract/abstract4053.shtml>)

(Kolonodale nickel laterite E Sulawesi in weathering profile of ultramafic rocks)

Gan, C., Y. Wang, X. Qian, X. Lu, K.A. Mustapha, Y. Zhang & S. Wu (2022)- Diorite enclaves and host granite of the Early Miocene Gorontalo pluton in the North Sulawesi Arc, Indonesia: implications for recycled oceanic crust and crust-mantle interaction. J. Asian Earth Sciences 227, 105101, p. 1-13.

(Miocene North Sulawesi Arc traditionally regarded as intra-oceanic arc on Eocene oceanic crust. Diorite enclaves and host granites of Gorontalo pluton with zircon U-Pb ages of ~20- 22.4 Ma for host granites and ~19.5- 20.4 Ma for diorite enclaves (no inherited older zircons). Host granites derived from partial melting of juvenile mafic crust; diorite enclaves products of hybridisation of magmas derived from depleted mantle and juvenile crust. Provide evidence for E Miocene (or earlier) crust-mantle interaction in N Sulawesi Arc)

Gani, M.U.A. & H. Soetjito (1999)- Coal ash characteristization of Tondongkurah coal, Pangkajene, South Sulawesi. Proc. 28th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, 2, p. 293-300.
*(online at: <https://www.iagi.or.id/web/digital/65/21.pdf>)
(Eocene? coal from S Sulawesi. Sub-bituminous (vitrinite reflectance R_o 0.34%. Coal ash dominated by SiO_2 , Al_2O_3 , Fe_2O_3 , etc.))*

Gani, M.U.A., H. Soetjijo & S. Indro (1996)- Karakterisasi dan kualitas pemanfaatan batubara Tondongkurah, Pangkajene Sulawesi Selatan. Proc. 25th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 2, p. 313-324.
('Characterization and quality of Tondongkurah coal, Pangkajene, S Sulawesi')

Gani, M.U.A. & Sudarsono (1997)- Karakteristik batu marmer di daerah Bulu Panampu Kabupaten Maros, Sulawesi Selatan. Proc. 26th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 899-912.
*(online at: <https://www.iagi.or.id/web/digital/64/65.pdf>)
(Characteristics of marble rock in the area of Bulu Panampu, Maros District, S Sulawesi'. Tertiary Tonasa Fm limestone affected by trachy-andesitic intrusion))*

Garrard, R.A., D. Silalahi, D. Schiller & P. Mahodim (1989)- Sengkang Basin, South Sulawesi, Post Convention Field Trip. Indonesian Petroleum Association (IPA), Fieldtrip guidebook, Jakarta, p. 1-46.
(SW Sulawesi fieldtrip guide book)

Garrard, R.A., G. Nusatriyo & D.Q. Coffield (1992)- The prospectivity of Early Tertiary rift sequences in the Neogene foldbelts of South Sulawesi. In: Eastern Indonesian Exploration Symposium, Jakarta, April 1992, Pertamina and Simon Petroleum Technology, p. 1-12.

Garwin, S.L., D. Hendri & P.F. Lauricella (1995)- The geology of the Mesel sediment-hosted gold deposit, North Sulawesi, Indonesia. In: J.L. Mauk & J.D. St. George (eds.) Exploring the Rim, Proc. PACRIM 1995 Congress, Auckland, Australasian Institute of Mining and Metallurgy (AusIMM), Parkville, Publ. Ser. 9/95, p. 221-226.
('Carlin-type' sediment-hosted, disseminated Au-Ag deposit in extensional M Miocene basin in N Sulawesi volcanic arc (only one of this type in Indonesia?). Discovered in 1988. Gold in finely disseminated pyrite n carbonates adjacent to andesite intrusive. Early decalcification and dolomitisation enhanced porosity and permeability prior to silicification and sulphidation)

Girardeau, J., C. Monnier, R. Maury, M. Villeneuve, D. Soetisma & H. Samodra (1995)- Origin of the East Sulawesi ophiolite. In: Abstracts, Eighth Regional Conference Geology Minerals and Energy Resources of SE Asia (GEOSEA 95), Manila, 8, p. 51-52.
*(online at: https://www.researchgate.net/publication/338823330_Origin_of_the_East-Sulawesi_ophiolite)
(East Sulawesi dismembered ophiolitic nappe (second largest in world!) emplaced during Eocene. Ophiolite section 10 km thick, including 6 km of mantle peridotites (lherzolites, harzburgites, dunites), overlain by 4 km-thick crustal part (gabbros, plagiogranites, sheeted dolerites, lava flows). Overthrust to W or WNW and tectonically overlie C Sulawesi metamorphics (incl. blueschists). Geochemical and geochronological data suggest ESO ophiolite formed in back-arc basin environment, 44 Ma ago (M Eocene) ((not in agreement with Cretaceous age of supposedly overlying Boba/ Matano oceanic radiolarites and pelagic limestones (Simandjuntak 1992); Late Cretaceous zircon ages (Liao, 2024), etc. JTvG))*

Gisolf, W.F. (1917)- Beschrijving van een microscopisch onderzoek van gabbro's en amfibolieten, herkomstig van Midden-Celebes. Thesis Technical University of Delft, Immig, Rotterdam, p. 1-141. *(Unpublished)*

(Read online at: <https://catalog.hathitrust.org/Record/100579912>)

(*'Description of microscopic investigations of gabbros and amphibolites from C Sulawesi'. Incl. glaucophanites and eclogites from Latimojong Complex. Presumably same as Gisolf (1917) in Abendanon (1917)*)

Gisolf, W.F. (1917)- Petrografie van Midden-Celebes. Microscopisch onderzoek van de gesteenten der Midden-Celebes verzameling van E.C. Abendanon. In: E.C. Abendanon, E.C. (1917) Geologische en geographische doorkruisingen van Midden-Celebes (1909-1910), E.J. Brill, Leiden, vol. 3, p. 1017-1381.

(online at: <https://www.delpher.nl/nl/boeken/view?identifier=MMKB21:041967000:00005>)

(*Petrography of rocks from C Sulawesi collected by Abendanon. Mainly igneous (granites, gabbros, peridotites, trachytes, andesites, etc.) and metamorphic (gneiss, eclogite, amphibolite, jadeite, quartzite, etc.) rocks*)

Gisolf, W.F. (1920)- Lawsonite en epidoot in de schisten van het Latimojong gebergte, Celebes. Handelingen 17th Nederlandsch Natuur- Geneeskundig Congres, Leiden 1919, p. 422-424.

(Online read only at: <http://babel.hathitrust.org/cgi/pt?id=uc1.b3093406;view=1up;seq=476>)

(*'Lawsonite and epidote in the schists of the Latimojong Mountains, Sulawesi'. Lawsonite observed in epidote-chlorite schists collected by Abendanon near Bulu Palaka in Latimojong Mts, C Sulawesi*)

Gisolf, W.F. (1923)- On the occurrence of diamond as an accessory mineral in olivine and anorthite bearing bombs, occurring in basaltic lava, ejected by the volcano Gunung Ruang (Sangir-Archipelago north of Celebes). Proc. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam, 26, 7-8, p. 510-512.

(online at: <https://dwc.knaw.nl/DL/publications/PU00014971.pdf>)

(*Accessory diamonds in volcanic bomb from Gunung Ruang volcano in Sangir Archipelago, N Sulawesi*)

Gisolf, W.F. (1925)- Mikroskopisch onderzoek van gesteenten uit Zuidoost Selebes. Jaarboek Mijnwezen Nederlandsch-Oost Indie 53 (1924), Verhandelingen, p. 66-113.

(*'Microscopic investigations of rocks from SE Sulawesi'. Brief descriptions of igneous (granites peroditites, serpentinites, volcanics), metamorphic (mica-schists, phyllites, gneiss, amphibolite, glaucophane schist, eclogite, quartzite) and sedimentary (sandstone, limestone, shales, radiolarian chert) rocks collected by Julius and other geologists. Localities poorly described, no locality maps*)

Godang, S., Fadlin & B. Priadi (2016)- Geochemical signatures of potassic to sodic Adang Volcanics, Western Sulawesi: implications for their tectonic setting and origin. Indonesian J. on Geoscience (IJOG) 3, 3, p. 195-214.

(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/344/226>)

(*Late Miocene Adang Volcanics represent ~400m thick series of (ultra-) potassic- sodic lavas and tuffs of mainly trachytic composition. Part of widespread Late Cenozoic (latest Miocene- E Pliocene) high-K volcanics and associated intrusive rocks, widespread in W Sulawesi. Mafic to mafitic-intermediate characteristics (SiO₂: 46- 56 wt%, etc.). Major rock forming minerals leucite/pseudoleucite, diopside/aegirine and high T phlogopite. Likely formed in post-subduction, intra-continental extensional tectonic setting*)

Godang, S., F. Fadlin, B. Priadi, A. Idrus & I Gde Sukadana (2021)- Komatiitic lamprophyre in West Sulawesi: first evidence for >1350°C and 3.5 - 3.8 GPa mantle melts. Indonesian J. on Geoscience (IJOG) 8, 1, p. 39-58.

(online at: <http://ijog.bgl.esdm.go.id/index.php/IJOG/article/view/517/325>)

(*Late Cenozoic Talaya Volcanic Fm in W Sulawesi with lamprophyric lava. Geotectonic setting supra-subduction alkaline continental-arc. Protolith of magma from partial melting of depleted MORB mantle at high P (3.5-3.8 GPa); at depth of ~120 km, with melting T >1350°C*)

Godang, S., A. Idrus, Fadlin, B. Priadi & N.I. Basuk (2019)- Saprolitization characteristics of Rare Earth Elements in volcanic regolith on drill core #65 in Western Sulawesi, Indonesia. Asian J. Applied Sciences 7, 4, p. 435-450.

(online at: <https://www.ajouronline.com/index.php/AJAS/article/view/5873>)

(*Regolith weathering profile of leucite-bearing mafic trachytic rocks of Adang Volcanics in W Sulawesi. Enrichment of REEs in saprolite zones is 2.73 times compared to parent mafic trachytic rocks. Etc..*)

Godang, S., S.P. Saputro, H. Li, A.H. Satyana & W. Srichan (2025)- Geochemistry of the Adang Volcanics in Western Sulawesi: Unveiling the tectonic evolution of the opening of the Makassar Strait. *Solid Earth Sciences* 10, 1, 100228, p. 1-13.

(online at: <https://www.sciencedirect.com/science/article/pii/S2451912X25000017>)

(Miocene Adang Volcanics in Mamuju area in W Sulawesi: exposures of M-L Miocene (but older K/Ar dated Pliocene) volcanics, with intercalations of crystalline limestone and carbonates, indicating marine environment of deposition. Mainly low-Si mafic rocks (leucite/pseudoleucite-bearing trachytic tuff, agglomerate, breccia, lavas, leucitic intrusions, etc.). Geochemistry suggests magmatism from continental extension rather than subduction arc or mature continental rifts, from partial melting of enriched subcontinental lithospheric mantle, not asthenospheric mantle. (Suggested link to Makassar Strait opening seems rather unlikely, as that happened 30 Myrs earlier, in Middle-Late Eocene; JTvG))

Golightly, J.P. (1979)- Geology of Soroako nickeliferous laterite deposits. In: D.J.I. Evans et al. (eds.) *International Laterite Symposium, New Orleans 1979*, Soc. Mining Engineers (SME) of American Institute Mining Metallurgy Petroleum Engineering (AIMM & PE), New York, p. 38-56.

(Nickel mined by PT INCO from laterite overlying E Sulawesi Cretaceous ultramafic complexes. In situ weathering of 20-50 m thick column of ophiolite in last 10 My believed to have formed 5-30m thick laterite, with only minor lateral migration of nickel in solution)

Golightly, J.P. & O.N. Arancibia (1979)- The chemical composition and infrared spectrum of nickel- and iron-substituted serpentine from a nickeliferous laterite profile, Soroako, Indonesia. *Canadian Mineralogist* 17, 4, p. 719-728.

Gomez, J.M., R. Madariaga, A. Walpersdorf & E. Chalard (2000)- The 1996 earthquakes in Sulawesi, Indonesia. *Bull. Seismological Society of America* 90, 3, p. 739-751.

(1996 earthquakes in relay zone between N Sulawesi trench and Palu-Koro transcurrent fault. Slip vectors NNW orientation parallel to direction of convergence between N Sulawesi arm and Celebes Sea)

Goto, S. et al. (1972)- Report on the survey for nickel smelter construction in Pomalaa area, Republic of Indonesia. Open File report Overseas Technical Cooperation Agency, Japan, p. 1-158.

(online at: <https://openjicareport.jica.go.jp/pdf/10553600.pdf>)

(With overview of earliest nickel mining in SE Sulawesi since 1935, and recommendation for building a nickel smelter along coast at Pomalaa to process low-grade laterite nickel ores)

Graha, D.S. (1998)- Zonasi umur pada batuan granitik Polewali, Sulawesi Selatan. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 8, 78, p. 9-19.

('Age zonation in granitic rocks of Polewali, S Sulawesi'. K-Ar ages of biotite in Polewali granite 3.1- 14.0 Ma suggest age zonation of ~3.1-3.5 Ma at outside, 6.1-9.8 Ma in middle and 14.0 Ma in center. Ages from hornblende and biotite from Riso syenite 4.5- 6.75 Ma)

Grainge, A.M. & K.G. Davies (1983)- Reef exploration in the East Sengkang Basin, Sulawesi. *Proc. 12th Annual Conv. Indonesian Petroleum Association (IPA)*, Jakarta, 1, p. 207-227.

(East Sengkang Basin Late Miocene reefs in outcrop and as shallow gas-bearing Late Miocene reefs in N part of basin. Four accumulations with ~0.75 TCF of dry gas in place at average depth 700m. Kampung Baru is largest field and contains over half the total. Reservoir quality excellent. Gas probably generated in W Sengkang Basin and sub-sequently migrated into E Sengkang Basin)

Grainge, A.M. & K.G. Davies (1985)- Reef exploration in the East Sengkang Basin, Sulawesi, Indonesia. *Marine and Petroleum Geology* 2, p. 142-155.

(Shallow, gas-bearing Upper Miocene reefs in N part Sengkang basin, with Kampung Baru as largest field. Lower Miocene mudstones and limestones unconformable over Eocene volcanics acoustic basement. Two M Miocene periods of deformation and erosion. Late Miocene widespread carbonate deposition with platform limestones and pinnacle reef complexes. Reef growth ceased at end Miocene and clastic sedimentation covered irregular limestone surface. Walanae sinistral strike-slip fault zone separates E and W Sengkang Basins)

Greenfield, T., A.C. Copley, C. Caplan, P. Supendi, S. Widiyantoro & N. Rawlinson (2021)- Crustal deformation and fault strength of the Sulawesi subduction zone. *Tectonics* 40, 3, e2020TC006573, p. 1-18.

(online at: <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2020TC006573>)

(Seismicity and rheology of N-Sulawesi subduction zone from wave modeling of moderate magnitude (M5–M6.5) earthquakes on N Sulawesi megathrust and surrounding region. Slip vectors of megathrust earthquakes radiate outward from Sulawesi, implying lateral spreading of high topography, controlled by gravitational potential energy contrasts. Region acts as region of weak crust spreading out over strong subducting plate. Subducting Celebes Sea oceanic plate has age of 35-45 Ma, with elastic thickness-typical of mature oceanic lithosphere (age >25 Ma))

Gunawan, W. (1999)- Structure, stratigraphie et evolution de la partie centrale de Sulawesi (Indonesie orientale). Doct. Thesis Universite de Aix-Marseille, p. 1-283. (*Unpublished*)

(Sulawesi is area of collision between Eurasian and Gondwanan blocks. Three main events: (1) collision of Asia- Banda Blocks (= E Sulawesi) in Late Oligocene, (2) collision of Banda- Lucipara blocks in M Miocene and (3) collision of Banggai-Sula and Sulawesi in M Pliocene. C Sulawesi marks collision between Asia and Banda blocks, with obduction of ophiolite nappe of Asian origin over E Sulawesi block. E Sulawesi block sedimentary cover starts with Triassic reefal/ platform carbonates followed by Early Jurassic platform interior carbonates, Lower Cretaceous radiolarites and Upper Cretaceous-Oligocene pelagic limestones. High P- low T metamorphism during W-directed subduction in Early Oligocene. Western active margin has substrate metamorphosed in Aptian- Albian, overlain by Upper Cretaceous- Pliocene volcano-sedimentary formations, and deformed by thrusting during Oligocene collision, possibly followed by Middle Miocene event also known from Buton island)

Guntoro, A. (1996)- Seismic interpretation and gravity models of Bone Bay in relation to its evolution. Proc. 25th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 3, p. 349-369.

Guntoro, A. (1997)- Stratigrafi dan evolusi tektonik Pulau Tanahjampea dan sekitarnya, Kabupaten Selayar, Sulawesi Selatan. *Berita Sedimentologi* 4, p. 9-17.

*(‘Stratigraphy and tectonic evolution of Tanahjampea Island and surroundings, Selayar District, S Sulawesi’. Oldest rocks Eocene volcanic breccia (part of Langi volcanics of S Sulawesi?), overlain by E Miocene limestone with *Lepidocyclina* (part of Tonasa Lst of Sulawesi?), Pleistocene volcanic breccia)*

Guntoro, A. (1997)- Preliminary study of the geology and tectonics of the Flores Sea islands, South Sulawesi. Proc. 26th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 291-313.

(online at: <https://www.iagi.or.id/web/digital/64/24.pdf>)

*(Islands S of SW Sulawesi/ Flores Sea (Selayar, Bonerate and Kalaotoa groups) poorly known. Similar stratigraphy to SW Sulawesi. Extensive volcanic and tectonic activity since Eocene (old volcanic breccias similar to Langi Volcanics in SW Sulawesi). Tanahjampea and Tanahmalala islands mainly SW Sulawesi-like granite, also Eocene and M-U Miocene calc-alkaline volcanics, possibly overlain by Batu Fm limestone with large *Lepidocyclina*. Suggesting W-dipping subduction zone E of W Sulawesi in E Tertiary continued to E of these islands. Kalao island 11 uplifted coral reef terraces on andesite; Tertiary rocks dip 40° to SW. Bonarate, Kalaotoa islands also with uplifted Quaternary reefal limestones (no mention of Verbeek (1908) work))*

Guntoro, A. (1999)- The effect of collision of the Banggai-Sula microcontinent to the tectonic development in Central Indonesian region. In: G.H. Teh (ed.) Proc. 9th Regional Congress Geology Mineral Energy Resources of SE Asia (GEOSEA '98), Kuala Lumpur 1998, Bull. Geological Society Malaysia 43, p. 103-111.

(online at: <https://gsm publ.wordpress.com/wp-content/uploads/2014/09/bgsm1999011.pdf>)

(Seismic interpretation shows presence of major faults indicating extensional, compressional and inversion tectonics in Makassar Strait, Sulawesi and Bone Bay. Gravity models indicate presence of oceanic crust in middle of Makassar Strait and Bone Bay and remnant subduction to S of Bone Bay. Origin of oceanic crust in Makassar Straits and Bone Bay due to rifting, with E-ward driving mechanism subduction roll-back of Pacific Plate eastward since E Tertiary. Bone Bay openings due to M Miocene collision of Banggai-Sula with Sulawesi,

causing displacement and rotation of two Walanae and Palu-Koro faults. Banggai-Sula collision also caused inversion structures at E and W sides of N Makassar Basin by inverting Eocene extensional basin)

Guntoro, A. (2004)- The relationship between tectonic development of Central Indonesian region and collision of Banggai-Sula microcontinent to the east Sulawesi. *Jurnal Teknologi Mineral (ITB)* 11, 1, p. (Central Indonesia with major faults indicating extension, compression and inversion. Gravity data indicate presence of oceanic crust in middle of Makassar Straits and Bone Bay, related to rifting. Driving mechanism of rifting in Makassar Strait is subduction roll-back of Pacific Plate E-ward since early Tertiary. Rifting in Bone Bay due to collision of Banggai-Sula Microcontinent against Sulawesi causing displacement and rotation of two major faults, Walanae and Palu-Koro)

Guritno, N., D.Q. Coffield & R.A. Cook (1996)- Structural development of central South Sulawesi, Indonesia. *Proc. 25th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, 1, p. 253-266.* (S Sulawesi stratigraphy: pre-Tertiary basement, Eocene synrift, Oligo-Miocene post-rift, M Miocene syn-magmatic, and Late Miocene-Pliocene synorogenic sedimentary packages. E part hinterland of exposed Cretaceous basement in W-vergent thrust system. W of basement outcrops is basement-involved, W-vergent Kalosi fold-thrust, with exposed Paleogene sediments. Further W shortening thin-skinned Majene foreland fold-thrust belt. S Sulawesi is W-vergent orogen superimposed on M Miocene magmatic arc. Bone Bay is continent-continent suture recently disrupted by transtensional wrenching and collapse of orogen's eastern extremity. SE Sulawesi E-vergent portion of orogen with allochthonous ophiolite nappes from continent-continent suture. Leading edge of orogen along Banda Sea W margin)

Hadiwijoyo, S., D. Sukarna & K. Sutisna (1993)- Geological map of the Pasangkayu Quadrangle, Sulawesi (Quad. 2014), 1: 250,000, Geological Research Development Centre (GRDC), map + 19p. text. (W Sulawesi map between 1-2°S. Oldest rocks ?Triassic metamorphics (no data to support age), unconformably overlain by low-metamorphic Upper Cretaceous clastics. Overlain by Oligocene and E Miocene Lamasi andesitic-dacitic volcanics. Unconformably overlain by M-L Miocene Talaya andesitic-basaltic series and Late Miocene- Pliocene molasse. Oil seep at Doda. Unlike areas to S, no Eocene rocks present in outcrop)

Haile, N.S. (1974)- An unusual unconformity of radiolarian chert on schist and gneiss west of Pangkajene, SW arm, Sulawesi (Celebes). *Geological Society Malaysia Newsletter* 52, p. 21-22. (Abstract only) (online at: <https://gsmpubl.wordpress.com/wp-content/uploads/2014/09/ngsm1974007.pdf>) (Brief note on mid-Cretaceous unconformity in Sungai Dera (tributary of Sg Paring) ~22 km E of Pangkajene, SW Sulawesi. Brecciated gneiss and micaschists of Bantimala Complex overlain with horizontal unconformity, by slightly folded ~7m thick red chert sequence. Near base of chert are up to 30cm thick beds of rel. coarse quartz-mica sandstone with up to 35% lithics of micaschists and altered ultrabasic rocks. (Age of radiolaria in chert Late Albian- E Cenomanian; Wakita 2000; similar succession in Miomaffo complex of W Timor; JTvG))

Haile, N.S. (1978)- Reconnaissance palaeomagnetic results from Sulawesi, Indonesia, and their bearing on palaeogeographic reconstructions. *Tectonophysics* 46, p. 77-85. (SW Sulawesi Jurassic radiolarian chert rotated ~35° CCW since Late Mesozoic. E Cretaceous radiolarian chert formed at ~3° and may have formed single plate with Kalimantan and Malay Peninsula, which rotated ~35-50° CCW since Cretaceous. Jurassic cherts from SE Sulawesi formed at high latitude (61°S))

Haile, N.S., A.J. Barber & D.J. Carter (1979)- Mesozoic cherts on crystalline schists in Sulawesi and Timor. *J. Geological Society, London*, 136, p. 65-70. (online at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.820.2026&rep=rep1&type=pdf>) (Non-metamorphosed Jurassic or Early Cretaceous pelagic radiolarian chert deposited unconformably on brecciated gneiss of Bantimala Complex in Pangkajene valley, SW Sulawesi. Cherts associated with turbiditic lithic sandstones, with grains of mica schist, muscovite, altered ultramafic rock, rare garnet and tourmaline. Radiolaria deemed to be of Jurassic or E Cretaceous age by Ling (no details). Very similar rock succession on Timor (Miomaffo) suggest Sulawesi and Timor probably part of continuous terrain during deposition of radiolarian cherts (see also Harahap 2000))

Hakim, A.Y.A. (2017)- Genesis of orogenic gold in the Latimojong district, South Sulawesi, Indonesia. Dissertation Montan Universitat Leoben, Germany, p. 1-355.

(online at: <https://pure.unileoben.ac.at/portal/files/2214320/AC14527918n01.pdf>)

(Awak Mas and Salu Bullo gold deposits in Latimojong Metamorphic Complex, S Sulawesi. Latimojong MC part of Late Cretaceous accretionary complex with high-P metamorphics, W of obducted Lamasi Complex (= E Sulawesi Ophiolite?). Gold hosted in quartz veins in pumpellyite- to greenschist-facies metasedimentary and metavolcanic rocks. Metamorphic reactions in metasedimentary rocks during retrogression stage considered main source of ascending fluids forming Au-mineralization)

Hakim, A.Y.A. & F. Melcher (2016)- The Salu Bullo mesothermal gold deposit in South Sulawesi, Indonesia. GeoTiro 2016 Conference, Innsbruck, 1p. (Abstract only)

(Mesothermal gold deposit hosted by greenschist facies rocks in late Cretaceous Latimojong metamorphic complex. Structural evolution includes accretion of Lamasi ophiolite onto sedimentary sequences by major NNW thrusting. At Salu Bullo, four N-S trending ore bodies dipping with high angle to E. Gold-bearing veins hosted by fine-grained meta-sedimentary and meta-volcanic rocks)

Hakim, A.Y.A., F. Melcher, W. Prochaska, R. Bakker & G. Rantitsch (2018)- Formation of epizonal gold mineralization within the Latimojong Metamorphic Complex, Sulawesi, Indonesia: evidence from mineralogy, fluid inclusions and Raman spectroscopy. Ore Geology Reviews 97, p. 88-108. (online at: www.academia.edu/96992451/Formation_of_epizonal_gold_mineralization_within_the_Latimojong_Etc.)

(Gold deposits in Latimojong Metamorphic Complex, S Sulawesi (Awak Mas, Salu Bullo) in pumpellyite-greenschist facies metasedimentary and metavolcanic rocks. Gold in quartz veins in N-S normal faults and extensional fractures. Minerals dominated by pyrite, chalcopyrite, galena, minor tetrahedrite and sphalerite; gold is electrum with low silver content. Gold bearing fluids trapped in quartz at ~180-250 °C at depths <5 km. Isothermal decompression during retrogression stage mobilized large volumes of fluids, leading to significant gold mineralization)

Hakim, A.Y.A., F. Melcher, W. Prochaska & T.C. Meisel (2022)- Magmatic and metamorphic evolution of the Latimojong Metamorphic Complex, Indonesia. J. Asian Earth Sciences 227, 105095, p. 1-19.

(Development of accretionary complex of Latimojong Metamorphic Complex began in Cretaceous, followed by deformation, folding, and uplift above sea level before Eocene. REE patterns of metasedimentary rocks might be interpreted as slab dehydration during high-P metamorphism at mantle depths. Metamorphic conditions point to high-P (up to 12 kb) to low T (300-415 °C), as typically observed in subduction zones. Latimojong MC underwent tectonic evolution and accretion history similar to other metamorphic complexes in S Sulawesi (Barru, Bantimala), although protoliths and metamorphic P-T conditions may have varied)

Hakim, F.R. & A. Idrus (2021)- Preliminary study of geology, alteration and ore mineralisation at East Motoling Area, South Minahasa District, North Sulawesi, Indonesia Proc. 3rd Int. Conf. Global Issue for Infrastructure, Environment, and Socio-Economic Development (GIESED 2020, Makassar), IOP Conference Series: Earth and Environmental Science 921, 012034, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/921/1/012034/pdf>)

(E Motoling prospect in the Minahasa region of N Sulawesi with low sulfidation epithermal mineralization. Volcanic Rock Formation of Late-Middle Miocene age host rock for ore mineralization)

Handyarso, A., H. Permana, M. Hanafi, P. Sendjaja & M.M. Mukti (2023)- Extensional tectonic investigation based on gravity and magnetic data analysis in the Gulf of Tomini, Indonesia. Rudarsko-geolosko-naftni Zbornik (Mining-Geology-Petroleum Engineering Bulletin), Zagreb, 38, 4, p. 1-18.

(online at: <https://hrcak.srce.hr/clanak/447262>)

(Gulf of Tomini between E and N Arms of Sulawesi (also called Gorontalo Bay) not well understood. Gravity and magnetic data suggest extensional tectonics, with multiple parallel NW-SE dextral strike-slip faults. Second-order grabens include Gorontalo, Tomini and Poso basins, separated by Lalanga and Togian ridges. Moho depth ~12- 28 km beneath surface. Also volcanic activity around Togian and Una-Una islands)

- Harahap, B.H. (1995)- Petrology of the Neogene subvolcanic rocks from the western part of South Sulawesi. Bull. Geological Research Development Centre (GRDC) 18, p. 68-85.
(*Neogene K-rich volcanics in SW Sulawesi*)
- Harahap, B.H. (1999)- Asal lava bantal Salu Latupa, Latimojong, Sulawesi Selatan. Majalah Geologi Indonesia (IAGI) 15, 1-2, p. 25-38.
(*Genesis of Salu Latupa pillow lava, Latimojong, S Sulawesi*)
- Harahap, B.H. (2000)- Petrologi lava basaltik dari jalan raya antara Palopo dan Rantepao, Sulawesi selatan. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 10, 101, p. 2-9.
(*Petrology of basaltic lava from the main road between Palopo and Rantepao, S Sulawesi*). Basalts outcropping at km 376-379 intrude Eocene Toraja Fm equivalent rocks. Age unclear? Geochemistry suggest subduction-related lavas, probably from before M Miocene Banggai-Sula collision with Sulawesi)
- Harahap, B.H. (2000)- Kejadian rijang di Sungai Paring Sulawesi Selatan. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 10, 105, p. 2-11.
(*Genesis of chert in the Paring River of South Sulawesi*). Red, thin-bedded deep marine radiolarian chert Fm in Paring River near Bantimala, 22km E of Pangkajene. Unconformably overlies Bantimala melange complex, composed of schist, ultramafic rocks, clastic sediments, etc. With slump structures; associated with sandstones and breccias with fragments of schist. Chert contains radiolaria indicative of U Albian- Lower Cenomanian age (~100 Ma; Wakita 1996; 7m of radiolarian cherts with some turbiditic sandstones on brecciated gneiss from same area also described by Haile et al. 1978))
- Harahap, B.H. (2000)- Petrologi lava dan korok basalt dari Walenrang, Sulawesi. Proc. 29th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 4, p. 179-189.
(*Petrology of lava and basalt of Walenrang, Sulawesi*). C Sulawesi Pliocene Lamasi volcanics chemistry comparable to Mid-Ocean Ridge Basalts)
- Harahap, B.H. (2002)- Ofiolit di Pegunungan Latimojong Sulawesi bagian selatan dan implikasi geodinamika dalam tatanan tektonik dan stratigrafi regional Sulawesi. Buletin Geologi (ITB) 34, 1, p. 1-20.
(*Ophiolite of the Latimojong Mts, S Sulawesi and geodynamic implications for the regional tectonic and stratigraphic history of Sulawesi*)
- Harahap, B.H. (2004)- Plio-Pleistocene volcanic rocks from Tanatoraja South Sulawesi. Majalah Geologi Indonesia (IAGI) 19, 2, p. 81-90.
- Harahap, B.H., S. Maryanto, W. Sunata, Sudijono & T. Sihombing (1999)- Stratigrafi Sulawesi Selatan. Pusat Penelitian dan Pengembangan Geologi (Geological Survey), Bandung, Special Report, p. 1-94. (*Unpublished?*)
(*Stratigraphy of South Sulawesi*)
- Hardjadinata, K. (1992)- Beberapa aspek lapangan batuan vulkanik daerah Gorontalo, Sulawesi Utara. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 2, 6, p. 4-8.
(*Some aspects of the volcanic rocks of the Gorontalo area, northern Sulawesi*)
- Hardjana, I. (2011)- The discovery, geology and exploration of the high sulphidation Au-mineralization system in the Bakan District, North Sulawesi. In: N.I. Basuki (ed.) Proc. Conf. Sulawesi Minerals Resources 2011, Manado, MGEI/IAGI, p. 161-188. (also in *Majalah Geologi Indonesia* 27, 3, p. 143-157)
(online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/731)
(*Gold mineralization in Bakan, N Sulawesi, hosted by dacitic tuffs of Plio-Pleistocene Bakan Fm, which unconformably overlies Miocene basement units of andesitic lavas, feldspathic sandstones and diorite porphyry*)
- Harjanto, A., Sutanto, A. Subandrio, I.M. Suasta, J. Salam, G. Hartono, P. Saputra et al. (2016)- Alterasi hidrotermal di Dumoga Barat, Kabupaten Bolaang Mongondow, Sulawesi Utara. Eksplorium 37, 1, p. 27-40.
(online at: <https://jurnal.batan.go.id/index.php/eksplorium/article/view/2666/pdf>)

(‘Hydrothermal alteration in West Dumoga, Bolaang Mongondow Regency, North Sulawesi’)

Harjanto, Ernowo (2017)- Hydrothermal alteration and gold mineralization of the Awak Mas gold deposit, Sulawesi Island, Indonesia. Ph.D. Thesis RWTH Aachen University, Germany, p. 1-177.

(Awak Mas metasedimentary-hosted gold deposit in Cretaceous metamorphic Latimojong Fm, S Sulawesi. Hosted by phyllites-schists representing metamorphosed shales derived from acidic arc volcanic rocks in continental island arc setting, and metamorphosed under low P-T conditions (greenschist-facies). Obduction and thrusting of Lamasi Ophiolite Complex onto Latimojong Metamorphic Complex in Miocene led to ductile deformation, followed by crustal thickening that caused melting at base of crust and granitic magmatism at 5-8.1 Ma. Granodiorites of calc-alkaline magmatic affinity emplaced in transition between volcanic-arc and syn-collisional granite tectonic setting. Extensional collapse caused brittle deformation (normal faulting/fracturing) and formation of veins controlled gold mineralization. Awak Mas epigenetic, orogenic gold deposit)

Harjanto, E., F.M. Meyer & A. Idrus (2015)- Geology and mineralization of Awak Mas gold deposit and challenges for new exploration targeting in the metamorphic rock terrain of eastern Indonesia. Proc. 13th Biennial Meeting Society for Geology Applied to Mineral Deposits (SGA), Nancy, p. 103-106.

(Awak Mas metamorphic-rock hosted gold deposits in C Sulawesi Cretaceous Latimojong metamorphic belt. Dominant lithologies slate, phyllite and mica schist. Mineral assemblage reflects high P/ low T environment or greenschist facies metamorphic rocks. Extensional faults, shears and fractures control gold mineralization)

Harjanto, Ernowo, F.M. Meyer, A. Idrus, H. Widyanarko & N.L. Endrasari (2016)- An update of key characteristics of Awak Mas mesothermal gold deposit, Sulawesi Island, Indonesia. Proc. 8th Annual Conv. Indonesian Soc. Economic Geologists (MGEI), Bandung, p. 72-75.

(Awak Mas gold deposit in metamorphic belt of Sulawesi. Hosted by low-metamorphic Cretaceous Latimojong Fm flysch sequence locally intruded by diorite dykes. Believed to have formed by hydrothermal fluids sourced from metamorphic dewatering reactions of marine sediments (mesothermal orogenic gold deposit))

Harju, H.O. (1979)- Exploration of P.T. INCO's nickel laterite deposits in Sulawesi, Indonesia. In: D.J.I. Evans et al. (eds.) International Laterite symposium, American Inst. Mining Metallurgical Petroleum Engineering (AIME), New Orleans, p. 292-299.

Hasan, K. (1990)- The Upper Cretaceous flysch succession of the Balangbaru Formation, Southwest Sulawesi, Indonesia. Ph.D. Thesis, University of London, p. 1-336. *(Unpublished)*

(Upper Cretaceous (Turonian-Maastrichtian) Balangbaru Fm ~3300m of deep marine flysch, unconformably over accretionary complex. Not internally deformed, only slight E tilt. Paleocurrent of gravity flows mainly from NW to SE and W to E. Provenance in lower part mainly metamorphic lithics and chert from accretionary complex, upper part influenced by magmatic arc provenance. Tectonic setting small fore-arc basin on trench slope. Basement complex uplifted from significant depth prior to deposition of Balangbaru Fm, thus preventing transport of volcanoclastics into basin)

Hasan, K. (1991)- The Upper Cretaceous flysch succession of the Balangbaru Formation, Southwest Sulawesi. Proc. 20th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, p. 183-208.

(Summary paper of above thesis on Upper Cretaceous (Turonian-Maastrichtian) Balangbaru Fm 'flysch' in SW Sulawesi)

Hasan, K., R. Garrard & P. Mahodim (1991)- SW Sulawesi, Post-convention field trip guidebook. Indonesian Petroleum Association (IPA), p. 1-61.

(Balangbaru area of SW Sulawesi Albian (111, 115 Ma) age metamorphics. Late Cretaceous (Turonian-Maastrichtian) Balangbaru flysch 3300m thick, unconformably over fractured ultrabasic rocks. Uplift/ erosion event followed by Eocene fluvio-deltaics and Nummulites limestones, overlain by up to 500m Late Eocene- E Miocene Tonasa Limestone)

Hasanuddin, M.S. Kaharuddin, M. Adam & M. Fathurahman (2023)- Preliminary study of accretion complexes of Mangilu area, Pangkep Regency, South Sulawesi. British J. Environmental Studies 3, 1, p. 13-22.

(online at: <https://www.al-kindipublisher.com/index.php/bjes/article/download/5372/4513>)
(Cretaceous rocks in Mangilu area, Pangkep Regency, SW Sulawesi, represent subduction zone accretionary complex, with melange, low-high grade metamorphism and deep-sea sediments (flysch, radiolarian cherts, olistostrome). Mangilu succession consists of melange (autoclastic with blocks of blueschist, eclogite, greenschist, granulite), Olistostrome with granite olistoliths), U Cretaceous Rijang radiolaria chert and Balangbaru Sandstone flysch with some chert, autoclastic breccia, thrust over Paleogene Mallawa Sst and Tonasa Lst (Miocene Pangkajene thrust?)

Hasanuddin, Kaharuddin, B. Syam, B.R. Maulana & B.N. Aisyah (2022)- Petrological study of autoclastic Breccia Formation in Mangilu Region, Pangkep, South Sulawesi Province. Proc. 51st Annual Conv. Indonesian Association Geologists (PIT IAGI 51), Makassar 2022, p. 1-9.

(online at: <https://www.iagi.or.id/web/digital/71/PITIAGI-22-P-Abs-118.pdf>)

(Mangilu area in N part of Bantimala Complex with two types of breccia (1) broken formation along Pangkajene River in Mesozoic greenschist, radiolarian chert, Balangbaru Sst with boudinage, etc.; (2) autoclastic breccia formation (in same rocks, also schist, serpentinite, peridotite, pillow lava)? Represents deformation in subduction zone? (not sure why this is called autoclastic; mixture of large blocks is imbricated formation or olistostrome?))

Hasibuan, F. (2001)- *Ostrea (Turkostrea) doidoiensis* n.sp. from the Middle Eocene of Malawa Formation, South Sulawesi. Proc. 30th Annual Conv. Indonesian Association Geologists (IAGI) and 10th GEOSEA Regional Congress, Yogyakarta, p. 191-194.

(New oyster species from M Eocene Malawa Fm that unconformably overlies Late Cretaceous Balangbaru flysch in Doidoi village, S of Ralla, S Sulawesi. *Ostrea (T.) doidoiensis* is from basal marine beds above the two coal beds of Malawa Fm and is associated with gastropods, solitary corals and other bivalves)

Hasibuan, F. (2009)- Lingkungan pengendapan Formasi Malawa, Sulawesi Selatan berdasarkan kandungan makro fosil. Jurnal Sumber Daya Geologi (JSDG) 19, 2, p. 95-106.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/196/188>)

(‘Environment of deposition of the Malawa Fm, S Sulawesi based on macrofossils’. Malawa Fm with E-M Eocene palynomorphs and overlain by Tonasa Lst with Eocene Nummulites javanus. Four M Eocene stratigraphic units with molluscs, incl. *Ostrea doidoiensis* and *Septifer*. Environments mangrove swamp, fluvial, lagoon- sandbars and deltaic)

Hasibuan, F. & A. Kusworo (2008)- Umur Formasi Nambo di Sulawesi Tengah dengan acuan khusus fosil Moluska. Jurnal Sumber Daya Geologi (JSDG) 18, 1, p. 43-54.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/226/216>)

(‘Age of the Nambo Fm in C Sulawesi based on fossil molluscs’. Nambo Fm along Kali Nambo near Luwuk in E Arm of Sulawesi 50m thick calcareous shale of latest Jurassic (Tithonian) age with molluscs (*Retroceramus haasti*, *Malayomaorica malayomaorica*) and belemnites (*Belemnopsis mangolensis*, *B. stolleyi*, *B. aucklandica simitis*, *B. moluccana*, *B. galoi*). Similar to upper part of Buya Fm of Sula islands)

Hasibuan, F. & A. Limbong (2009)- Geologi dan paleontologi Formasi Balangbaru dan Formasi Marada berumur Kapur, Sulawesi Selatan. Jurnal Sumber Daya Geologi (JSDG) 19, 6, p. 365-376.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/220/210>)

(‘Geology and paleontology of the Cretaceous Balangbaru and Marada formations, S Sulawesi’. Balangbaru Fm Albian- Maastrichtian turbiditic series with macrofossils including echinoids, bivalve *Inoceramus* sp. and ammonite *Grossouvreites* sp. Marada Fm partly distal equivalent of Balangbaru Fm, with *Spirorhapha* trace fossil and Turonian- Late Maastrichtian nannofossil assemblages)

Hasibuan, F., Sudijono, A. Limbong, Suyoko & E.H. Nugroho (1996)- Data baru umur Formasi Nambo, Sulawesi Tengah. Proc. 25th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 2, p. 52-70.

(‘New data on the age of the Nambo Fm, E Sulawesi’. Late Jurassic deposits)

Hasria, S. Asfar, Adriyansyah, Masri, Muliddin, Arisona, Al Firman, A. Okto & L.M. Golok Jaya (2021)- Fasiae batuan metamorf daerah Wumbubangka, Kecamatan Rarowatu Utara, Kabupaten Bombana, Provinsi Sulawesi Tenggara. *Jurnal Geomine* 9, 1, p. 55-64.

(online at: <https://jurnal.teknologiindustriumi.ac.id/index.php/JG/article/view/896/pdf>)

(*'The metamorphic rock facies of the Wumbubangka area, North Rarowatu District, Bombana Regency, SE Sulawesi Province'. Metamorphic rocks in study area consist of muscovite schists and marble (greenschist metamorphic facies), interpreted to have formed at 300-500 °C*)

Hasria, S. Asfar & E.R. Tawakkal (2021)- Profil endapan nikel laterit di Kecamatan Tinanggea, Kabupaten Konawe Selatan, Provinsi Sulawesi Tenggara. *Jurnal Promine* 9, 1, p. 13-22.

(online at: <https://journal.ubb.ac.id/index.php/promine/article/view/2345/1775>)

(*'Profile of laterite nickel deposits at Tinanggea District, S Konawe Regency, SE Sulawesi Province'*)

Hasria, E.S. Hasan, Deniyatno, L.M I. Salihin & Asdiwan (2020)- Characteristics of ultramafic igneous rock ofiolite complex in Asera District, North Konawe Regency, Southeast Sulawesi Province, Indonesia. *J. Geoscience Engineering Environment Technology (JGEET)* 5, 3, p. 114-118.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/4113/2648>)

(*Two types of ultramafic rocks in SE Sulawesi study area: peridotite (wehrlite and lherzolite) and serpentinite. Type of magma in study area is tholeiitic series and origin*)

Hasria, A. Idrus & I.W. Warmada (2017)- The metamorphic rocks-hosted gold mineralization at Rumbia Mountains prospect area in the Southeastern Arm of Sulawesi Island, Indonesia. *J. Geoscience Engineering Environment Technology (JGEET)* 2, 3, p. 217-223.

(online at: <http://journal.uir.ac.id/index.php/JGEET/article/view/434/376>)

(*On 'orogenic gold' in gold-bearing quartz veins in Pompangeo Metamorphic Complex of Permo-Carboniferous metasediments and mica schists at Rumbia Mountains, SE Sulawesi. Veins sheared/deformed and brecciated, 1- 15.7 cm thick. Associated with pyrite, chalcopyrite, hematite, cinnabar, stibnite and goethite. Gold also in derived placer deposits*)

Hasria, A. Idrus & I.W. Warmada (2019)- Alteration, mineralization and geochemistry of metamorphic rocks hosted hydrothermal gold deposit at Rumbia Mountains, Bombana Regency, Southeast Sulawesi, Indonesia. *J. Geoscience Engineering Environment Technology (JGEET)* 4, 2, p. 83-92.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/2346/1834>)

(*Recent gold prospects discovered in association with metamorphic rocks include metamorphic rocks at Rumbia Mts, SE Sulawesi. Hydrothermal gold deposits in Mendoke and Rumbia consist of 3 alterations, sericitic, argillic and propylitic. Mineralization of hydrothermal gold deposits in greenschist metamorphics in gold-bearing quartz veins. Protoliths of metamorphic rocks in Rumbia Mountain sedimentary rocks*)

Hasria, A. Idrus & I.W. Warmada (2019)- Alteration and ore mineralogy of metamorphic rocks hosted hydrothermal gold deposit at Rumbia Mountains, Bombana Regency, Southeast Sulawesi, Indonesia. *Proc. ITS Int. Geoscience Convention, Surabaya 2017, IOP Conference Series: Earth and Environmental Science*, 375, 012007, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/375/1/012007/pdf>)

(*Placer gold in Rumbia mountains, SE Sulawesi, derived from gold-bearing quartz veins in Pompangeo Metamorphic Complex (continental metasediments and metamorphic rocks of Permian-Carboniferous age). Gold associated with chalcopyrite, pyrite, hematite, cinnabar, stibnite and possibly minor goethite, indicating primary gold deposits in area of orogenic type*)

Hasria, A. Idrus & I.W. Warmada (2019)- Stratigrafi Pegunungan Rumbia, Kabupaten Bombana, Provinsi Sulawesi Tenggara. *Ophiolite: Jurnal Geologi Terapan* 1, 1, p. 10-20.

(online at: <https://ojs.uho.ac.id/index.php/Ophiolite/article/view/9311/6604>)

(*'Stratigraphy of the Rumbia Mountains, Bombana Regency, SE Sulawesi Province'. Five stratigraphic units at southern tip of SE Arm of Sulawesi, from old to young: Pompangeo Schist, Langkowala Sandstone, Eemoiko*

Limestone, Boepinang clayey limestone and Alluvial deposits (no strat column, no ages discussed, not clear what is new here?; JTvG)

Hasria, A. Idrus & I.W. Warmada (2020)- Perubahan komposisi batuan metamorf akibat proses alterasi hidrotermal pada endapan emas di Pegunungan Rumbia, Pada Lengan Tenggara Pulau Sulawesi. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 21, 3, p. 119-127.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/477>)

(‘Changes in the composition of metamorphic rocks due to hydrothermal alteration processes in gold deposits in the Rumbia Mountains, on the Southeast Arm of Sulawesi Island’)

Hasria, A. Idrus & I.W. Warmada (2021)- Geologi Pegunungan Mendoke, Lengan Tenggara Pulau Sulawesi, Indonesia. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 22, 3, p. 121-131.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/581/457>)

(‘Geology of the Mendoke Mountains, SE Arm of Sulawesi Island, Indonesia’. Stratigraphy: Mengkoka Schist, Pompangeo Schist, Diorite intrusion, Ultramafic harzburgite serpentinite, Langkowala Conglomerate Sandstone and Boepinang Sandstone. Geological structure trending SE-NW and E-W)

Hasria, A. Idrus & I.W. Warmada (2022)- Protolit batuan metamorf di Pegunungan Rumbia Kabupaten Bombana, Provinsi Sulawesi Tenggara, Indonesia. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 23, 1, p. 25-33.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/638/472>)

(‘Protoliths of the metamorphic rocks in the Rumbia Mountains, Bombana Regency, SE Sulawesi Province, Indonesia’. Protoliths of metamorphic rocks in Rumbia Mts are sedimentary rocks (pelitic and greywacke), now in greenschist facies with low-medium grade metamorphism)

Hasria, R.I. Jaya, S.M. Awadh, Riskiyanti, Deniyatno, Syahrul & S. Septiana (2024)- Mineralogy and geochemical characteristics of lateritic nickel deposit in Wiwirano District, North Konawe, SE Sulawesi, Indonesia. *Iraqi Geological J.* 57, 2C, p. 171-183.

(online at: <https://igj-iraq.org/igj/index.php/igj/article/view/2576/2060>)

(Geochemistry of nickel laterite deposit in East Sulawesi Ophiolite Belt in Wiwirano District, North Konawe, SE Sulawesi)

Hasria, Masri, S. Asfar, Arisona, A. Okto, La Ode Restele, La Ode Ngkoimani & R. Yustika (2021)- Characteristics of chromite deposits at North Kabaena District, Bombana Regency, Southeast Sulawesi Province, Indonesia. *J. Geoscience Engineering Environment Technology (JGEET)* 6, 2, p. 94-98.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/6424/3295>)

(Chromite deposits in peridotite rocks of N Kabaena District, in weathered surfaces and as podiform deposits with dimensions of 30-60cm)

Hasria, Masri, M.A. Azzaman & M.Jerniawan. (2023)- Petrogenetic study on ultramafic rocks from Waturapa and surrounding areas, South Konawe Regency, Southeast Sulawesi Province. *J. Geoscience Engineering Environment Technology (JGEET)* 8, 1, p. 10-16.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/11035/5102>)

(Ultramafic igneous rocks in Waturapa area in SE-most Sulawesi (previously unmapped?) are serpentinitized olivine websterite and lherzolite, overlain by Mio-Pliocene ‘Celebes Molasse’. Belong to tholeiitic magma series that formed in oceanic islands or oceanic intraplate margins)

Hasria, A.M. Ramadhan, A. Okto, Masri, Bahdad, L.O. Ngkoimani & M.A. Azzaman (2022)- Analisis petrografi dan geokimia batuan ultramafik kompleks ofiolit Kecamatan Andowia Kabupaten Konawe Utara, Provinsi Sulawesi Tenggara. *Jurnal Geosapta* 8, 2, p. 91-97.

(online at: <https://ppjp.ulm.ac.id/journal/index.php/geosapta/article/view/14112/pdf>)

(‘Petrographic and geochemical analysis of ultramafic rocks in ophiolite complex, Andowia District, North Konawe Regency, Southeast Sulawesi Province’. SE Sulawesi ophiolite NW of Kendari with peridotite-gabbro rock with tholeiitic affinity, formed in Mid Oceanic Ridge)

- Hasria, H., M. Resmin, A. Okto, M. Masri, A. Arisona, A.F. Al Firman, H. Harisma et al. (2023)- Pengaruh kemiringan lereng terhadap ketebalan endapan nikel laterit daerah Tobimeita, Kecamatan Langgikima, Kabupaten Konawe Utara, Provinsi Sulawesi Tenggara. *J. Geosains dan Teknologi (UNDIP)* 6, 3. p. 174-185.
(online at: <https://ejournal2.undip.ac.id/index.php/jgt/article/view/20209>)
(*'The effects of slope angle on nickel laterite deposit at Tobimeita area, Langgikima District, North Konawe Regency, SE Sulawesi Province'. Areas on gentle slopes produce relatively thick laterite deposits. (= common knowledge since 1930s?; JTvG)*).
- Hasria, M. Ruliansyah, S.M. Awadh, Masri, M.A. Azzaman, A. Okto & Sawaludin (2024)- Identification of lateritic nickel deposits potential in the Kokoe Area, Kabaena Island, Central Buton Regency, Southeast Sulawesi Province, Indonesia. *Iraqi Geological J.* 57, 1A, p. 179-193.
(online at: <https://igj-iraq.org/igj/index.php/igj/article/view/1909>)
(*Four types of lateritic profiles, A-D, on Kabaena Island off S tip of East Sulawesi Ophiolite; Types A and C promising potential due to higher grades of Ni*)
- Hasria, M. Sidik, S.M. Awadh, Masri, Ali Okto, M.A. Azzaman, Muliddin et al. (2023)- Orogenic gold deposit in metamorphic rocks: minerals and structural control at Rarowatu Area, Southeastern Arm of Sulawesi, Indonesia. *Iraqi Geological J.* 46, 1B, p. 16-31.
(online at: <https://igj-iraq.org/igj/index.php/igj/article/view/1279/1250>)
- Hayatuzzahra, S.& S.U. Pratomo (2023)- Petrogenesis of andesite rocks in Datae Area, Sidenreng Rappang Regency, South Sulawesi Province. *J. Earth and Marine Technology (JEMT)* 4, 1, p. 85-96.
(online at: <https://ejurnal.itats.ac.id/jemt/article/view/4695/3449>)
(*Pliocene Pare-Pare andesitic breccias and ignimbrites in western S Sulawesi identified as high-K calc-alkaline and shoshonitic series, and as products of subduction (earlier interpretations shoshonitic-potassic, extensional regime? e.g. Yuwono et al 1985; JTvG)*)
- Helmers, H. (1991)- Sulawesi blueschists and subduction along the Sunda continent, an alternative view. In: E.P. Utomo et al. (eds.) *Proc. The Silver Jubilee LIPI- Symposium on the Dynamics of subduction and its products*, Yogyakarta-Karangasambung 1991, Research and Development Center for Geotechnology, Indonesian Institut of Sciences (LIPI), Bandung, p. 220-223.
(*Alternative scenario for development of 600 km long belt of blueschist (= high P- low T metamorphic continental rocks) in E Sulawesi. Blueschist metamorphism age ~28 Ma, cooling ages 22.5-16 Ma, and older than Banggai-Sula and Tukang Besi collisions. Tied to obduction related to Oligocene rotation of Borneo. Early Miocene extension enabled rise of blueschist and created Gulf of Bone- Lake Poso depressions*)
- Helmers, H., E.H. Hebeda & W.J. Lustenhouwer (1990)- The enigmatic relationship between subduction-caused metamorphism, ophiolite emplacement and collision in eastern Sulawesi, Indonesia. In: *Orogenesis in Action: Tectonics and processes at the West Equatorial Pacific margin*, Geological Society, London, p. 30.
(*Abstract only*)
- Helmers, H., P. Maaskant & T.H.D. Hartel (1990)- Garnet peridotite and associated high-grade rocks from Sulawesi, Indonesia. *Lithos* 25, p. 171-188.
(*Garnet peridotite and associated granulite-facies contact rocks from along Palu-Koro strike-slip fault (uplifted lower crustal rocks)*)
- Helmers, H., J. Sopaheluwakan, E. Surya Nila & S. Tjokrosapoetro (1989)- Blueschist evolution in southeast Sulawesi, Indonesia. In: J.E. van Hinte et al. (eds.) *Proc. Snellius II Symposium*, Jakarta 1987, Netherlands J. of Sea Research 24, p. 373-381.
(*SE Sulawesi blueschists graphite-mica schists and metabasites of MORB-affinity, latter increasing to S and part of 600 km N-S belt of blueschists. After fast burial during subduction rocks recrystallized at high P (10.5 kbar) and low T (~400°C). Exhumation started immediately; rocks moved to 400°C/ 2-3 kbar on normal thermal gradient in few million years. Lack of radiometric age determinations prevents geotectonic modeling*)

Hendrawan, D. (2015)- Exploration history and mineral inventory of Tombulilato Block, Gorontalo, Indonesia. In: N.I. Basuki (ed.) Proc. Indonesian Soc. Economic Geologists (MGEI) 7th Annual Convention, Balikpapan, p. 27-33.

(Gold-copper-silver belt of N Sulawesi Arm, an extension of Phillipine porphyry Cu-Au belt, has long exploration history since era of Dutch colonialism. Tombulilato Block I with discoveries in 3 complexes: Sungai Mak, Cabang Kiri and Pombolo. Three types of mineralization: porphyry Cu-Au, high sulphidation epithermal Cu-Au-Ag and low sulphidation epithermal Au-Ag)

Hendrawan, D. & G.N. Putranto (2013)- The Tombulilato copper gold project in Sulawesi, Indonesia 'Facing the challenges and opportunities'. Proc. Symposium East Asia: Geology, exploration technologies and mines, Bali, Bull. Australian Institute of Geoscientists (AIG) 57, p. 32-33. *(Extended Abstract)*

(online at: <https://www.aig.org.au/library/publications/aig-bulletins/>)

(Tombulilato district in N Sulawesi characterized by >3400m thick Late Miocene?- Pleistocene island arc-type volcano-sedimentary pile. Main compressional deformation event in Pliocene. Uplift and erosion removed ~2 km of rock in last 3 My and progressive unroofing of hydrothermal system. Intrusive bodies postdate folding/thrusting. Three mineralization types in district: (1) porphyry Cu-Au (Cabang Kiri, Sungai Mak, Kayubulan Ridge, Cabang Kanan); (2) high-sulfidation epithermal Au-Cu-Ag (Motomboto, Mohutango, Ridho); (3) low-sulfidation epithermal Au-Ag (Kaidundu, Mamungaa, Pombolo, Hulapa, Ombulo, etc.)

Hendri, D. & M.C. Farmer (1997)- The discovery of the Mesel sediment hosted gold deposit, North Sulawesi, Indonesia. Proc. Conf. New Generation Gold Mines '99, case histories of discovery, Perth 1997, AMF, Adelaide, p. 5.1-5.13.

(Example of sediment-hosted, disseminated gold deposit in Mesel in Late Miocene limestone in N Sulawesi)

Hendri, D. & M.C. Farmer (1997)- The discovery of the Mesel sediment hosted gold deposit, North Sulawesi, Indonesia. Proc. 26th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 119-131.

(online at: <https://www.iagi.or.id/web/digital/64/10.pdf>)

(Same as Hendri & Farmer (1997) above. Mesel sediment-hosted, disseminated gold deposit discovered by Newmont in 1988 in Ratatotok District, 70km S of Manado, N Sulawesi. Close to early 1900's Dutch alluvial gold mining operation (Mt. Totok). Gold mineralization hosted in M Miocene limestone, intruded by porphyritic andesite, near-contemporaneous with sedimentation, First gold pour in March 1996)

Hennig, J. (2014)- Age, origin and exhumation history of magmatic and metamorphic rocks of NW Sulawesi, Indonesia. Ph.D. Thesis, Royal Holloway, University of London, p. 1-584. *(Unpublished)*

Hennig, J., E.L. Advokaat, A. Rudyawan & R. Hall (2014)- Large sediment accumulations and major subsidence offshore; rapid uplift on land: consequences of extension of Gorontalo Bay and northern Sulawesi. Proc. 38th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA14-G-304, p. 1-16.

(online at: https://www.researchgate.net/publication/263398549_Large_Sediment_Accumulations_and_Major_Subsidence_Offshore_Rapid_Uplift_on_Land_Consequences_of_Extension_of_Gorontalo_Bay_and_Northern_Sulawesi)

(Pliocene rollback of N Sulawesi subduction zone caused subsidence of Gorontalo Bay to water depths of up to 2 km and uplift of Neck and parts of C Sulawesi to 3 km. Late Miocene-Pliocene granitic and volcanic rocks in N Arm and in C Sulawesi all underwent rapid Pliocene exhumation. Neogene metamorphic core complexes in N Arm (Malino) and S of Gorontalo Bay in Tokorondo and Pompangeo Mts, suggesting regional extensional setting. W part of Gorontalo Bay underlain by Australian continental crust added to Sundaland margin in Cretaceous. Metapelite schist and paragneiss from Palu Metamorphic Complex in S Neck of Sulawesi with Cretaceous and Eocene/Oligocene protolith ages and do not represent old Australian basement rocks. Age of deposition of Celebes Molasse at W side of Neck is Pleistocene)

Hennig, J., R. Hall & R.A. Armstrong (2016)- U-Pb zircon geochronology of rocks from west Central Sulawesi, Indonesia: extension-related metamorphism and magmatism during the early stages of mountain building. Gondwana Research 32, p. 41-63.

(online at: http://searg.rhul.ac.uk/pubs/hennig_etal_2016%20Sulawesi%20U-Pb%20zircons.pdf)
(Metamorphic and granitoid rocks from Palu Metamorphic Complex (PMC) of W C Sulawesi with inherited Proterozoic-Paleogene zircons. Mesoproterozoic and Triassic inherited populations similar to New Guinea Birds Head region (and different from E Java). Some metamorphic rocks with Late Eocene zircons indicating metamorphism not older than Late Eocene, and metamorphosed in Neogene after Sula Spur collision and subsequent extension. Some metapelites of PMC with Cretaceous zircons, possibly from Sundaland (Schwaner intrusions in Kalimantan). Widespread M Miocene- Pliocene magmatism in W C Sulawesi: (1) M Miocene-Late Miocene (~14-10 Ma?) K-rich shoshonitic suite; (2) Late Miocene-Pliocene shoshonitic to high-K calc-alkaline rocks with intermediate I-type granitoids mainly ~8.5- 5 Ma, felsic S-types ~5- 2.5 Ma. Many rims of metamorphic zircons ~3.8-3.0 Ma (M Pliocene). Eocene zircons in metamorphic rocks show metamorphism of PMC metapelites younger than previously inferred; not Mesozoic or older Australian basement rocks. Co-occurrence of magmatism and metamorphism in M Pliocene during extensional phase)

Hennig, J., R. Hall, M.A. Forster, B.P. Kohn & G.S. Lister (2017)- Rapid cooling and exhumation as a consequence of extension and crustal thinning: implications from the Late Miocene to Pliocene Palu Metamorphic Complex, Sulawesi, Indonesia. *Tectonophysics* 712-713, p. 600-622.

(online at: http://searg.rhul.ac.uk/pubs/hennig_etal_2017%20Rapid%20cooling%20Palu%20Sulawesi.pdf)
(Metamorphic complexes form 1.5- 2km high mountains in W Sulawesi, and younger than previously thought. Some have Eocene sedimentary protoliths. Palu Metamorphic Complex strongly deformed and partially melted to migmatites. $^{40}\text{Ar}/^{39}\text{Ar}$ dating shows cooling in E Pliocene (~5.3-4.8 Ma) in N, and Late Pliocene (~3.1-2.7 Ma) in S. Intruded S-type granites similar Pliocene ages. Fast cooling and rapid exhumation in very young orogenic belt. Contemporaneous magmatism and deformation interpreted as consequence of decompressional melting due to extension. I-type magmatic rocks, separated from Palu MC by Palu-Koro Fault exhumed from upper crustal levels at moderate rates)

Hennig, J., R. Hall, I. Watkinson & M. Forster (2012)- Timing and mechanisms of exhumation in West Central Sulawesi, Indonesia. AGU Fall Meeting, San Francisco, T43E-2713, 1p. (Abstract only)

(online at: <http://fallmeeting.agu.org/2012/eposters/eposter/t43e-2713/>)
(Basement and intrusive rocks from NW Sulawesi record Neogene deformation, younger than expected, with rapid exhumation. C Sulawesi granitic orthogneiss with zircons with Proterozoic inherited cores and Devonian, Permo-Triassic and Jurassic zircon populations, suggesting Australian-derived terrane. Palu Metamorphic Complex basement rocks complex history of metamorphism. Pre-kinematic cordierite, etc., indicate regional high T-low P metamorphic event. Pliocene cooling age. Granites from Sulawesi Neck and mountain range W of Palu-Koro Fault mainly Late Miocene crystallisation ages (7.2 Ma, 6.4 Ma). Late-stage exhumation started in Neck in Pliocene (2.9 Ma). Magmatism, core complex exhumation and subsidence of Gorontalo Bay all related to crustal thinning due to extension driven by subduction rollback)

Herdiansyah, F., M. Burhannudinnur, M. Ali Jambak & T. Irano (2021)- New insight of surface and subsurface sedimentology of Salodik Group, Banggai Basin. Proc: 2nd International Conference Earth science and Energy, Kuala Lumpur 2020, IOP Conference Series: Earth and Environmental Science 819, 012020, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/819/1/012020/pdf>)
(Outcrop and offshore (Tiaka field) stratigraphy in S part of East Arm of Sulawesi. Salodik Group limestones deposited in M Eocene- M Miocene. In subsurface Salodik Gp deposited in Early-Late Miocene, with inner shelf-outer bathyal depositional environment)

Hermiyanto, M.H., S. Andi Mangga & Koesnama (2010)- Lingkungan pengendapan batubara Formasi Kalumpang di daerah Mamuju. *Jurnal Sumber Daya Geologi (JSDG)* 20, 4, p. 179-187.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/171/167>)
(‘Depositional environment of coal in the Kalumpang Formation, Mamuju area’, SW Sulawesi. Kalumpang (Toraja) Fm syn-rift sediments of M-L Eocene age, with quartz sst, conglomerate, shale, claystone with alternations of coal and limestone. Coal caloric value 2480-7440 kal/gr, moisture 1.3- 6.7%, volatile matter 14.7 - 45%, sulphur 0.8-7.7%. Petrography shows vitrinite 91- 100%. Vitrinite reflectance (Rv-max) 0.32- 0.62%. High vitrinite suggests Kalumpang coal derived from plants in humic condition (wet forest swamp))

Hetzel, W.H. (1927)- The geology of Kabaena island, Indonesia. Report Dienst van het Mijnwezen (Geol. Survey), Bandung, p. 1-24. *(Unpublished)*
(Unpublished Geological Survey report on Kabaena island, south of SE Arm of Sulawesi. Translation of Dutch original?)

Hetzel, W.H. (1930)- Over de geologie der eilanden in de Flores-Zee. De Mijningenieur 11, 3, p. 53-56.
(‘On the geology of the islands in the Flores Sea’. On islands Jampea, Kalao, Bonerate and Kayu Adi, in Flores Sea, S of SW arm of Sulawesi, based on July 1926 survey. Jampea oldest rocks alkaline and calc-alkaline rocks, associated with (overlain by) limestone with Lepidocyclina, also granites/ (Wichmann 1925, Siboga Expedition). Etc. Kalao island mainly uplifted reef limestones, 11 terraces, overlying andesitic-basaltic rocks. Tertiary sediments dip 40° to SW. Bonerate all uplifted reef limestones. Kayu Adi andesitic-basaltic rocks. Tiger Islands large atoll-reefs complex, 1800 km² area, probably formed after Quaternary sea level rise)

Hetzel, W.H. (1932)- De geologie van het eiland Wowoni. Report Dienst van den Mijnbouw (Geological Survey), Bandung, p. *(Unpublished)*
(‘The geology of Wowoni Island’. Geological survey report on island off SE Arm of Sulawesi, N of Buton)

Hetzel, W.H. (1935)- Enkele kritische aantekeningen bij een recente publicatie over de geologie van den Oost arm van Celebes. De Ingenieur in Nederlandsch-Indie (IV) 4, p. IV.29- IV.31.
(online at: <https://www.stichtingblauwelijn.nl/assets/files/1935-04.pdf>)
(Brief critique of Von Loczy (1934) paper on E Sulawesi, noticing inconsistencies and unjustified conclusions)

Hikmy, I.G., A. Rudyawan, B.S. Putri, B. Sapiie & I. Gunawan (2025)- The uplift rate of Sulawesi East Arm and the activity of Batui Fault using a tectonic geomorphology approach in the Luwuk Area, Sulawesi. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 26, 1, p. 1-15.
(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/663/573>)
(Morphometry analysis of watersheds in Luwuk area of East Arm of Sulawesi, uplift of Neogene Salodik limestone to 1469 m asl and Celebes Molasse up to 2000 m asl, etc., suggests uplift rates at active Batui and Pasini Thrusts of ~ 0.41 and 0.21 mm/year. Uplift increasing to W (Pompangeo Schist of C Sulawesi)

Hinde, G.J. (1917)- Notes on specimens of organic rocks from Central Celebes collected by Mr. E.C. Abendanon. In: E.C. Abendanon (1917), Geologische en geographische doorkruisingen van Midden-Celebes (1909-1910), E.J. Brill, Leiden, 3, p. 953-958.
(Poorly preserved radiolaria from red cherts in C Sulawesi, collected by Abendanon in 1910, interpreted as ‘not older than Late Jurassic in age’. Assemblages comparable to Molengraaff’s Danau Fm in C Kalimantan)

Hirschi, H. (1911)- Lagerstätte von kristallisiertem Gold in einem Kalkmassiv zu Totok. Zeitschrift für Praktische Geologie 19, 5/6, p. 213-214.
(online at google books, etc.)
‘Deposits of crystallized gold in a limestone massif at Totok’. Brief paper, based on 1909 fieldwork in Minahassa District, of N Sulawesi, with specimens of gold-ore donated to HH by Mr. Zimmermann of Totok Mijnbouw Maatschappij. Mining by TMM started in 1897, in area with common relicts of abandoned native shallow gold diggings. Gold-silver bearing quartz veins in Oligo-Miocene limestones, overlain by younger volcanic breccias near Totok. Mineralization linked to amphibole-andesite intrusion, but not sure if tied to older Tertiary or Quaternary volcanic episodes. No sulphidic ores)

Hirschi, H. (1913)- Geologische Beobachtungen in Ost-Celebes. Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap (2) 30, 5, p. 611-618.
(online at: <https://resolver.kb.nl/resolve?urn=MMUBA13:001659001:pdf>)
(‘Geological observations in E Sulawesi’. Summary of 1909 reconnaissance of part of Tomini Bay coastal area and traverse NW from Tomori Bay. Between Bongka Koi and Podi folded ‘Celebes Molasse’ with coral limestone breccias with well-preserved Lepidocyclina (suggests older parts of Celebes Molasse is Miocene in age, if not reworked?; JTvG). Molasse overlies serpentized rocks and diabase, with clasts including gabbro, serpentinite, etc.)

Hofstra, A.H. & O.D. Christensen (2002)- Comparison of Carlin-type Au deposits in the United States, China, and Indonesia: implications for genetic models and exploration. In: S.G. Peters (ed.) *Geology, geochemistry and geophysics of sedimentary rock-hosted Au deposits in P.R. China*, U.S. Geological Survey (USGS) Open-File Report 02-131, Chapter 2, p. 62-94.

(online at: http://pubs.usgs.gov/of/2002/of02-131/chapters/OF02-131_chapter2.pdf)

(Includes data on Mesel Au deposit in N Sulawesi, in island arc setting, a 'Carlin-type' disseminated gold mineralization in M Miocene Ratatotok Limestone)

Hojnos, R. (1934)- Verslag over een micropalaeontologisch onderzoek van sedimentaire gesteenten uit Celebes. *Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien*, Geologische Serie 10, p. 291-294.

(*'Report on a micropaleontologic investigation of sedimentary rocks from Sulawesi'*. Chapter in Von Loczy 1934 paper on thin sections DD21-DD33. White and reddish deep marine limestones from Tokala Mts/ N Boengkoe Mts in E arm of Sulawesi (called 'Boeroe Lst- Tokala Lst by Von Loczy; highly deformed, surrounding ophiolite massifs, with canaliculate belemnites in lower parts, and radiolaria of Late Jurassic and Early Cretaceous ages (NB: Hojnos' age interpretations were questioned by Tan Sin Hok (1935), but species identified by Hojnos are indeed diagnostic of Late Jurassic- Early Cretaceous age; JTvG) (Sanfilippo and Riedel 1985, p. 576 suggest Cretaceous ages only (Neocomian and Senonian))

Hopper, R.H. (1941)- A geology reconnaissance in the East arm of Celebes and Island Peleng. *Nederlandsche Pacific Petroleum Maatschappij (NNPM)*, p. (Unpublished Report, Copy available at Library of Geological Survey, Bandung?).

(Unpublished report by Caltex geologist Richard H. Hopper, partly summarized by Van Bemmelen (1949) and Cornee et al. (1999): Includes intensely deformed Triassic-Jurassic-Cretaceous limestones, clastics and radiolarian cherts. With record of E Jurassic ammonite *Harpoceras cf. toarcense* in E Arm of Sulawesi, identified by Von Koenigswald)

Hornaday, W.T., R.A. de Boer, J.N. Grant, N. Nastiti & P. Astono (1996)- Sengkang Basin (SW Sulawesi). In: Pertamina/BPPKA (eds.) *Petroleum geology of Indonesian basins*, VII, Jakarta, p. 1-34.

(Overview of the mainly Neogene Sengkang Basin of SW Sulawesi. With series of Eocene- Pliocene paleogeographic maps of SW Sulawesi)

Hotz, W. (1913)- Vorläufige Mitteilung über geologische Beobachtungen in Ost-Celebes. *Zeitschrift Deutschen Geologischen Gesellschaft*, Berlin, 65, Monatsberichte 6, p. 329-334.

(online at: <https://www.biodiversitylibrary.org/item/37576#page/337/mode/1up>)

(*'Preliminary note on geological observations in E Sulawesi'*. Summary of 1912 survey for 'Nederlandsche Maatschappij Mijnbouwkundige Werken' in southern coastal area of East arm of Sulawesi. First report of Mesozoic rocks in East arm of Sulawesi: probably Jurassic-age blue-grey marls with common belemnites near Lontio village, probably in core of anticline in area dominated by Tertiary beds. Upper Bongka River near drainage divide red cherty limestones and Nummulites limestones. Age of gabbro and peridotites rel.young?)

Hovig, P. (1918)- Contactmetamorfie ijzerertsen aan de Salo Talimbangan en de Salo Pebatoean (Centraal Celebes). *Jaarboek Mijnwezen Nederlandsch Oost-Indie* 45 (1916), *Verhandelingen* 2, p. 25-38.

(*'Contactmetamorphic iron ores along Talimbangan and Pebatoean rivers (C Sulawesi)'*. Granodioritic intrusive into probably Eocene age interbedded shale-limestone, with magnetite-hematite mineralization in limestones of contact zone, 12 km from Rante Pao)

Hsia, J., J. Zhang, J. Qian, J. Liu, M. Guo, C. Yu, WW. Xian, C. Yin & Y. Tian (2024)- Isothermal compression record in the high-pressure Bantimala garnet amphibolite: Implications on the Mesozoic subduction system between the Sundaland and Western Sulawesi (Indonesia), *Lithos* 488-489, 107813, p.

(*Isothermal isothermal compression is special prograde metamorphic P-T path in high-P rocks. Bantimala Complex metamorphic basement in W Sulawesi preserves records of High-P to Ultrahigh-P metamorphism during Cretaceous subduction of Mesotethys Ocean under Sundaland. Garnet amphibolite from Bantimala*

underwent eclogite-facies metamorphism at ~23.5 kbar/588 °C; overall P-T trajectory counterclockwise with two loops. $^{40}\text{Ar}/^{39}\text{Ar}$ dating indicates timing of HP metamorphism at 136-128 Ma (~Valanginian-Barremian) E Cretaceous). Magmatic zircons suggest protolith formation age around 212 ± 3.1 Ma (Late Norian, Late Triassic))

Hsia, J., J. Zhang, J. Qian, J. Liu, Y. Tian, W.W. Xian, C. Yin, P. Gao, M. Forster & M. Guo (2024)- Metamorphic P-T-t constraint on the Bantimala garnet-epidote-glaucophane schist and its implication on Mesozoic evolution of Western Sulawesi, Indonesia. *Tectonophysics* 873, 230228, p. 1-16.

(Bantimala Complex, with garnet-epidote-glaucophane blueschist and eclogite, underwent Franciscan-type metamorphism with peak conditions of 24.5- 28.5 kbar/ 580-640 °C. Peak metamorphism in E Cretaceous, before 125 Ma ($^{40}\text{Ar}/^{39}\text{Ar}$ dating), characterized by cold deep subduction of oceanic lithosphere between Sundaland landmass and East Java- West Sulawesi terrane during Early Cretaceous (and collision))

Hsia, J., J. Zhang, G. Zhao, J. Qian, J. Liu, M. Sun, C. Yin, P. Gao, W.W. Xian & M. Guo (2023)- Newly discovered youngest UHT metamorphism on Earth, Western Sulawesi, Indonesia. *Geoscience Frontiers* 14, 2, 101500, p. 1-13.

(online at: <https://www.sciencedirect.com/science/article/pii/S1674987122001530>)

(New discovery of HT-UHT metamorphic rocks (incl. amphibolite, granulite, eclogites, gneiss) in Palu region of W. Sulawesi. Granulite samples with high garnet content suggest UHT conditions of 7.2-8.5 kbar/940-1080 °C and 7.0-7.3 kbar/1000-1040 °C. Two generations of metamorphic zircons (1) age of 36-5.3 Ma is ascribed to syn- to post-M1 metamorphism; (2) 5.1- 3.8 Ma linked to syn- and post-M2 stage. UHT metamorphism probably consequence of upwelling of asthenospheric mantle, triggered by post-collisional delamination of lithosphere in Miocene-Pliocene (~5 Ma). Possibly youngest known UHT metamorphism on Earth)

Hufenbach, C. (1992)- Petrogenetische und Tektonische Entwicklung des Ophiolith-Komplexes von Ost-Sulawesi, ein Beispiel für die Obduktion ozeanischer Kruste. *Doct. Thesis Georg-August University, Göttingen, Germany*, p. 1-120. *(Unpublished)*

(‘Petrogenetic and tectonic development of the ophiolite complex of East Sulawesi; an example of obduction of oceanic crust’)

Hui, G., S. Li, P. Wang, Y. Suo, Q. Wang, I.D. Somerville (2018)- Linkage between reactivation of the sinistral strike-slip faults and 28 September 2018 Mw7.5 Palu earthquake, Indonesia. *Science Bulletin (China)* 63, 24, p. 1635-1640.

(online at: <https://www.sciengine.com/SB/doi/10.1016/j.scib.2018.11.021>)

(Reactivation of Palu-Koro fault during September 28, 2018 Mw 6.1 and Mw 7.5 (main shock). earthquakes)

Husain, R. (2023)- Characteristics of foraminifera distribution in volcanic tuff of Parepare Tanamailie Pinrang, South Sulawesi. *Journal of World Science* 2, 9, p. 1345-1352.

(online at: <https://jws.rivierapublishing.id/index.php/jws/article/view/426/959>)

*(Fine-grained tuffaceous rocks exposed at Tanjung Tanamailie in western S Sulawesi (lower part of Parepare volcanic stratigraphic sequence) contain planktonic foraminifera of late M Miocene- E Pliocene age (N13-N19) (interpreted as shallow marine deposits, but clearly outer neritic or deeper marine assemblages; benthic forams identified as *Textularia* looks like *Bolivina*; JTvG))*

Husain, R., Kaharuddin & F. Wahyu (2023)- Karakteristik olistolit daerah Tondong Tallasa, Sulawesi Selatan. *Jurnal Geosapta* 9, 2, p. 111-116.

(online at: <https://ppjp.ulm.ac.id/journal/index.php/geosapta/article/view/16423/pdf>)

(‘Olistolith characteristics of the Tondong Tallasa Area, South Sulawesi’. Olistoliths from Tondong Tallasa olistostrome in imbricated thrusts along Pangkajene River)

Husainy, S.T., N. Sulaiman, R. Ismail, N. Sulaiman, R. Langkoke & M. Farida (2020)- Paleontological assessment of Malawa Formation, Padanglampe, Barru Regency, South Sulawesi. *Int. Conference on Science and Technology 2020, Malaysia, IOP conference Series: Earth and environmental Science* 596, 012051, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/596/1/012051/pdf>)

(Five gastropods and two bivalves from Eocene Malawa Fm in S Sulawesi suggest age from early Triassic to Middle Neogene (No mention of classic references on Eocene molluscs of Java, etc.; why was this published?))

Husein, S., M.I. Novian & D.H. Barianto (2014)- Geological structures and tectonic reconstruction of Luwuk, East Sulawesi. Proc. 38th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA14-G-137, p. 1-16.

(online at: https://www.researchgate.net/publication/282604525_Geological_Structures_and_Tectonic_Reconstruction_of_Luwuk_East_Sulawesi)

(Luwuk area at E end of East Arm of Sulawesi, where E Sulawesi Ophiolite Complex thrusted S-ward over Banggai-Sula microcontinent in Neogene. C part of E Sulawesi Arm is compressional, Pliocene, thin-skinned NW-verging fold-thrust belt with common Eocene-Miocene carbonates. In ophiolite complex at N side (facing Tomini Gulf) extensional, block-faulting tectonic regime (Plio-Pleistocene relaxation of earlier compressive phase) (NB: suggested NW vergence of thrust belt is opposite of suggested by all previous workers?; No documentation given for age control of stratigraphy and tectonic events; No mention of Kundig (1956) work in same area; JTvG))

Hutubessy, S. (2003)- Pola cekungan dan struktur bawah permukaan di Sulawesi dan sekitarnya berdasarkan analisis data gayaberat. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 13, 135, p. 24-39.

('Basin patterns and deep structure of Sulawesi and surroundings based on analysis of gravity data'. Gravity patterns interpretation of E Sulawesi.)

Iddings, J.P. & E.W. Morley (1915)- Contributions to the petrography of Java and Celebes. Journal of Geology 23, p. 231-245.

(Brief petrographic and geochemical analyses of lavas and crystalline rocks of Bulu Saraung (Maros Peak), SW Sulawesi and Pleistocene Muria volcano NE Java)

Iddings, J.P. & E.W. Morley (1917)- A contribution to the petrography of Southern Celebes. Proc. National Academy of Sciences USA 3, 10, p. 592-597.

(Additional brief descriptions and chemical analyses of igneous rocks from SW Sulawesi)

Idrus, A., Fadlin, S. Prihatmoko, I.W. Warmada, I. Nur & F.M. Meyer (2012)- The metamorphic-rock hosted gold mineralization at Bombana, Southeast Sulawesi: a new exploration target in Indonesia. Jurnal Sumber Daya Geologi (JSDG) 22, 1, p. 35-48.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/105/97>)

(Placer gold discovered in Bombana, SE Sulawesi not associated with volcanic rocks, but possibly derived from quartz veins hosted by Mesozoic Pompangeo Metamorphic Complex of N Rumbia Mts mica schists, etc. Three generations of veins identified. Gold mainly as 'free gold' among silicate minerals. May be called 'orogenic gold', and may have formed at 5km depth)

Idrus, I., A. Imai, A. Makkawaru, Kamrullah, I.W. Warmada, I. Nur & R. Langkoke (2009)- Preliminary study on orogenic deposit type as a source of placer gold at Bombana, Southeast Sulawesi, Indonesia. Proc. Int. Symposium on Earth Science and Technology, Fukuoka 2009, p. 569-572.

(Gold deposits in Indonesia generally in volcanic-related hydrothermal deposits, but recent SE Sulawesi placer gold discoveries tied to gold-bearing quartz veins in metamorphic rocks. Such veins recognized in metamorphic rocks at Wumbubangka Mt (N flank Rumbia Mts) and in Mendoke Mts. (N of Langkowala). These gold deposits classified as 'orogenic gold type')

Idrus, A., S. Mansur, Ahmad, Rahmayuddin & A. Mahdi (2016)- Occurrences and characteristics of gold mineralization in Rampi Block prospect, North Luwu Regency, South Sulawesi Province, Indonesia. J. Applied Geology (UGM) 1, 2, p. 63-70.

(online at: <https://journal.ugm.ac.id/jag/article/view/26962>)

(Quartz ± gold veins in Rampi block prospect mainly hosted by metamorphic and metasedimentary rocks of Latimojong Fm and Pompangeo metamorphic complex. Orientation and distribution of veins controlled by NW-

SE and NE-SW trending structures. Orogenic/mesothermal gold type, with similarities to Awak Mas mesothermal prospect in Luwu district)

Idrus, A., I. Nur, Sufriadin, Fadlin, Indra Sanjaya & R. Langkoke (2020)- Low-sulfidation epithermal carbonate-base metal- gold mineralisation hosted by Tertiary sedimentary rocks in Bastem Prospect, Luwu District, Sulawesi Island, Indonesia: a preliminary study. *J. Applied Geology (UGM)* 5,1, p. 53-63.
(online at: <https://jurnal.ugm.ac.id/jag/article/view/55472/28369>)

(Sediment-hosted low sulfidation epithermal gold mineralisation in Bastem prospect, Luwu district, W-C Sulawesi. Bastem prospect gold-bearing quartz veins hosted in Tertiary Toraja Fm mudstone -siltstone, adjacent to volcanic rocks of Lamasi Fm. Possibly originated in back-arc rift/basin setting)

Idrus, A., I. Nur, I.W. Warmada & Fadlin (2011)- Metamorphic rock-hosted orogenic gold deposit type as a source of Langkowala placer gold, Bombana, Southeast Sulawesi. *Jurnal Geologi Indonesia* 6, 1, p. 43-49.

(online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/301)

(Same paper as Idrus, Warmada et al. 2010)

Idrus, A. & S. Prihatmoko (2011)- The metamorphic rock-hosted gold mineralization at Bombana, Southeast Sulawesi: a new exploration target in Indonesia. In: N.I. Basuki (ed.) *Proc. Conference Sulawesi Mineral Resources 2011*, Manado, MGEE/IAGI, p. 243-258.

(Bombana area 'orogenic' gold deposits, hosted in mica schists of Carboniferous-Permian Pompangeo Metamorphic Complex)

Idrus, A., S. Prihatmoko, E. Harjanto, F.M. Meyer, I. Nur, W. Widodo & L.N. Agung (2016)- The metamorphic rock-hosted gold mineralization at Bombana (Southeast Sulawesi) and Buru Island (Maluku): their key features and significances for gold exploration in Eastern Indonesia. *Proc. 8th Annual Conv. Indonesian Soc. Economic Geologists (MGEE)*, Bandung 2016, p. 80-87.

(online at: www.researchgate.net/publication/309764235_The_metamorphic_rock-hosted_gold_Etc.)

(Review of metamorphic rock-hosted 'orogenic' gold mineralization in Bombana (Rumbia Mts, SE Sulawesi; gold-bearing quartz veins in Pompangeo metamorphics) and NE Buru Island (quartz veins in Permo-Carboniferous Wahlua mica schists))

Idrus, A., S. Prihatmoko, E. Harjanto, F.M. Meyer, I. Nur, W. Widodo & L.N. Agung (2017)- The metamorphic rock-hosted gold deposit style at Bombana (Southeast Sulawesi) and Buru Island (Maluku): their key features and significances for gold exploration in Eastern Indonesia. *J. Geoscience Engineering Environment Technology (JGEET)* 2, 2, p. 124-132.

(online at: <http://journal.uir.ac.id/index.php/JGEET/article/view/291/130>)

(same as Idrus et al. 2016)

Idrus, A., S. Septiana, F. Zaccarini, G. Garuti & H. Hasria (2022)- Mineralogical, textural and chemical characteristics of ophiolitic chromitite and Platinum Group Minerals from Kabaena Island (Indonesia): their petrogenetic nature and geodynamic setting. *Minerals (MDPI)* 12, 5, p. 1-24.

(online at: <https://www.mdpi.com/2075-163X/12/5/516>)

(First mineralogical study of chromite composition, silicates and PGM (platinum group minerals; mainly laurite), by electron microprobes, in podiform chromitite of Kabaena Island (off SE Sulawesi). Mined by locals in the past. Chromitite within Cretaceous East Sulawesi Ophiolite, which, on Kabaena, overlies Pompangeo schist complex and is overlain by Cretaceous pelagic limestone (Matano Fm) (?). Calculated composition of parental melt varies from arc to MORB (mid-ocean ridge basalts). Composition of chromitites suggests they formed in mantle of forearc ophiolite)

Idrus, A., Sufriadin & I. Nur (2011)- Hydrothermal ore mineralization in Sulawesi: a view point of tectonic setting and metallogenesis. *Proc. 36th HAGI and 40th IAGI Annual Conv.*, Makassar, JCM2011-298, p. 1-12.

(online at: https://www.iagi.or.id/web/digital/10/2011_IAGI_Makassar_Hydrothermal-Ore-Mineralization.pdf)

(Review of the potential and metallogenesis of hydrothermal-related ore deposits, particularly along Neogene magmatic arc of W Sulawesi and Paleozoic metamorphics-hosted arm of SE-Central Sulawesi. W Sulawesi 3

magmatic provinces, each with different magmatic and mineralization characteristics: (1) S Sulawesi with K-alkaline shoshonitic affinity and mainly Pb-Zn-Cu base metal in epithermal veins; (2) C Sulawesi with high-K calc-alkaline affinity and porphyry Mo mineralization; (3) N Sulawesi-Sangihe island arc with low-K-normal calc-alkaline affinity and porphyry Cu-Au and other Au deposits)

Idrus, A., I.W. Warmada, I. Nur, Sufriadin, A. Imai, S. Widasaputra, S.I. Marlia, Fadlin & Kamrullah (2010)- Metamorphic rock-hosted gold deposit type as a source of Langkowala placer gold, Bombana, Southeast Sulawesi, Indonesia. Proc. 39th Annual Conv. Indonesian Association Geologists (IAGI), Lombok, PIT-IAGI-2010-068, p. 1-7.

*(online at: www.academia.edu/9413275/METAMORPHIC_ROCK_HOSTED_OROGENIC_GOLD_DE Etc.)
(Placer gold discovered in 2008 in Langkowala area, SE Sulawesi, interpreted derived from 'orogenic gold': sheared gold-bearing quartz veins, hosted by metamorphic rocks (mica schist, metasediment of Pompangeo Complex in Wumbubangk- Rumbia Mts to S). At least two generations of veins. Similar quartz veins probably in Mendoke Mts at N side of Langkowala area)*

Ikhwan, M., M.H. Thamrin & I.B. Raharjo(2021)- A revised tectonic model of Minahasa District based on LiDAR image log and fracture stability analysis in Tompaso. Proc. 43rd New Zealand Geothermal Workshop, Wellington 2021, p, 1-17.

*(online at: https://www.researchgate.net/publication/358604450_A_REVISED_TECTONIC_MODEL_OF_MINAHASA_DISTRICT_BASED_ON_LiDAR_IMAGE_LOG_AND_FRACTURE_STABILITY_ANALYSIS_IN_TOMPASO)
(Study of structures around Tompaso geothermal field, with dominant NE-striking fractures)*

Ikhwana, N., M. Farida & H. Umar (2022)- Paleoenvironment analysis of the Tonasa Formation based on Nannofossils in the Barru River, South Sulawesi Province. Proc. 51st Annual Conv. Indonesian Association Geologists (IAGI), Makassar, 93, p. 1-5.

*(online at: <https://www.iagi.or.id/web/digital/71/PITIAGI-22-P-Abs-050.pdf>)
(Tonasa Fm widely distributed carbonate rock formation in SW Sulawesi. In Barru River 170 m thick section sampled, yielding coccoliths of zones NP16- NP25 (M Eocene- Oligocene). Oligotrophic- eutrophic-oligotrophic changes deduced from sizes of coccoliths)*

Ilhami, A.S. (2012)- Provenance and sedimentology study of Mesozoic clastic sandstone of Meluhu Formation, Southeast Arm of Sulawesi, Eastern Indonesia. Proc. 41st Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 2012-SS-20, p. 1-5.

(online at: https://www.iagi.or.id/web/digital/9/2012_IAGI_Yogyakarta_Provenance-and-Sedimentology-Study-of-Mesozoic.pdf)

(Late Triassic fluvial-deltaic Meluhu Sst of SE Sulawesi underlain by metamorphic rocks and unconformably overlain by Paleogene(?) Tampakura Fm carbonates. Halobia and Daonella in Meluhu, Tinala and Tokala Fms indicate Late Triassic age. Petrography shows litharenite, sublitharenite and quartz arenite with average composition of 65% monocrystalline quartz (some with metamorphic undulose extinction, but also likely volcanic provenance), 12% polycrystalline quartz, 16% rock fragments, 1.5% feldspar, some muscovite and heavy minerals (tourmaline, zircon). Lithics dominated by metamorphic rock fragments, indicating source area dominated by metamorphic basement. Southern part of study area was closer to source of lithic fragments)

Ilyas, A., K. Kashiwaya & K. Koike (2016)- Ni grade distribution in laterite characterized from geostatistics, topography and the paleo-ground water system in Sorowako, Indonesia. J. Geochemical Exploration 165, p. 174-188.

*(online at: <https://core.ac.uk/download/pdf/77625923.pdf>)
(Modeling of Ni-content suggests that highest grade Ni ores are concentrated below slopes in 5-19° range)*

Ilyas, A. & K. Koike (2012)- Geostatistical modeling of ore grade distribution from geomorphic characterization in a laterite nickel deposit. Natural Resources Research 21, 2, p. 177-191.

(online at: <https://core.ac.uk/download/pdf/77620831.pdf>)

(Modeling of Ni grade in laterite Ni deposits in PT INCO nickel mining area at Sorowako, East C Sulawesi. Maximum Ni grade in saprolite zone in areas of slight slope. Ni accumulation probably originates from deep weathering of (Tertiary?) ultramafic rocks by groundwater infiltrating through rock fractures)

Imran, A.M. (2000)- Microfacies and diagenesis of the Tertiary Selayar Limestone (Walanae Formation), South Sulawesi, Indonesia. Doctoral Thesis, University of Erlangen-Nurnberg, p. 1-187. *(Unpublished)*
(Study of Pleistocene raised coral reef terraces at SE coast of SE Sulawesi. Overlying Walanae Volcanics)

Imran, A.M., M. Farida, M.F. Arifin & R. Husain, (2015)- Pleistocene coral reef facies in Bira, South Sulawesi. Int. Journal of Engineering and Science Applications (IJESCA) (UNHAS) 2, 2, p. 183-189.
(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/163/118>)
(Pleistocene raised reef coral terrace with reef front, reef core and back reef facies in Bira area at SE tip of S Arm Sulawesi. Part of complex of four seaward-young narrow terraces of U Miocene-Pleistocene 'Selayar Limestone', reflecting uplift of area (Bone Bay rift shoulder?; JTvG))

Imran, A.M., M. Farida, M.F. Arifin, R. Husain & A.Hafidz (2016)- Reef development as an indicator of sea level fluctuation: a preliminary study on Pleistocene reef in Bulukumba, South Sulawesi. Indonesian J. on Geoscience (IJOG) 3, 1, p. 53-66.
(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/231/205>)
(Similar to papers above and below on Pleistocene Selayar Limestone four or more raised reef terraces on SE tip of S Arm of Sulawesi)

Imran, A.M., R. Husein & A. Prayudil (2017)- Pleistocene reef development in Bulukumba, South Sulawesi. Proc. Sriwijaya Int. Conference on Engineering Science Technology, Bangka (SICEST 2016), MATEC Web of Conferences 101, 04020, p. 1-4. *(online at: https://www.matec-conferences.org/articles/mateconf/pdf/2017/15/mateconf_sicest2017_04020.pdf)*
(Description of uplifted Pleistocene fringe reef lower terrace in Bulukumba area at SE tip of South Arm of Sulawesi. Four reef facies)

Imran, A.M., Kaharuddin M.S., D.A. Suriamihardja & H. Sirajuddin (2013)- Geology of Spermonde Platform. Proc. 7th Int. Conference on Asian and Pacific Coasts (APAC 2013), Bali 2013, p. 1062-1067.
(online at: <http://repository.unhas.ac.id/bitstream/handle/123456789/11699/171.CR%2003.pdf?sequence=1>)
(Mainly review of setting for development of Quaternary reef complexes on Spermonde Platform along S Makassar Straits, off SW Sulawesi, since sea level rise of ~7000 years ago (mainly based on De Klerk 1982))

Imran, A.M. & R. Koch (2006)- Microfacies development of the Selayar Limestone, South Sulawesi. Proc. 35th Conv. Indonesian Association Geologists (IAGI), Pekanbaru 2006, PITIAGI2006-028, p. 1-8. *(online at: https://www.researchgate.net/publication/289970015_MICROFACIES_DEVELOPMENT_OF_THE_SELAYAR_LIMESTONE_SOUTH_SULAWESI)*
(Four stages of coral reef terrace development in Late Miocene- Pleistocene Selayar Limestone in SE Bulukumba area of SW Sulawesi, ~200 km SE of Makassar. Oldest unit B1 is Late Miocene Amphistegina-Cycloclypeus foram limestone that forms knoll reefs. Three younger units (Pliocene- Pleistocene) form terraces, reflecting Plio-Pleistocene uplift, composed of coral reef and Halimeda algal grainstone facies)

Imran, A.M. & R. Koch (2008)- Marine diagenetic history of the Selayar Limestone, South Sulawesi. Jurnal Informasi Teknologi (INTEK) 14, 2, p. 109-117. *(online at: https://www.researchgate.net/publication/289970053_Marine_Diagenetic_History_of_the_Selayar_Limestone_South_Sulawesi)*
(Common marine radial fibrous calcite cement in Late Miocene- Pleistocene Selayar Limestone)

International Nickel Indonesia (1972)- Laterite deposits in the south-east arm of Sulawesi. Bull. of National Institute Geology and Mining (NIGM), Bandung 4, 1, p. 37-57.
(PT INCO review of principal occurrences of nickeliferous laterite in E Sulawesi, which coincide with two NW trending belts of ultrabasic rocks and derived sediments: (1) SW belt from Sua-Sua through Pomalaa and

Torobulu to Wowoni Island and (2) NE belt from Malili and Kolonodale at N end of E Arm to Lasolo on E Coast. Nickeliferous laterite on undulating, somewhat dissected plateaus of low relief; rugged areas have little or no laterite cover)

Irfan, U.R., A.M. Imran & M.N.A. Abbas (2021)- Physical and chemically changes in limestone intruded by trachytic dyke: implications for cement raw material. Proc. 3rd Int. Conf. Global Issue for Infrastructure, Environment, and Socio-Economic Development (GIESED 2020), IOP Conference Series: Earth and Environmental Science 921, 012044, p. 1-15.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/921/1/012044/pdf>)

(Alteration of M Miocene Tonasa Limestone around trachyte dike in Poloe area in Maros Regency, S Sulawesi. Secondary minerals garnet and wollastonite in limestone 0-20 m from intrusion contact. Decreasing CaO₂ and Fe₂O₃, inceasing SiO₂, Al₂O₃ and MgO towards contact. Ideal composition for cement 20-70 m from contact)

Irfan, U.R., M.S. Kaharuddin, Budiman & H. Umar (2014)- Analisis litofasies batuan vulkanik Pare-Pare di daerah Lumpue Sulawesi Selatan. Proc. 43st IAGI Annual Conv. Exhib., Jakarta, PIT IAGI 2014 272, p. 1-5.

(online at: <https://files01.core.ac.uk/download/pdf/25496287.pdf>)

(‘Lithofacies analysis of Pare-Pare volcanics in the Lumpue area of South Sulawesi’. Description of Pare-Pare volcanic breccias, tuffs, etc.(radiometric ages latest Miocene- E Pliocene, ~6.6- 4.2 Ma))

Irfan, U.R., M.S. Kaharuddin, D.A. Suriamiharja & N. Irzal (2013)- Identification of lava domes in Pangkajene caldera, South Sulawesi, Indonesia. Proc. HAGI-IAGI Joint Convention, Medan 2013, p. 1-4.

(online at: https://www.iagi.or.id/web/digital/8/2013_IAGI_Medan_Identification-of-Lava-Domes.pdf)

(Mounded features on Walanae Depression plain in S Sulawesi, composed of volcanic products of Mio-Pliocene Pare-Pare Fm trachytic volcanics and interpreted as lava domes or volcanic necks (see also Yuwono et al., 1985))

Irfan, U.R., A. Maulana & F. Muhammad (2021)- Role of bedrock serpentinization on the development of nickel laterite deposit in Sorowako, Sulawesi, Indonesia. Proc. 3rd Int. Conf. Global Issue for Infrastructure, Environment, and Socio-Economic Development (GIESED 2020), IOP Conference Series: Earth and Environmental Science 921, 012028, p. 1-11.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/921/1/012028/pdf>)

(Olivine-rich bedrock and low degree of serpentinization have high-Ni concentration in laterite profiles of Soroako area, E Sulawesi)

Irfan, U.R., I. Nur & M. Kasim (2017)- Hydrothermal alteration mineralogy associated with gold mineralization in Buladu area, Gorontalo, Northern Sulawesi, Indonesia. Int. J. Advanced Science Engineering Information Technology (IJASEIT) 7, 6, p. 2244-2250.

(online at: http://www.insightsociety.org/ojaseit/index.php/ijaseit/article/view/3837/pdf_606)

(Au-quartz veins in Buladu gold prospect, in Miocene Wobudu volcanic breccia in N Sulawesi magmatic arc)

Irzon, R. (2017)- Pengayaan logam berat Mn, Co, dan Cr pada laterit nikel di Kabupaten Konawe Utara, Provinsi Sulawesi Tenggara. Buletin Sumber Daya Geologi 12, 2, p. 71-86.

(online at: <http://buletinsdg.geologi.esdm.go.id/index.php/bsdg/issue/archive>)

(‘Heavy metal enrichment of Mn, Co, and Cr in nickel laterite in North Konawe Regency, SE Sulawesi’. Weathering of ultramafic rock causes Mn, Co and Cr enrichment mostly in laterite, whilst Ni concentrated in transitional bedrock. Highest REE concentrations in lateritic horizon)

Irzon, R. & Baharuddin (2016)- Geochemistry of ophiolite complex in North Konawe, Southeast Sulawesi. Eksplorium 37, 2, p. 101-114.

(online at: <http://jurnal.batan.go.id/index.php/eksplorium/article/view/2868/pdf>)

(Geochemistry of N Konawe ultramafic rocks suggest origin in arc tholeiitic tectonic environment setting. SiO₂ 38.5- 41%, etc. Emplaced in E Cretaceous, unconformably overlain by Late Cretaceous Matano Fm)

Ito, A., T. Otake, A. Maulana, K. Sanematsu, Sufriadin & T. Sato (2021)- Geochemical constraints on the mobilization of Ni and critical metals in laterite deposits, Sulawesi, Indonesia: A mass-balance approach. *Resource Geology* 71, 3, p. 255-282.

(online at: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/rge.12266>)

(Examination of Ni enrichment and potential accumulation of critical metals in four laterite profiles with varying degrees of serpentization and weathering intensity in Soroako and Pomalaa areas of E Sulawesi, Indonesia. Nickel contents in saprolite horizon of profiles that are strongly weathered and developed over serpentized peridotite higher than those weakly weathered and developed over unserpentized harzburgite. Ni remobilization is main control on Ni enrichment in profiles. Enrichments in Co and rare earth elements strongly influenced by formation of Mn-oxyhydroxides in oxide zone of profiles)

Jablonski, D., P. Priyono, S. Westlake & O.A. Larsen (2007)- Geology and exploration potential of the Gorontalo Basin, Central Indonesia- Eastern extension of the North Makassar basin? Proc. 31st Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, G-083, p. 197-223.

(Seismic in Gorontalo basin S of N arm of Sulawesi suggests basin underlain by Eocene rift grabens. Active petroleum system suggested by E-W depocenters, locally >10 km thick, mostly S-ward focused hydrocarbon migration, onshore oil seeps along S edge of basin and AVO anomalies. Potential plays: (1) Older blocks associated with Australian plate rifting and Cretaceous collision with Borneo; (2) Eocene rift fault-blocks; (3) Oligocene-Miocene platform carbonates; (4) Late Miocene-Pliocene build-ups; (5) Late Miocene-Recent lowstand deltas and turbidites; (6) Late Miocene-Recent compressional folds associated with collision of Sundaland with Australian plate)

Jambak, M.A., I. Ibrahim, B. Harnest, T. Irano, G. Prabawa, R. Luthfi & A.B. Prasetyo (2024)- Reinterpretation of Salodik Group performance based on facies and diagenesis approaches to classify reservoir quality. *Indonesian J. on Geoscience (IJOG)* 11, 1, p. 91-109.

(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/811/450>)

(Study of Eocene- Miocene Salodik Gp (Tomori and Minahaki Fms) carbonate reservoirs from outcrop sections in East Arm of Sulawesi area, Banggai- Sula Basin. Focused on facies, diagenesis and reservoir quality. Lower Tomori Fm Alveolina-Nummulites limestone (Fig. 17). Primary porosity generally not well preserved (cementation); secondary porosity more important)

Jaya, Asri (2001)- Sikuen stratigrafi dan diagenesa batugamping Formasi Tonasa Lintasan Ralla Sulawesi Selatan. Masters Thesis, Institut Teknologi Bandung, p. (Unpublished)

(‘Sequence stratigraphy of the Tonasa Limestone in the Ralla Section, South Sulawesi’)

Jaya, A. (2001)- Sequence stratigraphy of the Tonasa Limestone, Ralla Section, South Sulawesi. *J. Penelitian Enjiniring (JPE)*, Hasanuddin University, 8, 1, p. 59-68.

Jaya, A. (2006)- Facies and sedimentary environment of Camba Formation, Dutungan area, South Sulawesi. *J. Penelitian Geosains* (Hasanuddin University, Makassar) 2, 3, p. 243-256.

Jaya, A. (2014)- Tectonic evolution of South Sulawesi, Indonesia: reconstructed by analysis of deformation structures. Doct. Engin. Thesis, Dept. Engineering and Resource Science, Akita University, Japan, p. 1-148.

(online at: air.lib.akita-u.ac.jp/dspace/bitstream/10295/2714/1/kouhakuotsu634.pdf)

(Biru Metamorphic Complex E of Makassar, S Sulawesi mainly epidote-amphibolite and amphibolite facies metamorphics from mid-oceanic ridge and calc-alkali basalts and island-arc tholeiite protoliths. E Cretaceous K-Ar age (109 ± 2.4 Ma) indicates metamorphism of Biru Complex coeval with Bantimala Complex and Barru Block. NE-SW striking/ S/SE-dipping schistosity also similar to Barru Block, despite different lithologic associations. Emplacement of Biru granodiorite in E-M Miocene. E Walanae Fault stress generated by collision of Sulawesi with Australian fragments since Late Miocene, continuing to present-day)

Jaya, A. & O. Nishikawa (2011)- Deformation microstructures of metamorphic rocks in the Biru area South Sulawesi. Proc. Joint 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-175, p. 1-10.

(Biru metamorphic rocks in Biru area, S Sulawesi adjacent to W Walanae Fault (WWF). Rocks mainly metabasite, adjacent to Cretaceous Marada Fm sediments. Higher greenschist-amphibolite metamorphic grade. Multiple deformation phases. Schistosity dips 15-52° to SE. Two groups of fold structures: SSW trending tight fold (F1) and ENE-WSW trending gentle-open fold (F2)).

Jaya, A. & O. Nishikawa (2011)- Microstructure deformation of metamorphic rocks in the Biru area, South Sulawesi, Indonesia. *Majalah Geologi Indonesia (IAGI)* 26, 1, p. 19-28.

(online at: <http://repository.unhas.ac.id/handle/123456789/12490>)

(Small exposure of metamorphic rocks in Biru area, S Sulawesi, adjacent to prominent topographic lineament along W Walanae Fault and Cretaceous sedimentary rocks (Marada Fm). Mainly metabasite of higher greenschist- amphibolites metamorphic facies. Deformation in metamorphic rocks may be connected to W Walanae Fault or M Miocene regional extension during uplift of western mountain range)

Jaya, A. & O. Nishikawa (2013)- Paleostress reconstruction from calcite twin and fault slip data using the multiple inverse method in the East Walanae fault zone: implications for the Neogene contraction in South Sulawesi, Indonesia. *J. Structural Geology* 55, p. 34-49.

(Stress states caused by collision of SE margin of Sundaland with Australian microcontinents during Pliocene detected from combination of calcite-twin data and fault-slip data. Pliocene NE-SW to-E-W directed compression activated E Walanae fault zone in S. Sulawesi as reverse fault, with dextral component of slip with pervasive development of secondary structures in zone between Bone Mts and Walanae Depression)

Jaya, A., O. Nishikawa & Y. Hayasaka (2017)- LA-ICP-MS zircon U-Pb and muscovite K-Ar ages of basement rocks from the south arm of Sulawesi, Indonesia. *Lithos* 292-293, p. 96-110.

(online at: www.researchgate.net/publication/319657018_LA-ICP-MS_zircon_U-Pb_and_muscovite_K-Ar_ages_of_basement_rocks_from_the_south_arm_of_Sulawesi_Indonesia)

(Ages of detrital zircons in Bantimala Complex and muscovite K-Ar of amphibolite in Biru Complex 109-115 Ma. Youngest detrital zircon in schist from Barru Complex 243-247 Ma (M Triassic). Age data indicate protoliths of S Sulawesi basement complexes involved in (M Triassic?) subduction system and metamorphosed in late E Cretaceous. Felsic igneous intrusives of Late Cretaceous and Eocene ages, similar to Meratus Complex of S Kalimantan. Detrital zircon age distributions of basement rocks support W Sulawesi block origin from circum-Bird's Head-Australia (Inner Banda block). Absence of Jurassic zircon age populations in S Arm of Sulawesi. W Sulawesi composed of several blocks separated from Inner Banda block with different histories)

Jaya, A., O. Nishikawa & S. Jumadil (2023)- Paleoseismic analysis of the Walanae Fault Zone in South Sulawesi, Indonesia. *Indonesian J. on Geoscience (IJOG)* 10, 2, p. 215-227.

(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/825/426>)

(Walanae Fault most seismogenic fault system of S Sulawesi. Two parallel faults, 150km-long, 3km-wide fault traces, separated by narrow lowland (Walanae Depression; 25 km). Sheared soils dated as 3050- 3990 yrs BP)

Jaya, A., O. Nishikawa & S. Jumadil (2019)- Distribution and morphology of the surface ruptures of the 2018 Donggala-Palu earthquake, Central Sulawesi, Indonesia. *Earth Planets and Space* 71, 144, p. 1-13.

(online at: <https://earth-planets-space.springeropen.com/articles/10.1186/s40623-019-1126-3>)

(A 160-km rupture zone was formed on surface along NS to NNW-SSE trending Palu-Koro fault during 28 september 2018 earthquake)

Jaya, A., O. Nishikawa, Sufriadin & S. Jumadil (2021)- Fluid migration along faults and gypsum vein formation during basin inversion: an example in the East Walanae fault zone of the Sengkang Basin, South Sulawesi, Indonesia. *Marine and Petroleum Geology* 133, 105308, p. 1-6.

(Young gypsum veins in narrow area along W limb of Sengkang anticline, where East Walanae Fault cuts Pliocene Walanae Fm. Probably formed by fluids that reacted with framboidal pyrites in sedimentary rocks)

Jaya, A. & D.R. Salamba (2014)- Studi struktur makro (mesoscale structure) batuan metamorf daerah Barru Provinsi Sulawesi Selatan. *Pros. 2014 Seminar Penelitian Teknologi Terapan 2014* (8), Hasanuddin University, Makassar, p. TG3-1- TG3-8.

(online at: <http://repository.unhas.ac.id/handle/123456789/16802>)

(*'Study of the macrostructure (mesoscale structure) of metamorphic rocks in the Barru region, S Sulawesi'. Barru metamorphic block composed of low- moderate grade metamorphic rocks, with foliation generally NE-trending and tilting to SE. Two main stretching directions i.e., SE-NW-trending and NE-SW-trending, both plunging to W. Fault low angle dip-slip or thrust and horizontal movement or strike-slip. Locally high angle dip-slip faults. Folds formed earlier than faults*)

Jaya, A., A.I.S. Simalango & A. Maulana (2015)- Struktur dan deformasi batuan metamorf daerah Paboya Provinsi Sulawesi Tengah. J. Penelitian Geosains (Hasanuddin University) 11, 1, p. 35-41.

(online at: <http://repository.unhas.ac.id/handle/123456789/16801>)

(*'Structure and deformation of metamorphic rocks in the Poboaya region of Central Sulawesi province'. Poboaya/ E Palu District in 'neck' of Sulawesi with outcrops of molasse sediments, gneiss and biotite schist. Folding and post-Tertiary horizontal faulting. Quartz crystal orientations and porphyroblasts in amphibolite-greenschist facies indicate formation at low-medium T (300-700°C) and P <1 Gpa, during syn-tectonic sinistral shear, related to Palu-Koro regional fault*)

Jaya, A., Sufriadin & I. Nur (2011)- A short note on sedimentary rocks of the Barru area, South Sulawesi. Berita Sedimentologi 22, p. 9-14.

(online at: <https://journal.iagi.or.id/index.php/FOSI/article/download/199/169>)

(*On Late Cretaceous-Tertiary stratigraphy of Barru area, SW Sulawesi, ~120km N of Makassar. Three measured sections at SE side of Barru basement complex, with M Eocene Malawa Fm fluvio-deltaic clastics, M-Late Eocene Tonasa Fm mixed clastics and redeposited carbonates, Mio-Pliocene Camba Fm deeper marine volcanoclastics*)

Jaya, A., I. Sumantri, D.I. Bachri & B.R. Maulana (2022)- Understanding and quantitative evaluation of geosites and geodiversity in Maros-Pangkep, South Sulawesi, Indonesia. Geoheritage 14, 2, 40, p.

(*Maros-Pangkep area in S Sulawesi with 9 significant potential geosites in (Cretaceous) melange, Cenozoic limestone karst topography and caves and offshore modern reef islands of Spermonde Archipelago*)

Jezek, P.A., D.J. Whitford & J.B. Gill (1981)- Geochemistry of recent lavas from the Sangihe- Sulawesi arc. In: A.J. Barber & S. Wiryosujono (eds.) The geology and tectonics of Eastern Indonesia, Proc. CCOP-IOC SEATAR Working Group Meeting, Bandung 1979, Geological Research Development Centre (GRDC), Bandung, Special Publ. 2, p. 383-389.

(*Sangihe Arc stretches from NE of Sulawesi to N, at W side Molucca Sea. 130-180 km above W dipping Benioff zone that extends to 650 km depth. S sector mainly olivine basalts and pyroxene andesite, N part more hornblende andesites. No evidence of involvement of sediments in lavas*)

Jugovics, L. (1940)- Der granodiorit von Gorontalo auf Nordcelebes. Foldtani Kozlony 70, 7-9, p. 163-176 and p. 222-231.

(online at: http://real-j.mtak.hu/8885/4/Foldtani_Kozlony_1940_70_7-9.pdf)

(*'The granodiorite of Gorontalo on North Sulawesi'. Description of granodiorite collected by L. von Loczy in 1928 at port of Gorontalo, N Sulawesi*)

Jugovics, L. (1950)- Beitrage zur Kenntnis der Gesteine von Ost-Celebes. Geologica Hungarica, Series Geologica, 8, p. 1-112.

(online at: http://epa.oszk.hu/02900/02986/00010/pdf/EPA02986_geologica_hungarica_ser_geol_1950_08_015-112.pdf)

(*'Contributions to the knowledge of rocks from East Sulawesi'. Descriptions of igneous rocks collected by Loczy in 1928. Mainly ophiolitic igneous rocks (gabbro, hartzburgite, serpentinite), some metamorphics and volcanics*)

Junursyah, G.M.L., Alviyanda & N. Novandaru (2018)- Studi mikrofacies dan diagenesis batugamping dari Formasi Tetambahu sebagai mikrokontinen Mesozoikum di daerah Teluk Tomori. J. Geologi Kelautan 16, 1, p. 1-14

(online at: https://www.researchgate.net/publication/331873819_STUDI_MIKROFACIES_DAN_DIAGENESIS_Etc.)

(‘Microfacies and diagenesis study of limestone from Tetambahu Formation as Mesozoic microcontinent in the Tomori Bay area’. Jurassic sediments in Korolama section SE of Kolonodale: clastics dominated at base (‘Nanaka Fm), limestone-dominated at top (Tetambahu Fm). (No data to support ages, no thickness info of studied section, no attempt of identifying bioclasts in limestones; JTvG))

Jurkovic, I. & I.B. Zalokar (1990)- The copper deposit of Batu Marupa in Central Sulawesi, Indonesia. Rudarsko-Geolosko-Naftni Zbornik (Mining-Geology-Petroleum Engineering Bulletin), Zagreb, 2, p. 29-33.
(online at: <https://hrcak.srce.hr/en/file/38908>)

(Brief description of small abandoned copper mines of Batu Marupa (Sangkaropi), N Toraja area, 35-40 km N of Makale in central West Sulawesi. Exploited by Japanese in WWII who destroyed the mine after retreat. Ore bodies lenses of chalcopyrite, pyrrhotite, sphalerite, etc., inside altered intermediary subvolcanic rocks)

Kadar, A.P. & Sudijono (1993)- Biostratigrafi fosil nanno Tersier Tengah Formasi Tonasa (Penampang Rala), Sulawesi Selatan. Proc. 22nd Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 2, p. 1100-1113.

(online at: [https://www.iagi.or.id/web/digital/53/22nd-Volume-2-\(6-9-Des-1993\)-498-511.pdf](https://www.iagi.or.id/web/digital/53/22nd-Volume-2-(6-9-Des-1993)-498-511.pdf))

(‘Biostratigraphy of Middle Tertiary nanofossils in the Tonasa Formation (Rala Section), South Sulawesi’. Nanofossils from lower Tonasa Fm show Late Eocene (NP18-NP20)- Early Oligocene (NP21-NP23) ages. Calciurbitides in Late Eocene (NP20) with larger foraminifera Discocyclina, Pellatispira, etc. In E Oligocene zone NP23 olistostrome bed with reworked Eocene larger forams)

Kadarusman, A. (2011)- Basement rocks of Sulawesi and their contribution to the metallogenic formation. In: N.I. Basuki (ed.) Proc. Sulawesi Minerals Resources, Manado 2011, Indonesian Soc. Economic Geologists (MGEI) - IAGI, p. 121-130.

(Sulawesi five basement types (1) accretionary-collision complex (Bantimala and Barru Complex in SW arm), (2) metamorphic rocks with continental margin parentage (metamorphic complexes in W, NW, C and SE Sulawesi), (3) ophiolitic rock and oceanic crust (E and N arm, respectively), (4) melange or broken formation (C part), (5) continental granitic basement (Banggai-Sula and Tukang Besi). All basements Mesozoic in age; some metamorphic rocks have Paleozoic protoliths)

Kadarusman, A., H.K. Brueckner, H. Yurimoto, C.D. Parkinson & S. Maruyama (2001)- Geochemistry and Sm-Nd dating of garnet peridotites from Central Sulawesi, and its implication to the Neogene collision complex in Eastern Indonesia. American Geophysical Union (AGU), Fall Meeting 2001, T52D-08, 1p. (Abstract only)

(Small garnet-bearing peridotites on Sulawesi in two regions in strike-slip fault zones: Palu-Koro fault zone and right-lateral Ampana fault in Bongka river valley juxtaposed against E Sulawesi ophiolite. P-T time plot suggests prograde subduction zone peridotite. Sm-Nd ages 27-20 Ma. 27 Ma probably peak metamorphism and 20 Ma cooling age. Ultramafic rocks most likely metamorphosed to garnet- assemblages during Late Oligocene- E Miocene continent-continent collision in C Sulawesi. Due to buoyancy peridotites uplifted within Neogene metamorphic complex)

Kadarusman, A., S. Miyashita, S. Maruyama & A. Ishikawa (2002)- The East Sulawesi Ophiolite: the accreted Cretaceous huge ophiolite massif formed by Southwest Pacific superplume. Abstract Superplume Workshop, Tokyo, p. 1-4.

(online at: http://192.129.24.144/licensed_materials/10069/free/conferen/superplu/..)

(Ophiolite complexes of W and C Indonesia (i.e. Java, Kalimantan) of Tethyan provenance, those in E Indonesia probably parts of Circum-Pacific ophiolite belt. E Sulawesi Ophiolite tectonically dismembered, >15 km thick ophiolite sequence from mantle peridotite to mafic cumulate, gabbro, sheeted dolerites and basaltic volcanics. Geochemistry suggests oceanic plateau origin, may have originated in SW Pacific Superplume. Ages Paleogene (60-32 Ma; termination of generation of oceanic lithosphere?) and Cretaceous (79-137 Ma; first generation of oceanic lithosphere?). Obduction onto Sundaland ~30 Ma (age of metamorphic sole))

Kadarusman, A., S. Miyashita, S. Maruyama, C.D. Parkinson & A. Ishikawa (2004)- Petrology, geochemistry and paleogeographic reconstruction of the East Sulawesi ophiolite, Indonesia. Tectonophysics 392, p. 55-83.

(online at: https://www.researchgate.net/publication/223330932_Petrology_geochemistry_and_paleogeographic_reconstruction_of_the_East_Sulawesi_Ophiolite_Indonesia)
(*E Sulawesi Ophiolite (ESO) tectonically dismembered and widely distributed in C and E Sulawesi. Comprises, from base: mantle peridotite, gabbro, sheeted dolerites and basaltic volcanic rocks. Possible oceanic plateau origin (15 km thick). Possible Cretaceous origin of oceanic plateau component indicated on basis of calculated paleopositions using plate trajectory analyses together with published paleolatitude data*)

Kadarusman, A. & C.D. Parkinson (2000)- Petrology and P-T evolution of garnet peridotites from Central Sulawesi, Indonesia. *J. Metamorphic Geology* 18, 2, p. 193-209.

(online at: www.academia.edu/6899047/Petrology_and_P_Tevolution_of_garnet_peridotites_from_cen Etc.)
(*Alpine-type garnet-bearing peridotites associated with E Cretaceous (140-115 Ma) quartzo-feldspathic gneisses of in two areas of Sulawesi (Palu-Koro fault and outcrops juxtaposed against gabbros and peridotites of E Sulawesi ophiolite in right-lateral Ampana fault). Final exhumation from upper crustal levels facilitated by entrainment in Neogene granitic plutons, and/or Oligocene transtension in deep-seated strike-slip fault zones*)

Kadarusman, A., T. van Leeuwen & R. Soeria-Atmadja (2005)- Discovery of eclogite in the Palu region of Central Sulawesi and its implication for the tectonic evolution of Sulawesi. *Majalah Geologi Indonesia (IAGI)* 20, 2, Special Edition, p. 80-89.

(online at: www.researchgate.net/publication/313429773_Discovery_of_eclogite_in_the_Palu_region_Central_S Etc.)
(*Eclogite and other high-grade metamorphic rocks in float in Palu-Koro fault valley. Proposed history: (1) Early Tertiary conversion of oceanic lithosphere into eclogite after subduction to ~60km below Sundaland; (2) Late Oligocene- Early Miocene collision between microcontinent and Sundaland margin incorporated eclogite fragments into upper plate; (3) latest Miocene- Pliocene rapid uplift after Banggai-Sula collision*)

Kadarusman, A., T. van Leeuwen & J. Sopaheluwakan (2011)- Eclogite, peridotite, granulite and associated high-grade rocks from the Palu region, Central Sulawesi, Indonesia: an example of mantle and crust interaction in a young orogenic belt. *Proc. Joint 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-379*, p. 1-10.

(online at: https://www.iagi.or.id/web/digital/10/2011_IAGI_Makassar_Eclogite,-Peridotite,-Granulite.pdf)
(*Palu region of C Sulawesi part of collision zone with peridotites and high-grade metamorphic rocks (eclogite, granulite). Formed at great depth during collision event between Sundaland and underthrust Australian continental fragment sometime in Late Eocene- E Miocene. Radiometric ages of Palu Metamorphic Complex two groups: Mesozoic (144-73 Ma) and Late Miocene-Pliocene (6-2 Ma). Younger ages probably overprint of widespread young granite magmatism*)

Kaharuddin, M. (2010)- Perkembangan tektonik dan stratigrafi Kompleks Bantimala, Sulawesi Selatan. *Pros. Hasil Penelitian Fakultas Teknik UNHAS* 4, p. TG 5-1-TG5-9.

(*Tectonic and stratigraphic development of the Bantimala Complex, South Sulawesi'. UNHAS research results*)

Kaharuddin, M., A.M. Imran. C.I. Abdullah & A. Jaya (2017)- Olistostrome and the Mesozoic tectonic of the Bantimala Complex, South Sulawesi. *Sriwijaya Int. Conf. Engineering Science Technology (SICEST 2016)*, Bangka, MATEC Web of Conferences 101, 04011, p. 1-6.

(online at: www.matec-conferences.org/articles/mateconf/pdf/2017/15/mateconf_sicest2017_04011.pdf)
(*Discussion of schist breccias between Bantimala metamorphic rocks and overlying mid-Cretaceous radiolarian cherts. Poorly sorted polymict olistholiths (schist, gneiss, also serpentinite-jadeite) in sandy matrix, conformably overlain by radiolarian chert. Schist-gneiss breccia interpreted as (mid-Cretaceous) olistostrome deposited in subduction trench. Common soft-sediment folding of chert beds*)

Kaharuddin, A.M. Imran, C.I. Abdullah & A. Jaya (2018)- Phenomenon of schistic breccia, autoclastic breccia and radiolarian chert, a Mesozoic tectonic trace in Bantimala tectonic complex area, Pangkep Regency South Sulawesi Province. *Proc. Int. Conf. Earth Science, Mineral, and Energy, Yogyakarta 2018, IOP Conference Series: Earth and Environmental Science*, 212, 012042, p. 1-11.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/212/1/012042/pd>)

(At top of Bantimala metamorphic complex 'autoclastic' schist breccia with multiple types of metamorphic rocks (greenschist, blueschist, eclogite, granulite; nearby also serpentinite blocks). Conformably overlain by five thin (15-60cm) folded layers of Cretaceous radiolarian chert with 3-25cm thick interbeds of coarse 'schistic sandstone' (similar outcrops discussed by Haile et al. (1979); JTvG). Overlain by Paleocene tuff.)

Kaharuddin, A.M. Imran, C.I. Abdullah & A. Jaya (2018)- Tektonik konvergen dan implikasi terhadap eksplorasi hidrokarbon (Studi kasus: Kompleks tektonik Bantimala Kabupaten Pangkep). Proc. 4th Seminar Ilmiah Nasional Sains dan Teknologi, 4, Hasanuddin University, Gowa 2018, p. 248-258. (online at: [https://www.academia.edu/38465625/TEKTONIK_KONVERGEN_DAN_IMPLIKASINYA_TERHADAP Etc.](https://www.academia.edu/38465625/TEKTONIK_KONVERGEN_DAN_IMPLIKASINYA_TERHADAP_Etc.)) (*'Convergent tectonics and its implications for hydrocarbon exploration (case study: the Bantimala Complex, Pangkep District)', S Sulawesi*)

Kaharuddin, A.M. Imran, C.I. Abdullah & A. Jaya (2019)- Olistostrome and its implication to geological disaster on coastal area with special reference to the Bantimala tectonic complex, Pangkep regency, South Sulawesi Province. In: 1st Int. Conf. Global Issue for Infrastructure, Environment & Socio-Economic Development (GIESED 2018), Makassar, IOP Conference Series: Earth and Environmental Science 235 (2019), 012043, 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/235/1/012043/pdf>)

(Cretaceous polymict (mainly metamorphic rocks) olistostrome in Bantimala Complex. Interpreted as submarine landslides (trench deposits). Four episodes, separated by folded radiolarian chert layers. Olistostrome formation may damage infrastructure).

Kaharuddin, A.M. Imran, C.I. Abdullah & A. Jaya (2019)- Olistostrome and its implications to geological disaster on coastal area with special reference to the Bantimala tectonic complex, Pangkep Regency South Sulawesi Province. Proc. 1st Int. Conf. Global Issue for Infrastructure, Environment & Socio-Economic Development (GIESED 2028), Makassar 2018, IOP Conference Series: Earth and Environmental Science 235, 012043, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/235/1/012043/pdf>)

(Another paper on Bantimala Complex Cretaceous (subduction zone) metamorphics and schist breccia, overlain by locally folded Albian-Cenomanian radiolarian chert with sandstone interbeds, all associated with with four episodes of submarine landslide polymict 'olistostrome breccias')

Kaharuddin M.S., A. Jaya & H. Sirajuddin (2015)- Olistostrome dan batu mulia kompleks tektonik Bantimala, Kabupaten Pangkajene dan kepulauan, Provinsi Sulawesi Selatan. Proc. 24th TPT and 9th Congress Assoc. Indonesian Mining Professionals (PERHAPI), Jakarta 2015, p. 65-76.

(online at: <http://repository.unhas.ac.id/bitstream/....>)

('Olistostrome and precious stones in the Bantimala tectonic complex, Pangkajene District, S. Sulawesi'. Bantimala Complex composed of metamorphic rocks such as glaucophane schist, hornblende mica schist, eclogite, granulite, phyllite and metaquartzite of Triassic age. Olistostrome components schist, quartzite, metachert, jadeite, Jurassic-Cretaceous metaperidotite and Cretaceous sediments (flysch, shale, sandstone, mudstone and radiolarian chert). Basement contains precious stones like agate, jade, turquoise, etc.)

Kaharuddin, H. Sirajuddin, A. Jaya, S. Jumadil & M.F.W. Wira P (2022)- Tectonic deformation and its implications for geological disasters; case study of Mangilu Area, Bantimala Complex Pangkep South Sulawesi Province. Proc. 51st Annual Conv. Indonesian Association Geologists (IAGI), Makassar, p. 1-9.

(online at: <https://www.iagi.or.id/web/digital/71/PITIAGI-22-P-Abs-108.pdf>)

(Mangilu area in N part of Bantimala complex which is a contact zone between continental and oceanic plate. Many rock deformation features, like melange formations, olistostromes, metamorphism, mud diapirs, melange injection and geological structures)

Kaharuddin M.S., A. Tonggiroh & H. Sirajuddin (2014)- Olistostrome dan obduksi ofiolit Lasitae, Kabupaten Barru, Provinsi Sulawesi Selatan. Proc. 43rd Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 1-8.

(online at: https://www.iagi.or.id/web/digital/6/2014_IAGI_Jakarta_Olistostrome-dan-Obduksi.pdf)

('Olistostrome and ophiolite obduction, Lasitae, Barru, S Sulawesi Province'. Polymict and limestone breccia olistostrome sediments exposed along Barru River (± 3 km), N of (and overthrust by?) schist-ophiolite complex. Composed of blocks of dacite, peridotite, Malawa sst, coal and silicified Eo-Oligocene Tonasa Lst with Nummulites. Four members in olistostrome, with tuffaceous marls in upper part. Formation of olistostrome most likely in Late Oligocene, at edge of shallow sea basin, and tied to obduction of Lasitae ophiolite)

Kamaruddin, H., R. Ardiansyah I., M.F. Rosana, N. Sulaksana & E.T. Yuningsih (2019)- Profil endapan laterit nikel di Pomalaa, Kabupaten Kolaka, Provinsi Sulawesi Tenggara. Buletin Sumber Daya Geologi 13, 2, p. 84-105.

(online at: http://103.87.161.68/index.php/bsdg/article/view/BSDG_VOL_13_NO_2_2018_2/pdf)

('Nickel laterite profiles in Pomalaa, Kolaka Regency, SE Sulawesi Province'. Pomalaa area in ultramafic rocks of East Sulawesi Ophiolite in SE Sulawesi. Hydrous Mg silicate nickel laterite deposits developed by weathering of serpentized harzburgite, preferentially on undulating hills with gentle slope angles of 10°- 25°)

Kartaadipoetra, L. Witoelar & T.W. Sudiro (1973)- A contribution to the geology of Southeast Sulawesi. Proc. 2nd Annual Conv. Indonesian Association Geologists (IAGI), p.

Kasim, M., A. Zainuri & Nurfaika (2014)- Petrogenesis of andesitic rock in Sumalata, North Gorontalo. Int. Journal of Engineering and Science Application (IJEScA; UNHAS) 1,1, p. 37-42.

(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/133/89>)

(Sumalata area on N coast of North Arm of Sulawesi with historic gold mines, now exploited by locals. Dominated by Miocene- Pliocene andesite and tuffs. Petrographic analyses of 20 samples indicate four types of rocks: andesite, trachyte, latite and quartz latite)

Katchan, G. (1994)- The Masmindo gold project, South Sulawesi, Indonesia. Indonesian Mining Conference, Jakarta, 1994, p. .

(Geology and gold mineralisation in the Awak Mas district, Latimojong Mts, central W Sulawesi)

Katili, J.A. (1970)- Additional evidence of transcurrent faulting in Sumatra and Sulawesi. Bull. of National Institute Geology and Mining (NIGM), Bandung, 3, 3, p. 15-28.

Katili, J.A. (1977)- Past and present geotectonic position of Sulawesi, Indonesia. Proc. 6th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, p. 317-332.

(Early plate tectonic model for Sulawesi, proposing Sulawesi- Kalimantan collision in Early Pliocene, followed by post-Pliocene Makassar Straits extension. Timing of various events described no longer current; JTvG)

Katili, J.A. (1978)- Past and present geotectonic position of Sulawesi, Indonesia. Tectonophysics 45, p. 289-322.

(Outdated overview of events shaping Sulawesi geology: Banda Sea= trapped old Indian Ocean crust, Sulawesi Sea= old trapped Pacific crust, opening of Makassar Straits in Quaternary, etc.)

Katili, J.A., L. Kartaadiputra & Surio (1963)- Magma type and tectonic position of the Una-Una Island, Indonesia. Bulletin of Volcanology 26, 1, p. 431-454.

(Una-Una rocks differ from other volcanoes in Indonesia: K-rich, medium alkaline, transitional between trachytes and andesites. Volcano lies outside orogenic belt, probably at intersection of two basement fissures of NE-SW and SE-NW directions. Extinct volcanism in Togeian ridge. Known eruption in 1898, earthquake in 1960 (and major eruption in 1983; Katili & Sudradjat 1984))

Kavalieris, I. (1984)- The geology and geochemistry of the Gunung Pani gold prospect, North Sulawesi. M.Sc. Thesis, Australian National University (ANU), Canberra, p. 1-224 + Appendices

(online at: <https://openresearch-repository.anu.edu.au/handle/1885/9263>)

(Study of Gunung Pani gold prospect near Marisa village, N Sulawesi, initially surveyed in 1920's. Gold mineralization low grade, large tonnage gold resource, hosted in intrusive porphyritic rhyodacites and

pyroclastics of Pliocene- Pleistocene Pani Volcanic Complex. Geochemically Pani Volcanics best compared to rocks from continental margin tectonic settings)

Kavalieris, I., T.M. van Leeuwen & M. Wilson (1992)- Geological setting and styles of mineralisation, North arm of Sulawesi, Indonesia. *J. Southeast Asian Earth Sciences* 7, p. 113-129.

(Sulawesi N arm Neogene island arc on Paleogene volcanic-sedimentary basement, underlain by oceanic crust. Sulawesi neck metamorphic rocks and felsic granitoids belong to Sundaland continental margin. N Sulawesi Arc two stages, separated by gap 13- 9.5 Ma, reflecting collision of N arm with Sula Platform microcontinent in M Miocene. E Miocene calc-alkaline arc due to W-directed subduction. Arc-continent collision resulted in back-arc thrusting, clockwise rotation of N arm, and inception of subduction along N Sulawesi Trench. Post-collisional magmatism in N Sulawesi Arc produced felsic-mafic volcanic suites related to rifting of former arc rather than subduction. Sulawesi Neck Dondo suite potassic granites of continental affinity. N arm rel. well mineralized. Porphyry Cu-Au mineralization at ~2-4 Ma in oceanic terrane following collision-related arc reversal and Mo mineralization in continental terrane that underwent lower crustal melting during extension following same collision. Cogenetic granites exposed over 5000 km² and intruded in arcuate belt, more than 400 km long, parallel to Sula Platform collision zone)

Kavalieris, I., J.L. Walshe, S. Halley & B.P. Harrold (1990)- Dome-related gold mineralization in the Pani Volcanic complex, North Sulawesi, Indonesia: a study of geologic relations, fluid inclusions, and chloritic compositions. *Economic Geology* 85, p. 1208-1225.

(Gold mineralization at Gunung Pani prospect near Marisa, N Sulawesi. related to Miocene or younger rhyodacitic volcanic center, which overlies and partly intrudes hornblende-biotite granodiorite and Eocene(?) basaltic volcanics)

Kemmerling, G.L.L. (1926)- Het Sopoetangebergte in de Minahassa. *Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap* 43, 2, p. 220-224.

(‘The Soputan Mountains in the Minahassa’. Critical discussion of report by surveyor L. Horsting in the Soputan volcanic complex in N Sulawesi)

Khorniawan, W.B. (2013)- Studi mikrofases dan diagenesis batuan karbonat Formasi Poh, Cekungan Luwuk-Banggai, Kecamatan Pagimana, Kabupaten Luwuk, Provinsi Sulawesi Tengah. *Geological Engineering E-Journal (Universitas Diponegoro)*. 5, 1, p. 287-301.

(online at: <https://ejournal3.undip.ac.id/index.php/geologi/article/download/5830/5620>)

(‘Microfacies and diagenesis study of carbonate rocks of the Poh Formation, Luwuk-Banggai Basin, Pagimana District, Luwuk Regency, Central Sulawesi Province’. 13 carbonate facies types in Late Oligocene- M Miocene Poh Fm (folded cover of collided Bangga-Sula Block- JTvG). Poor reservoir quality. No sample location map or stratigraphic column)

King, J., A.E. Williams-Jones, V. van Hinsberg & G. Williams-Jones (2014)- High-sulfidation epithermal pyrite-hosted Au (Ag-Cu) ore formation by condensed magmatic vapors on Sangihe Island, Indonesia. *Economic Geology* 109, p. 1705-1733.

(online at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.855.9057&rep=rep1&type=pdf>)

(Related Bawone and Binebase high-sulfidation epithermal Au (Cu-Ag) deposits on S Sangihe Neogene volcanic island hosted by altered andesitic rocks. Mineralization multiple generations of gold-bearing pyrite)

Koesnama (2014)- Pensesaran mendatar dan zona tunjaman aktif di Sulawesi: hubungannya dengan kegempaan. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 15, 2, p. 75-79.

(‘Strike-slip faults and active subduction in the Sulawesi area and their relationships with seismicity’. On Pulau-Koro, Walanae, Matano, Lawanopo and Gorontalo faults, mainly large strike-slip faults)

Koestono, H., E.E. Siahaan, M. Silaban & H. Franzson (2010)- Geothermal model of the Lahendong geothermal field, Indonesia. *Proc. World Geothermal Congress 2010, Bali, Indonesia*, 6 p.

(online at: <https://www.geothermal-energy.org/pdf/IGAstandard/WGC/2010/1259.pdf>)

Lahendong Geothermal Field in N Sulawesi, 30 km S of Manado, discovered in 1982. Part of depression of Pangolombian caldera. Thermal structures on surface mostly fault controlled, with NW-SE and NE-SW directions. Heat source believed to be magma cooling beneath Mt. Lengkoan and Mt. Kasuratan)

Komura, K. & J. Sugimoto (2021)- Shortcut faults and lateral spreading activated in a pullapart basin by the 2018 Palu earthquake, Central Sulawesi, Indonesia, 2021 Remote Sensing (MDPI) 13, 2939, p. 1-27.
(online at: <https://www.mdpi.com/2072-4292/13/15/2939>)
(Pull-apart basin along Palu-Koro fault system near the city of Palu)

Koolhoven, W.B.C. (1923)- Report on the investigation of nickel ore and chromite in the Lasolo area. (subsection: Kendari), Archives Pusat Jawatan Geologi, Bandung, No. 20/br, p.
(Unpublished report in Geological Survey archives. Probably WW-II English translation of 1923 Dutch-language Dienst van het Mijnwezen report)

Koolhoven, W.C.B. (1930)- Verslag over een verkenningstocht in de Oostarm van Celebes en den Banggai Archipel. Jaarboek Mijnwezen Nederlandsch-Indie 58 (1929), Verhandelingen, p. 187-225.
(*'Reconnaissance survey of Sulawesi E arm and Banggai Archipelago'. E Sulawesi isoclinally folded (N-dipping) Eocene limestones-sst and E Miocene limestones-marls (Oligocene absent), overthrust by ophiolites, both unconformably overlain by Pliocene 'Celebes molasse'. No crystalline basement. Small outcrops of underlying Jurassic? with belemnites (Cenomanian; Silver et al. 1983). In North ophiolites overlain by ?Miocene diabase, tuff, andesite. Several oil seeps in Pliocene Celebes Molasse, some with non-flammable H₂S-bearing gas, and also in gabbro in S. Babason. Eocene Nummulites limestone with Lacazina and Alveolina wichmanni (p. 202 'known only from New Guinea and E Celebes'). Quaternary limestones along S coast of E arm up to 500m uplift, little or none along N coast*)

Koolhoven, W.C.B. (1932)- De geologie van het Malili terrein (Midden Celebes). Jaarboek Mijnwezen Nederlandsch-Indie 59 (1930), Verhandelingen 3, p. 127-153.
(*Description of part of E Sulawesi ophiolite belt and pelagic cover in Malili area of Verbeek Mountains in C Sulawesi. Peridotites (= pre-Cretaceous oceanic crust/mantle?), with at top zone of 10's of m thick dynamometamorphic serpentinites with some metamorphic blocks (amphibolite, piemontite-quartzite, etc.). Overlain by?Late Jurassic- E Cretaceous? Matano series with lower member of red deep sea clay with radiolarian cherts and upper part of Late Cretaceous Discorbina (=Globotruncana) pelagic limestones, all interpreted to be deep sea deposits deposited directly on peridotite (Later authors suspected fault contact between peridotite and Matano Beds; (e.g. Van Bemmelen, 1949), but could be radiolarite deposition on top of older detachment surface exposed on seafloor?- JTvG). No Tertiary sediments)*

Koomans, C. (1935)- Die Trachyten und Andesiten der Tогianinseln und Oena-Oena (Niederlandisch Ost-Indien). Leidsche Geologische Mededelingen 6, p. 119-122.
(online at: www.repository.naturalis.nl/document/549748)
(*'The trachytes and andesites volcanics of the Tогian Islands and Una-Una', Tomini Bay E Sulawesi'. Brief petrographic descriptions of volcanic rocks collected by Molengraaff and Umbgrove. No ages or locality maps)*

Koperberg, M. (1900)- Verslag omtrent de gedurende het jaar 1899 in de Residentie Menado gedreven geologisch-mijnbouwkundige onderzoekingen en mijnontginning. Jaarboek Mijnwezen Nederlandsch-Indie 29 (1900), p. 30-50.
(*'Report on geological-mining investigations in the Menado Residency for the year 1899'. Investigations from December 1898 by Koperberg, continuing the survey work of the area that was started by R. Fennema. Initial work was investigation of gold deposits at Totok mine, associated with Miocene limestones. Reporting on activity of many, mostly unsuccessful, private gold prospecting companies)*

Koperberg, M. (1901)- Verslag van het geologisch en mijnbouwkundig onderzoek in de Residentie Menado over het jaar 1900. Jaarboek Mijnwezen Nederlandsch-Indie 30 (1901), p. 115-121.
(*'Report on geological-mining investigations in the Menado Residency for the year 1900'*)

- Koperberg, M. (1902)- Geologische en mijnbouwkundig onderzoekingen in de Residentie Manado gedurende het jaar 1901. Jaarboek Mijnwezen Nederlandsch-Indie 31 (1902), p. 147-161.
(*Geological-mining investigations in the Manado Residency during the year 1901'*)
- Koperberg, M. (1903)- Geologische en mijnbouwkundig onderzoekingen in de Residentie Manado gedurende het jaar 1902. Jaarboek Mijnwezen Nederlandsch-Indie 32 (1903), p. 170-197.
(*Geological-mining investigations in the Manado Residency during the year 1902'*)
- Koperberg, M. (1905)- Geologische en mijnbouwkundig onderzoekingen in de Residentie Manado gedurende het jaar 1903. Jaarboek Mijnwezen Nederlandsch-Indie 34 (1905), p. 172-197.
(*Geological-mining investigations in the Manado Residency during the year 1903'. Investigations in the Pagoeat and Mooetong districts. Also includes reconnaissance map of Todjo area between Posso and Tanjung Api on S side of Tomini Gulf. Page 189: Burning gas seeps at Cape Tanjung Api not in serpentinites (which are present nearby, but as large blocks in conglomerate), but in area of hornblende schist*)
- Koperberg, M. (1925)- Opmerkingen over de geologie van de residentie Manado. Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie 8 (Gedenkboek Verbeek, memorial volume), p. 312-328.
(online at: <https://books.google.com/books?id=Yy0RAAAAIAAJ&pg>)
(*'Remarks on the geology of the Manado Residency', N Sulawesi'. Brief review, no figures*)
- Koperberg, M. (1929)- Bouwstoffen voor de geologie van de Residentie Manado. Jaarboek Mijnwezen Nederlandsch-Indie 75 (1928), Verhandelingen 1, p. 1-397.
(*Elements of the geology of the Manado Residency'. Part I of major compilation of geology of N and N Central Sulawesi: Minahasa, Bolaang, E Gorontalo, etc.*)
- Koperberg, M. (1929)- Bouwstoffen voor de geologie van de Residentie Manado. Jaarboek Mijnwezen Nederlandsch-Indie 75 (1928), Verhandelingen 2, p. 1-446.
(*Elements of the geology of the Manado Residency'. Parts II (W Gorontalo, Bwool, Pageat, Maoeton, Una-Una) and III (Poso, Todjo areas) of major compilation of N and N Central Sulawesi region geology; incl. Una-Una volcano and Tanjung Api (p. 442). With separate Atlas volume*)
- Koswara, A. & D.Z. Hayat (2002)- Batuan plutonik kaitannya dengan daerah mineralisasi Pulau Tanahjampea, Sulawesi Selatan. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 12, 2002, p. 19-27.
(*Plutonic rocks and their relation to mineralized areas Tanahjampea Island, South Sulawesi'. Tanahjampea Island S of Selayar/ S Sulawesi in East Java Sea. Intrusive rocks Eocene-Oligocene granite and monzonite and M Miocene diorite, andesite, basalt, etc. of calc-alkaline affinity. Sediments Late Oligocene- E Miocene Batu Fm limestone, interfingering with Late Oligocene- E Miocene Kayuadi Fm 400m of volcanic breccias. M Miocene- Pliocene Kalao and Selayar Fms marine marls and limestones*)
- Koswara, A., H. Panggabean, Baharuddin & D. Sukarna (1994)- Geologic map of the Bonerate sheet, S Sulawesi. Geological Research Development Centre (GRDC), Bandung.
(*Geologic map of islands off S Sulawesi (Tambolongan, Kayuadi, Kalao, Bonerate, Madu, etc. Oldest rocks Cretaceous(?) ultramafics (pyroxenite, gabbro, basalt), Eocene- Oligocene granite. Overlain by E-M Miocene Kayuadi Fm andesitic volcanics and Batu Fm limestones, M Miocene- E Pliocene Kalao / Selayar/ Wanai Fms sst, marls, lst*)
- Kruyt, A.C. (1901)- Het ijzer in midden-Celebes. Bijdragen Taal Land en Volkenkunde van Nederlandsch-Indie 53, p. 148-160.
(online at: https://brill.com/view/journals/bki/53/1/article-p148_4.xml?language=en)
(*'Iron in Central Sulawesi', by Dutch Reformed missionary Albert C. Kruyt. Native iron industry well known from around Matano Lake, but also further North, in Poso district. Iron ore usually limonite from near-surface., and melted in wood-fired ovens*)

- Kundig, E. (1932)- Versuch einer petrographischen Charakteristik des kristallinen Grundgebirges von Celebes. Schweizerische Mineralogische Petrographische Mitteilungen 12, 2, p. 450-507.
(online at: <https://www.e-periodica.ch/digbib/view?pid=smp-001:1932:12#486>)
(*'Attempt at petrographic characterization of the crystalline basement of Sulawesi'. Early paper on metamorphic rocks in various basement complexes of S, C and SE Sulawesi (gneiss, phyllite, glaucophane schist (mainly at Rumbia), etc. With map of Pajangkene Massif (= Bantimala?; metamorphics). Large parts of E and SE arm of Sulawesi viewed as alpine thrust belt. With one map*)
- Kundig, E. (1932)- Morphologie und Hydrographie der Toili-Ebene (Ostcelebes). Mitteilungen Geographisch-Ethnograph. Gesellschaft Zurich 32, 2, p. 105-134.
(online at: <https://www.e-periodica.ch/digbib/view?pid=ghl-002:1931-1932:32#124>)
(*'Morphology and hydrography of the Toili plain (East Sulawesi). Geographic description of East Arm of Sulawesi. With 1: 200,000 topographic map of SE coast of East Arm*)
- Kundig, E. (1956)- Geology and ophiolite problems of East-Celebes. Verhandelingen Kon. Geologisch Mijnbouwkundig Genootschap, Geologische Serie 16 (Memorial volume/Gedenkboek H.A. Brouwer), p. 210-235.
(*Paper and map of Sulawesi E arm- Togian Islands, summarizing BPM work. Nice cross-sections of SE-directed imbricates of ophiolitic rocks and pelagic Upper Cretaceous limestones. Age of main orogenic phase is M Miocene (ophiolite debris in Upper Miocene 'Celebes Molasse'). Map shows ophiolite on Togian Islands where GRDC map shows young volcanoclastics*)
- Kusch, H. (1981): Spelaologische Forschungen auf der Insel Sulawesi (Celebes, Indonesien) zwischen 1857 und 1977 (Hohlenggebiete Sudostasiens VIII). Die Hohle 32, p. 91-102.
(online at: www.zobodat.at/pdf/Hoehle_032_0091-0102.pdf)
(*'Speleological investigations on the island of Sulawesi (Celebes) between 1857 and 1977'. Review of caves and caves investigations on Sulawesi since A.R. Wallace in 1857 and Von Richthofen in 1861. Main karst regions Maros, North Bone, Tana Toraja, etc.*)
- Kusnama & S. Andi Mangga (2007)- Hubungan lingkungan pengendapan Formasi Malawa dan keterdapatan batubara di daerah Soppeng, Sulawesi Selatan. Jurnal Sumber Daya Geologi (JSDG) 17, 4, p. 218-232.
(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/291/262>)
(*'Relationship of Malawa Fm depositional environment and coal beds in the Soppeng area, S Sulawesi' M Eocene (- Oligocene?) fluvial Malawa Fm m-c grained quartz sst, shale and claystone in lower part; mudstone and carbonaceous fine- grained sst in upper part. Thickness in Gatareng area ~100m. Detailed descriptions of several 50-120 cm thick sub-bituminous coal intercalations*)
- Kusnida, D., I.R. Silalahi, T. Naibaho & Subarsyah (2012)- Marine geological investigations in the Tomini Basin, Central Sulawesi. Marine Geological Institute, p. 1-35.
(online at: www.researchgate.net/publication/353862380_Marine_Geological_Investigations_in_the_T_Etc.)
(*Booklet describing MGI work with Geomarin III vessel in 2005, 2010. T omini Basin complex E-W-oriented back arc basin, separated from Gorontalo basin by west. Togian and Una-Una islands. Three Late Neogene tectono-stratigraphy sequences identified. Tomini Basin basement oceanic-like crust (peridotites?)*)
- Kusnida, D. & Subarsyah (2008)- Deep sea sediment gravity flow deposits in Gulf of Tomini, Sulawesi. Jurnal Geologi Indonesia 3, 4, p. 217-225.
(online at: www.bgl.esdm.go.id/dmdocuments/jurnal20080404.pdf)
(*Tomini/ Gorontalo Basin seismic interpretation*)
- Kusnida, D., Subarsyah & B. Nirwana (2009)- Basement configuration of the Tomini Basin deduced from marine magnetic interpretation. Jurnal Geologi Indonesia (Indonesian J. on Geoscience) 4, 4, p. 269-274.
(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/86/86>)

(Magnetic survey in Tomini Basin (= Gorontalo Basin), E Sulawesi, shows elevated magnetic susceptibility values in center of basin. Oceanic-like crust with nearly NE-SW symmetric lateral lineation of susceptibility values. At centre E-W trending basin axis, suggests rift-related graben)

Kusuma, R.A.I., H. Kamaruddin, M.F. Rosana & E.T. Yuningsih (2019)- Geokimia endapan nikel laterit di Tambang Utara, Kecamatan Pomalaa, Kabupaten Kolaka, Provinsi Sulawesi Tenggara. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 20, 2, p. 85-92.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/418>)

(‘The geochemistry of laterite nickel deposits in the North Mine, Pomalaa Sub-district, Kolaka Regency, Southeast Sulawesi Province’. Nickel laterite deposits result weathering of ultramafic rocks. Nickel laterite profile in North Mine area from top to bottom: top soil, limonite, saprolite, and bedrock zones. Thickness of laterite zone 25-30m. Highest Ni enrichment in saprolite zone, highest Fe in limonite zone)

Kusuma, R.A.I., H. Kamaruddin, R.R. Wibawa & M.R. Kamil (2015)- Geological prospect, resource and ore reserve estimation in Pomalaa Kolaka, Southeast Sulawesi, Indonesia. In: N.I. Basuki (ed.) *Proc. Indonesian Soc. Economic Geologists (MGEI) 7th Annual Conv.*, Balikpapan, p. 67-76.

(Pomalaa nickel mine/prospect in SE Arm of Sulawesi, 30km S of Kolaka, in N-Co laterite on East Sulawesi Ophiolite. Typical laterite profile: weathered, serpentinized ultramafic bedrock overlain by 2-7m thick saprolite layer with average 1.7-2.3% nickel (mainly garnierite), overlain by 3-7m thick yellow and red limonite zone with 0.4-1.2% nickel)

Kusumanto, D. & C.R.P. Swangga (2015)- Updated mineral inventory of Poboya prospect, Palu, Central Sulawesi, Indonesia. In: N.I. Basuki (ed.) *Proc. Indonesian Soc. Economic Geologists (MGEI) 7th Annual Conv.*, Balikpapan, p. 47-56.

(On Poboya low sulphidation epithermal gold-silver deposit in ‘neck’ of N Sulawesi, E of Palu-Koro fault system. Discovered by Rio Tinto in 1993. Three mineralization zones)

Kutassy, A. (1934)- Het Paleozoicum en de Trias van Oost Celebes. *Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie* 10, 3, p. 295-305.

*(‘The Paleozoic and Triassic of East Sulawesi’. Chapter in Von Loczy 1934 paper. Oldest rocks known from SE Sulawesi are deformed and partly metamorphosed Triassic-Jurassic Kendari Beds and Toeli Lst with Jurassic belemnites. Material collected by Von Loczy also contains dark grey marly bituminous limestone with probable Permian bivalve *Oxytoma* and brachiopods *Productus* and *Streptorhynchus*. Triassic Tokala Lst and sandstones with macrofossils include locally common *Misolia* spp., also known from Timor, Buru, Seram and Misool)*

Kutassy, A. (1934)- Jong Tertiaire korallen en mollusken uit de molasse-afzettingen in Oost-Celebes. *Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie* 10, p. 306-317.

(‘Young Tertiary corals and molluscs from E Sulawesi molasse deposits’. Chapter in Von Loczy 1934 paper)

Kwong Hiu Jing (2011)- Paleomagnetic investigation of the Balangbaru Formation, SW Sulawesi, Indonesia. Masters Thesis, University of Hongkong, p. 1-121.

(online at: <http://hub.hku.hk/handle/10722/134043>)

(Paleomagnetic study of six localities of Balangbaru Fm, an Upper Cretaceous (Turonian- Maastrichtian and older?) volcanoclastic marine turbiditic series of SW Sulawesi. No rock samples carry reversed polarity. Declination values show CCW rotation of ~15-20°, reflecting tectonic motion of Sunda Block since Late Cretaceous (similar to Sasajima et al. (1980) results on Marada Fm). Calculated paleolatitude for tilt-corrected inclination is 8.3° S (present-day latitude is ~4°45' S, indicating possible 3.5- 4° N-ward shift; JTvG)

Latorre, A.Q. (2001)- The discovery and geological setting of the Bima gold deposit; Minahasa Regency, north Sulawesi, Indonesia. M.Sc. Thesis, James Cook University, Townsville, p. *(Unpublished)*

Laurent, L. (1926)- Etude sur une plante fossile des depots du Tertiaire marin du Sud de Celebes. *Jaarboek Mijnwezen Nederlandsch-Indie* 54 (1925), *Verhandelingen* 1, p. 167-190.

*('Study on a fossil plant from marine Tertiary deposits of S Sulawesi'. Plant fossils associated with fish fauna in Early Miocene lithographic limestone at Patanuang Asu, NE of Makassar, collected by Brouwer. Mainly shallow marine seaweed *Cymodocea micheloti*)*

Lecuyer, F. (1998)- Relation entre le volcanisme et la tectonique active dans la region de Tondano au nord de Sulawesi (Indonesie). Doct. Thesis, Universite Blaise Pascal, Clermont-Ferrand, 183, p. 1-163. (*Unpublished*)
('The relation between volcanism and active tectonics in the Tondano region in North Sulawesi'. Includes Tondano caldera in pull-apart basin and adjacent stratovolcanoes Lokon-Empung twin volcanoes) and Tompaluan)

Lecuyer, F., O. Bellier, A. Gourgaud & P.M. Vincent (1997)- Tectonique active du Nord-Est de Sulawesi (Indonesie) et controle structural de la caldeira de Tondano. Comptes Rendus Academie Sciences, Paris, Ser. IIA, Earth Planetary Science 325, 8, p. 607-613.
('Active tectonics of NE Sulawesi and structural control of the Tondano caldera'. NE tip Sulawesi field study and SPOT image analyses show distributed active ENE-WSW sinistral strike-slip fault zone (with Tondano caldera in pull-apart basin). Faulting accommodates N-S movement of Celebes Sea plate and represents transfer fault zone between E end of Celebes Sea subduction and Moluccas Sea subduction zone)

Lee, J.H., I.J. Kim & J.M. Nassey (2011)- Olo-Oloho nickel laterite exploration in the Pakue District, North Kolaka Regency of the South-East Sulawesi Province, Indonesia., Economic and Environmental Geology (Korean Soc. Economic Env. Geology) 44, 4, p. 329-336.
(online at: www.koreascience.or.kr/)
(Olo-Oloho nickel laterite prospect in SE Sulawesi. Nickel ore derived from weathered, fractured ultrabasic rocks of U Mesozoic age, which overlies Carboniferous (?) schist)

Lelono, E.B. (2003)- Tropical Eocene palynomorphs from the Toraja Formation, Kalumpang, South Sulawesi. Lemigas Scientific Contributions 26, 1, p. 8-23.
(online at: <https://journal.lemigas.esdm.go.id/index.php/SCOG/article/view/991/783>)
*(Most tropical Eocene palynomorphs in S Sulawesi have India affinity, as in Nanggulan, S Java, but less diverse. (suggesting (Sunda-)land connection). Likely age of syn-rift Toraja Fm (latest M Eocene-) Late Eocene. Late Eocene age supported by appearance of *Proxapertites operculatus* with fine reticulation)*

Leterrier, J., Y.S. Yuwono, R. Soeria-Atmadja & R.C. Maury (1990)- Potassic volcanism in Central Java and South Sulawesi, Indonesia. J. Southeast Asian Earth Sciences 4, p. 171-187.
(Three types of Neogene and Quaternary K-rich volcanic series from C Java back-arc and from S Sulawesi. Emplacement of Late Miocene? and younger ultra-potassic rocks in S Sulawesi clearly post-dates latest known subduction event)

Liao, C.P. (2024)- Origin of the East Sulawesi Ophiolite, Eastern Indonesia: implications for oceanic crust generation and tectonic reconstruction in the Western Pacific. Ph.D. Thesis, Monash University, Melbourne, p. 1-218.
(online at: https://bridges.monash.edu/articles/thesis/Origin_of_the_East_Sulawesi_Ophiolite_Eastern_Indonesia_implications_for_oceanic_crust_generation_and_tectonic_reconstruction_in_the_Western_Pacific/26868547)
(East Sulawesi Ophiolite one of largest ophiolite suites worldwide. New zircon U-Pb ages for gabbros and plagiogranites from samples in East Arm of Sulawesi suggest main magmatic age linked to lithospheric spreading at ~75 Ma (= Campanian). East Sulawesi spreading center originated from depleted mantle source in back-arc location and was approaching Australian continental margin during late Cretaceous. Zircon U-Pb dating also reveals existence of inherited 0.5 Ga- 2.5 Ga exotic continental zircons in young oceanic rocks, likely upper mantle contamination of subducted sediments from Australian continental margin. Etc.)

Liao, J.P., O. Nebel, P. Cawood, S.L. Chung, A. Kadarusman & S. Maruyama (2023)- Geochronological and geochemical constraints on the East Sulawesi Ophiolite with implications for tectonic reconstructions in Southeast Asia. Goldschmidt Conference, Lyon 2023 Abstracts, 1p.
(online at: <https://goldschmidtabstracts.info/2023/15472.pdf>)

(First zircon U-Pb dating of E Sulawesi Ophiolite combined with radiogenic isotopes suggest main seafloor spreading time for generating this ophiolite at 74 ± 3 Ma (= ~Late Campanian), with zircon Hf isotope and apatite Nd isotope signatures consistent with depleted mantle source. Immobile trace elements of gabbros show different degrees of subduction influence and affinity of back-arc basin basalts rather than Pacific MORB. Supra-subduction zone (SSZ) plausible geodynamic setting for generation of ESO (NB: Ophiolite ages suggested here too young?; overlain by E Cretaceous (Valanginian?) pelagic radiolarian cherts and Late Cretaceous pelagic Globotruncana limestone (e.g. Simandjuntak 1988, 1994, Surono 2012) JTvG))

Liao, J.P., O. Nebel, S.L. Chung, A. Kadarusman, S. Maruyama & P. Cawood (2024)- Precambrian zircons in Cretaceous Sulawesi back-arc melts document the mantle record of a subducted sediment melange. *Chemical Geology* (paper rejected or in in press?)

(Zircons from gabbros and plagiogranites in East Sulawesi Ophiolite, which formed in Cretaceous back-arc spreading environment and was emplaced around 30 Ma. U-Pb ages for main back-arc spreading at $\sim 77 \pm 2$ Ma. Some mafic samples with ancient inherited zircons with age peaks at 470 Ma, 1.1 Ga, 1.4- 1.6 Ga, 1.8 Ga and 2.5 Ga (matching detrital zircon age profiles from Australian continent), and probably derived from mantle contamination by subducted sediments)

Lintjeras, L., I. Setiawan & A.A. Kausar (2019)- Profil endapan nikel laterit di daerah Palangga, Provinsi Sulawesi Tenggara. *J. Riset Geologi dan Pertambangan (LIPI)* 29, 1, p. 91-104.

(online at: <https://jrisetgeotam.lipi.go.id/index.php/jrisgeotam/article/view/970/pdf>)

(‘Profile of a nickel laterite deposit in the Palanga area, SE Sulawesi Province’. Laterite profile ~15m thick: (1) limonite zone ~0-3m with Ni grade ~ 0.8-1.8%, Fe ~34-48 %, (2) saprolite zone ~3-9m with Ni ~1.8-3%, Fe ~10-35%, (3) bedrock at ~9-10 m with Ni 1.2%, Fe ~7-8%. Locally overlain by limestone)

Liu, C. & Y.L. Shi (2022)- The role of fault interaction on earthquake migration in Central Sulawesi. Indonesia. *Tectonophysics* 839, 229530, p.

(On catastrophic earthquakes in area of coupling of Palu-Koro strike-slip fault and Minahassa Megathrust)

Liu, J., J. Zhang, J. Hsia, W.W. Xian, C. Tin, F.X. Djoko H.N., C. Cheng, C. Zhao, X.Liu et al. (2020)- Late Miocene to Pliocene crustal extension and lithospheric delamination revealed from the ~5 Ma Palopo granodioritic intrusion in Western Sulawesi, Indonesia. *J. Asian Earth Sciences* 201, 104506, p. 1-16.

(After collision between W Sulawesi- Sula Spur microcontinents in E-M Miocene, W Sulawesi microcontinent underwent extension. Granodiorite intrusion W of Palopo (at NW end of Bone Bay) with zircon crystallization age of 4.8 Ma. High Sr and low Y and Yb geochemical signature of adakites. Most plausible mechanism for generation of Late Miocene- Pliocene adakitic granodiorites in W Sulawesi partial melting of delaminated lower crust that interacted with mantle. Late Miocene- Pliocene crustal extension in W Sulawesi microcontinent triggered by delamination of thickened lithosphere (same time as S Banda Sea hyperextension?; JTvG))

Loche, M. (2018)- Facies development and geochemical signatures in large-scale carbonate platforms during the Cenozoic greenhouse to icehouse climatic change. Ph.D. Thesis University of Western Australia, p. 1-148.

(online at: https://api.research-repository.uwa.edu.au/ws/portalfiles/portal/101382927/THESIS_DOCTOR_OF_PHILOSOPHY_LOCHE_Marco_2020_Part_1.pdf)

(Geochemical analyses of Oligo-Miocene Tonasa carbonates from Sulawesi (samples collected by M. Wilson))

Lowder, G.G. & J.A.S. Dow (1977)- Porphyry copper mineralization at the Tapadaa Prospect, northern Sulawesi, Indonesia. *Transactions American Inst. Mining Metallurgical and Petroleum Engineers (AIME)* 262, p. 191-198.

Lowder, G.G. & J.A.S. Dow (1978)- Geology and exploration of porphyry copper deposits in North Sulawesi, Indonesia. *Economic Geology* 37, p. 628-644.

(N Sulawesi porphyry copper discoveries in two districts, with several centers of mineralization. Tombuililato district high-level quartz diorite porphyry stocks intrude Eocene- E Miocene island-arc sequence (Tinombo-Bilungala Fms), consisting mainly of andesite and rhyolite. Mineralization and alteration may have occurred

at relatively low temperatures (350-400°C). Tapada district mineralization in M-U Miocene dioritic plutons, root zones of high-level stocks whose eroded parts were like deposits exposed at Tombuililato)

Lu, X., C. Gan, P.A. Cawood, X. Qian & Y. Wang (2025)- Oligocene high-silica felsic magmatism in juvenile intra-oceanic arc crust, North Sulawesi Arc, Indonesia. *J. of Earth Science (China)* 36, p. 880–893, (*North Sulawesi arc complex Cenozoic records of magmatism and tectonics. Zircon U-Pb and other data of high-silica granites shows juvenile oceanic crust origin and ~mid-Oligocene ages (30.4- 27.3 Ma). High-silica granites interpreted as derived from juvenile arc crust in intra-oceanic setting, likely driven by mantle upwelling in response to slab roll-back linked to convergence of East Sulawesi ophiolitic crust or microcontinental fragments (see also Gan et al. 2022).*)

Lubis, H., S. Prihatmoko & L.P. James (1994)- Bulagidun prospect: a copper, gold and tourmaline bearing porphyry and breccia system in northern Sulawesi, Indonesia. *J. Geochemical Exploration* 50, p. 257-278. (*Bulagidun prospect in N Sulawesi characteristic of island-arc porphyry Cu-Au mineralization, although abundant tourmaline is unusual in SW Pacific. Mineralization tied to intrusions into widespread andesitic volcanic rocks (~9.4 Ma)*)

Lubis, H., S. Prihatmoko & F.E. Nugroho (2011)- Cu-Au porphyry mineralization at Bahumbung, North Sulawesi, Indonesia. *Jurnal Sumber Daya Geologi (JSDG)* 21, 6, p. 307-320. (*Bahumbung is porphyry Cu-Au prospect in N Arm of Sulawesi. Miocene andesitic volcanics intruded by multiple diorites and post mineral dykes of aplite. Bahumbung system experienced deep level of erosion. Currently considered sub-economic*)

Lubis, H., S. Prihatmoko & F.E. Nugroho (2011)- Cu-Au porphyry mineralization at Bahumbung, North Sulawesi, Indonesia. In: N.I. Basuki (ed.) *Proc. Sulawesi Minerals Resources 2011*, Manado, MGEI/IAGI, p. 145-160. (*Same paper as above*)

Lukman, M.N., K.A. Lamaliwa, S. Husein, A. Setianto, S.B. Samodra & S.S. Surjono (2016)- Understanding Matano Fault, Southeast Arm of Sulawesi, Indonesia. *Proc. 14th Regional Conference Geology and Mineral Resources of SE Asia (GEOSEA XIV) and 45th Annual Conv. Indonesian Association Geologists (IAGI) (GIC 2016)*, Bandung, p. 1-5. (*online at: https://www.researchgate.net/publication/314256232_Understanding_Matano_Fault_Southeast_Arm_of_Sulawesi_Indonesia*) (*Matano Fault ESE-WNW- left-lateral strike-slip fault in N part of Sulawesi SE Arm. >60 km displacement, formed Lake Matano pull-apart basin. Connected to Palu-Koro Fault to W and Sorong Fault to E*)

Magetsari, N.A. (1984)- L'île de Celebes, Indonesie orientale: analyse structurale par teledetection des grands lineaments, un exemple de collision. Thesis 3me Cycle, Universite de Chambéry, p. 1-134. (*Unpublished*) (*'Sulawesi island: structural analysis by remote sensing of large lineaments, an example of collision'. Several major lineaments from W to E: (1) Palu-Koro, 300 km, sinistral strike slip zone; (2) Matano and Malili-Kendari, also sinistral; (3) Batui in NE, corresponding partly with ophiolite obduction over Sula islands, continuing offshore as 'Batui Thrust'. Small Plio-Pleistocene pull-apart basins over large fault zones. Tectonics linked to NW-SE compression due to convergence of Australian plate and its split-off Sula fragment. Main collision in M Miocene, with obduction of peridotites and continental underthrusting of W side of Sula microcontinent. After that, convergence accommodated along major fault zones and absorbed by accretionary prism of N Celebes Trough and Tolo zone at Banda Sea margin. At same time N arm of Sulawesi underwent 90° CW rotation*)

Magetsari, N.A., P. Chotin & J.P. Rampnoux (1987)- Structural analysis by remote sensing of Sulawesi. The role of great lineament an example of Recent collision. *Proc. 16th Annual Conv. Indonesian Association Geologists (IAGI)*, p.

- Mardain, T., Y I. Arifin, M. Kasim & D.R. Rosadi (2022)- Geology and alteration of East Pinolosian area, Bolaang Mongondow, North Sulawesi Province. *Eksplorium* 43, 2, p. 71-77.
(online at: <https://jurnal.batan.go.id/index.php/eksplorium/article/view/5835/pdf>)
(*Bolaang Mongondow in eastern part of North Arm of Sulawesi, in Neogene magmatic arc (andesite, diorite intrusions, pyroclastic breccias). NW-SE and NE-SW faults with Au-Ag hydrothermal mineralization (high sulfide epithermal deposits)*)
- Marhum, F.A. & R.H.L. Djamaluddin (2012)- Rekonstruksi fasies dan lingkungan pengendapan berdasarkan analisis maseral pada batubara daerah Pasenrengpulu, Kecamatan Lamuru, Kabupaten Bone, Provinsi Sulawesi Selatan. Proc. 41st Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 2012-E-28, p. 1-7.
(*Reconstruction of facies and depositional environment based on analysis of coal macerals in the Pasenrengpulu area, Bone District, S Sulawesi'. Petrographic analysis of Eocene Malawa Fm coals. Coal composition: vitrinite (48.6% -83.8%), inertinite (2.4-16.2%) and liptinite (0-9%), clay minerals (2.0-38.4%) and pyrite (1.4-11.8%)*)
- Marrama, G., S. Klug, J. De Vos & J. Kriwet (2018)- Anatomy, relationships and palaeobiogeographic implications of the first Neogene holomorphic stingray (Myliobatiformes: Dasyatidae) from the Early Miocene of Sulawesi, Indonesia, SE Asia. *Zoological J. Linnean Society*, London, 184, p. 1142-1168.
(online at: <https://academic.oup.com/zoolinnean/article/184/4/1142/4995574>)
(*Redescription of Trygon vorstmani De Beaufort 1926, a stingray fossil from latest E Miocene fish-bearing laminated limestones of Tonasa Fm near Patoenoeang Asoe, E of Maros, SW Sulawesi. Assigned to new genus Protohimantura. First known holomorphic stingray specimen from Neogene*)
- Martin, K. (1890)- Notiz uber das Pliozan von Gorontalo. *Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap* (2), 7, p. 275-277.
(*Note on the Pliocene of Gorontalo', N Sulawesi. Brief note on some presumed Pliocene gastropods from sandstones exposed between Gorontalo and Limbotto, collected by C. van Schelle. No maps, no figures*)
- Martin, K. (1891)- Zur Geologie von Celebes, nach Anlass des Wichmann'schen Reiseberichtes. *Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap* (2), 8, p.
(*On the geology of Sulawesi, referring to Wichmann's travel reports'*)
- Martin, K. (1917)- Bemerkungen uber sogenannt Oligocene und andere Versteinerungen von Celebes. *Sammlungen Geologischen Reichs-Museums Leiden*, N.F., II, 7, p. 299-308.
(online at: <https://repository.naturalis.nl/pub/509591/SGRMNF1895002001007.pdf>)
(*Remarks on so-called Oligocene and other fossils from Sulawesi'. Critical review of Tertiary molluscs from Sulawesi identified by Dollfus (in Abendanon 1915).No plates*)
- Martin, K. (1918)- On some fossils from Celebes believed to belong to the Oligocene. *Proc. Koninklijke Nederlandse Akademie van Wetenschappen*, Amsterdam, 20, p. 793-799.
(online at: <https://dwc.knaw.nl/DL/publications/PU00012269.pdf>)
(*Fish fossils found by Abendanon near Enrekang along lower Saadang River, believed to be of Oligocene age by Dollfus, based on presence of Vicarya. However, this is misidentified and mollusc fauna more likely of Miocene? age*)
- Martini, R., D. Vachard & L. Zaninetti (1995)- *Pilamina sulawesiana* n.sp. (Ammodiscidae, Pilammininae, n. subfam.), a new foraminifer from Upper Triassic reefal facies in E. Sulawesi (Kolonodale area, Indonesia). *Revue de Paleobiologie*, Geneve, 14, 2, p. 455-460.
(online at: <http://archive-ouverte.unige.ch/unige:35376>)
(*New small, complex agglutinated ammodiscid foraminifera species Pilamina sulawesiana from Norian-Rhaetian limestones of Kolonodale area, E Sulawesi, typical of Late Triassic reefal carbonates. Association with Triasina hantkeni and conodont Miskella posthernsteini suggests U Rhaetian age (species subsequently also found in Asinepe Lst of Seram, Sambosan accretionary complex in Japan, N Italy, Karakorum, Turkey, Cyprus, etc.)*)

Martini, R., D. Vachard, L. Zaninetti, S. Cirilli, J.J. Cornee, B. Lathuiliere & M. Villeneuve (1996)- Upper Triassic reefal facies in E Sulawesi, Indonesia. In: Sediment '96, 11th Meeting of Sedimentologists, Universitas Wien, Vienna 1996, p. 109. (*Abstract only*)

(online at: <https://archive-ouverte.unige.ch/unige:4766>)

(*Widely outcropping Late Triassic reefal carbonate platform between Kolonodale and Tomata on W margin of Ophiolitic Zone of E and SE arms of Sulawesi. Late Norian-Rhaetian age based on rich benthic foraminifera, and also on youngest Mesozoic conodont Misikella posthemsteini. Two foraminiferal associations, lagoonal (Triasina hantkeni and other Aulotortidae) and reefal (porcelaneous foraminifers incl. Galeanella). Main framebuilders: branching coral Retiophyllia seranica, chaetetid sponge Blastochaetetes intabulata and solenoporacean algae (see also Cornee et al. 1994, Martini et al. 1997)*)

Martini, R., D. Vachard, L. Zaninetti, S. Cirilli, J.J. Cornee, B. Lathuiliere & M. Villeneuve (1997)- Sedimentology, stratigraphy, and micropaleontology of the Upper Triassic reefal series in Eastern Sulawesi (Indonesia). Palaeogeogr. Palaeoclim. Palaeoecology 128, p. 157-174.

(*E Sulawesi Late Norian- Rhaetian 150m thick reefal carbonates are part of larger, dismembered carbonate platform. Shallowing-upward series: lower 100m micritic limestone, upper 150m massive 'reefal' limestones, dominated by foram packstones-grainstones, but also sponge-algal-coral boundstones and oolitic wackestones/grainstones. Foram assemblages closest affinity to S Tethyan Seram and Wombat Plateau carbonates*)

Martono, U.M. (1999)- Structural diversity of the layered rocks in the metamorphic complex of the western arc of Central Sulawesi. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 9, 92, p. 2-12.

(*On layering in metamorphic rocks. Little regional geology info*)

Maryanto, S. (1999)- Proses diagenesis batugamping Eosen di lintasan S. Nanggala, Tana Toraja, Sulawesi Selatan. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 9, 94, p. 2-16.

(*'Diagenetic process in the Eocene limestone of the Nanggala River section, Tana Toraja, S Sulawesi'. Eocene-E Miocene Toraja Fm limestone of S Sulawesi 1000m thick or more. At Nanggala River section NE of Rantepao M-U Eocene bioclastic limestone ~80m thick, with larger foraminifera Nummulites javanus, Pellatispira, Discocyclina, Asterocyclina, Fasciolites and Heterostegina saipanensis. Descriptions of diagenetic features. Eocene limestone not feasible as hydrocarbon reservoir*)

Maryanto, S. (2002)- Stratigrafi Tersier daerah Torajah, Sulawesi Selatan. Proc. 31st Annual Conv. Indonesian Association Geologists (IAGI), Surabaya, 2, p. 734-768.

(online at: www.iagi.or.id/web/digital/18/STRATIGRAFI-TERSIER-DAERAH-TORAJA,-SULAWESI-SELATAN.pdf)

(*'Tertiary stratigraphy of the Toraja area, S Sulawesi'. General review of M Eocene- Pliocene stratigraphy. M-L Eocene Toraja Fm mixed clastics- carbonate facies with Nummulites, Pellatispira, Asterocyclina, etc.. Conformably overlain by latest Eocene- M Miocene Makale Fm platform carbonates, in basal part also with Nummulites and Pellatispira, higher up with Lepidocyclian and Miogypsina, etc.. Overlain by M Miocene- E Pliocene Sekata Fm volcanoclastic turbidites with planktonic foraminifera*)

Maryanto, S. (2002)- Lingkungan pengendapan Formasi Toraja di daerah Sekitat Rantepao, Sulawesi Selatan. Bull. Geological Research Development Centre (GRDC) 22, p. 63-84.

(*Sedimentology of Eocene Toraja Fm in the Rantepao area, NE part of Sulawesi SW arm. Mixture of fluvial, lacustrine, intertidal and shallow marine facies*)

Maryanto, S. & T. Sihombing (2004)- Stratigrafi dan sedimentologi batuan Paleogen di lintasan Sungai Ana, Kalumpang, Sulawesi Selatan. Geological Research Development Centre (GRDC), Bandung, Special Publ. 31, p. 269-282.

(*'Stratigraphy and sedimentology of Paleogene rocks in the Ana River section, Kalumpang, South Sulawesi'*)

Maryanto, S., E.E. Susanto & Sudijono (2004)- Sedimentologi Formasi Salokalupang di daerah Bone, Sulawesi Selatan. Jurnal Sumber Daya Geologi (JSDG) 14, 1 (145), p. 69-83.

('Sedimentology of the Salokupang Fm in the Bone area, S Sulawesi'. Salokupang Fm deposited in Late Eocene- M Miocene SW-NE trending deepwater basin, deepening to NE. To W is Tonasa Fm carbonate platform, to S Eocene volcanics. No marked boundary to E, probably connected with open sea. Paleogeography of basin in Salokupang Fm time shows alluvial plain in SW, whereas turbidity and deepwater depositional systems developed in NE)

Massinai, M.F.I. O.S. Bamba, A. Ical, S. Aswad, M.A. Massinai & Sulastri (2024)- Interpreting fault dynamics in terms of hypocenter relocation and fault characterization. *Geodynamics & Tectonophysics (Russia)* 15, 6, 0799, p. 1-12.

(online at: <https://www.gt-crust.ru/jour/article/view/1947/861>)

(SE and C Sulawesi characterized by high tectonic activity due to active Matano fault. Seismicity along this fault is high, but initial hypocenter relocation often deviates from fault's trend line. Focal mechanism solutions of 16 events of final relocation dominated by sinistral strike-slip faulting)

Matasak, T. (2011)- Coal deposits in Sulawesi. In: N.I. Basuki (ed.) Proc. Conference Sulawesi Minerals Resources, Manado 2011, MGEI/IAGI, p. 319- .

Maulana, A. (2009)- Petrology, geochemistry and metamorphic evolution of the South Sulawesi basement rock complexes, Indonesia. M. Phil. Thesis, Australian National University, Canberra, p. 1-188. *(Unpublished)*
(Two pre-Upper Cretaceous basement complexes in SW Sulawesi: (1) Bantimala block: ENE-dipping tectonic slices of metamorphic rocks (eclogites, blueschists, greenschist, some seafloor sediments and volcanics), overlain by ultramafic unit, emplaced from E (records subduction of cold ocean floor and exhumation of deeply subducted material, prior to collision with microcontinents to E and obduction of ultramafics); (2) Barru Block: smaller, 30 km to N, weakly metamorphosed sediments and volcanics, without high-P blueschist and eclogite. Metamorphism at higher geothermal gradients (quartzo-feldspathic gneisses, metabasic amphibolite) at sole of obducted ultramafics. Barru tectonic slices dip to NNW. Barru interpreted as roots of old island arc, subduction of some ocean floor with seamounts, and obduction of different ocean floor material from N. Barru intrusives indicate second arc formed on top of ultramafics as result of renewed subduction)

Maulana, A. (2013)- A petrochemical study on the Late Cenozoic granitic rocks in Sulawesi, Indonesia. Doct. Engineering Thesis, Kyushu University, Fukuoka, p. 1-167.

(online at: <http://repository.unhas.ac.id/handle/123456789/7116>)

(Study of granitic rocks from 11 areas in W and N Sulawesi. Plutons classified as (1) high-K /shoshonitic (HK), mainly in S and CW part of W Sulawesi; (2) high-K calc-alkaline (CAK) in C and NW part of province; (3) low K- tholeiitic, dominant in N Sulawesi. Most granitoids metaluminous I-type granitic rocks. HK and CAK granitic rocks derived from partial melting of lower crustal sources with arc signature; low-K /tholeiitic granites from oceanic crust. Crystallization depths ~4-12 km. Rapid exhumations of granites in W Sulawesi triggered by Late Miocene- Pliocene collision of Banggai- Sula microcontinent with E Sulawesi (Ar-Ar cooling ages 9.5.1 Ma. Exhumation of granites in N Sulawesi attributed to Celebes Sea subduction)

Maulana, A. (2013)- Mineral chemistry of chromite from ultramafic rock in South Sulawesi, Indonesia. *J. Penelitian Geosains (Hasanuddin University, Makassar)* 9, 2, p. 83-87.

(online at: <http://repository.unhas.ac.id/handle/123456789/15016>)

(Chromite occurs in chromitite as podiform lenses or layers 10-40 cm thick in depleted lherzolite and dunite from Bantimala and Barru blocks, S Sulawesi. Also other differences in mineral chemistry, suggesting chromitites originated in different settings, Bantimala from parental melt in island arc environment, Barru from boninitic lava)

Maulana, A. (2014)- Iron ore occurrence in Balanalu area Limbong District North Luwu South Sulawesi. *J. Penelitian Geosains (Hasanuddin University)* 10, 1, p. 38-49.

(online at: <https://geologiunhas.files.wordpress.com/2017/08/vol-10-no-1.pdf>)

(C Sulawesi magnetite and hematite mineralization in weathered and brecciated andesitic-dacitic tuff)

Maulana, A. (2019)- Geological constraints for disaster mitigation model in South Sulawesi. *Journal of Physics: Conference Series* 1341, 052004, p. 1-10.

(online at: <https://iopscience.iop.org/article/10.1088/1742-6596/1341/5/052004/pdf>)

(Natural hazards in S Sulawesi include earthquakes (along major Walanae, Palu-Koro and Matano Faults), landslides (especially in high topography areas with weathered volcanics), tsunami (especially S tip of peninsula where tsunami is generated by Flores back-arc thrust fault) and floods (in topographic low areas))

Maulana, A., M. Brocker & Wei Dan (2020)- Petrogenesis and geochronology of Cenozoic intrusions in the Poboya and Sassak gold and copper districts in Western Sulawesi, Indonesia: implications for the mineralization processes and magma sources. *J. Asian Earth Sciences* 193, 104303, p. 1-16.

(Gold- copper mineralization in Poboya and Sassak areas in W Sulawesi, intruded gneisses-schists of Late Miocene–Pliocene Palu Metamorphic Complex. In Poboya area, gold-bearing quartz veins are related to high-K calc-alkaline granitoids; in Sassak area porphyry Cu-Au mineralization associated with monzonitic intrusions intruded by gabbroic and syeno-diorities. Rb-Sr isotopic ages of Poboya 3.94 Ma, 2.97 Ma and Sassak 10.7 Ma. Zircon U-Pb dating of gabbro and diorite from Sassak 10.8-10.6 Ma. Poboya deposit near Palu distal part of reduced intrusion-related gold system)

Maulana, A., A.G. Christy & D.J. Ellis (2008)- The petrology of eclogites from Bantimala Complex, South Sulawesi, Indonesia. *Proc. 37th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 1*, p. 367-398.

(online at: https://www.iagi.or.id/web/digital/14/2008_IAGI_Bandung_The-Petrology-of-Eclogites.pdf)

(Eclogites as tectonic blocks in E Cretaceous high-P- low T blueschist facies rock of Bantimala basement complex, which consists mainly of high-P Triassic-Jurassic metamorphic rocks and late Albian- Cenomanian and younger sediments and ultramafics. Eclogites range of origins and formed at ~540-615 °C and 18-24 kbar)

Maulana, A., A.G. Christy & D.J. Ellis (2015)- Petrology, geochemistry and tectonic significance of serpentinized ultramafic rocks from the South Arm of Sulawesi, Indonesia. *Chemie der Erde* 75, 1, p. 73-87.

(online at: [/www.researchgate.net/publication/379450500_Petrochemistry_of_Ultramafic_Rock_in_Baula_-_Pomalaa_Ophiolite_Complex_Southeast_Sulawesi_Indonesia Etc.](http://www.researchgate.net/publication/379450500_Petrochemistry_of_Ultramafic_Rock_in_Baula_-_Pomalaa_Ophiolite_Complex_Southeast_Sulawesi_Indonesia_Etc.))

(Serpentinized ultramafic rocks of S Sulawesi in (1) Bantimala (harzburgite, dunite and clinopyroxenite, with lenses of podiform chromitite) and (2) Barru Block (harzburgite and podiform chromitite). Both derived from supra-subduction zone environment and obducted during closure of small back-arc basins. If no rotation of blocks, Bantimala ultramafics emplaced from ENE, Barru ultramafics from WNW. Ultramafic suites juxtaposed with metamorphic assemblages and later intruded by younger volcanics. Different metamorphic histories and different directions of obduction, suggest ultramafics of two blocks emplaced in separate events)

Maulana, A., A.G. Christy, D.J. Ellis & M. Brocker (2019)- The distinctive tectonic and metamorphic history of the Barru Block, South Sulawesi, Indonesia: petrological, geochemical and geochronological evidence. *J. Asian Earth Sciences* 172, p. 170-189.

(online at: <https://www.sciencedirect.com/science/article/pii/S1367912018303912?dgcid=author>)

(Barru Block in SW Sulawesi composed of tectonic stack of cherts, radiolarian mudstone, breccias, shales, phyllites, mica schist, gneisses, amphibolite and ultramafic rocks. Greenschist- to amphibolite-facies metasedimentary rocks represent detritus from nearby continental blocks redistributed by turbidity currents. Rb-Sr isochrons for mica schists indicate metamorphic ages of ~71Ma, 107 Ma and 110 Ma, confirming E Cretaceous (Albian) metamorphism, but also Late Cretaceous (Maastrichtian) metamorphic or deformational event at ~70 Ma. Overall, Barru rocks more felsic than Bantimala. Two blocks accreted at same time (E Cretaceous), but differences in protoliths and metamorphic P-T conditions)

Maulana, A., A.G. Christy, D.J. Ellis, A. Imai & K. Watanabe (2011)- The characteristic of serpentinised ultramafic rocks from South Sulawesi Indonesia: constraint from petrology and geochemistry data. *Proc. Int. Symposium on Earth Science and Technology, Fukuoka 2010*, p. 301-306.

(online at: [http://repository.unhas.ac.id/.](http://repository.unhas.ac.id/))

(Serpentinised ultramafic rocks with different characteristics in two basement complexes in S Sulawesi, Bantimala and Barru blocks)

Maulana, A., A.G. Christy, D.J. Ellis, A. Imai & K. Watanabe (2013)- Geochemistry of eclogite- and blueschist-facies rocks from the Bantimala Complex, South Sulawesi, Indonesia: protolith origin and tectonic setting. *Island Arc* 22, 4, p. 427-452.

(online at: https://www.researchgate.net/publication/259550114_Geochemistry_of_eclogite-and_blueschist-facies_rocks_from_the_Bantimala_Complex_South_Sulawesi_Indonesia_Protolith_origin_and_tectonic_setting)
(*Bantimala Complex, SW Sulawesi., eclogites both glaucophane-rich and glaucophane-free; blueschists are albite-epidote glaucophanite and quartz-glaucophane schists. Eclogite protoliths include enriched and normal mid-oceanic ridge basalt (E-MORB and N-MORB) and gabbroic cumulates. Blueschists protoliths include N-MORB, Oceanic Island Basalt (OIB) and Island Arc Basalt (IAB). All protoliths subducted, metamorphosed to blueschist/eclogite-facies and subsequently exhumed. Samples deduced to have come from thicker-crust environments (OIB, IAB) were subducted to shallower depths (blueschist facies) than MORB-derived samples, which reached eclogite-facies conditions. Geochemical data demonstrate variety of ocean floor types subducted under SE margin of Sundaland in Late Jurassic*)

Maulana, A., A.G. Christy, D.J. Ellis, Kaharuddin M. & A. Tonggiroh (2009)- Petrology, geochemistry and tectonic significance of the South Sulawesi ultramafic, Indonesia. Proc. 38th Annual Conv. Indonesian Association Geologists (IAGI), Semarang, PITIAGI2009-205, p. 1-40. (online at: https://www.iagi.or.id/web/digital/26/2009_IAGI_Semarang_Petrology,-Geochemistry-and-Tectonic.pdf)

(*Ultramafic rocks in S Sulawesi Bantimala and Barru basement complexes of different origins: (1) Barru lherzolite derived from supra-subduction zone environment, with no High-P metamorphics; (2) Bantimala ultramafics are cumulates associated with High-P metamorphics (eclogite and blueschist). Stratigraphic position suggests Bantimala ultramafic emplaced onto Bantimala block from spreading of oceanic crust at E-NE part of block. At same time, those from Barru block obducted from back arc basin setting at W-NW part of blocks). Serpentinised ultramafic rocks suggest different origins of two basement complexes in SW Sulawesi (Bantimala, Barru). Absence of gabbro, pillow basalt, sheeted dykes, etc., suggest incomplete ultramafic suites (dismembered ophiolite sequences). Barru ultramafics emplaced from N, Bantimala from E, suggesting obduction events not caused by W-ward thrust of Australian microcontinent or Pacific oceanic plate on Eurasian margin. Both complexes geochemical differences from ultramafic rocks of East Sulawesi Ophiolite*)

Maulana, A., D.J. Ellis & A.G. Christy (2010)- Petrology, geochemistry and tectonic evolution of the South Sulawesi basement rocks, Indonesia. Proc. 34th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA1-G-192, p. 1-26.

(*SW Sulawesi two Cretaceous basement outcrop complexes, with different ultramafic rocks and metamorphic histories. Bantimala block (in S) protoliths mainly oceanic basalts. Barru block (in N) quartzo-feldspathic gneisses more felsic and of arc affinity. Bantimala block records subduction of cold ocean floor and exhumation of deeply subducted material. Barru preserve roots of old island arc, subduction of some ocean floor, obduction of different ocean floor material from N, and too warm to preserve blueschist or eclogites. Two blocks derived from different sources and tectonic setting*)

Maulana, A., D.J. Ellis & A.G. Christy (2013)- Geodynamic significance of the South Sulawesi basement rocks, Indonesia: a petrochemical constraint. Proc. Seminar Nasional Kebumian 6, Universitas Gajah Mada, Teknik Geologi, Yogyakarta 2013, M-01, p. 178-187.

(online at: https://www.academia.edu/40355862/Prosiding_Seminar_Nasional_Kebumian_ke_6)
(*Pre-Tertiary basement outcrops in S Sulawesi in two separate blocks, Bantimala and Barru. Both Cretaceous age and parts of SE Sundaland margin, but different metamorphic rocks assemblages: (1) Bantimala records deep subduction of cold ocean floor including MORB, arc-related lavas and seamounts, and exhumation of deeply subducted material, prior to collision with microcontinents to E and obduction of ultramafics; (2) Barru block preserves roots of old island arc, subduction of some ocean floor with seamounts, and obduction of quite different ocean floor material from N, and too warm to preserve blueschist or eclogites*)

Maulana, A., D.J. Ellis, A.G. Christy, K. Watanabe, A. Imai & Purwanto (2011)- Rare Earth element in greenschist facies rock from Bantimala Complex, South Sulawesi, Indonesia. Proc. 36th HAGI and 40th IAGI

Annual Conv., Makassar, p. 1-7. (also in *Majalah Geologi Indonesia* 26, 2, p. 73-82) (online at: https://www.researchgate.net/publication/265894273_RARE_EARTH_ELEMENT_IN_GREENSCHIST_FACIE_S_ROCK_FROM_BANTIMALA_COMPLEX_SOUTH_SULAWESI_INDONESIA)

(Moderate irregular Rare Earth Element pattern in E Cretaceous greenschist facies 'Triassic-Jurassic basement' rock of Bantimala Complex, 40 km NE of Makassar, S Sulawesi. Greenschist facies rock (with epidote, albite, chlorite) derived from mid oceanic ridge basalt to upper continental crust rocks)

Maulana, A., A. Imai, T. Van Leeuwen, K. Watanabe, K. Yonezu, T. Nakano, A. Boyce, L. Page & A. Schersten (2016)- Origin and geodynamic setting of Late Cenozoic granitoids in Sulawesi, Indonesia. *J. Asian Earth Sciences* 124, p. 102-125.

(Late Cenozoic granitoids in 1600 km long belt in W and N Sulawesi. Three series: (1) shoshonitic (HK; ~14-4 Ma), (2) high-K felsic calc-alkaline (CAK (~5-2 Ma), and (3) normal calc-alkaline to tholeiitic (CA-TH; Miocene?, N Sulawesi; subduction-related)). All granitoids I-type and metaluminous- peraluminous. Two K-rich series restricted to W Sulawesi, and formed in extensional, post-subduction setting. Two parental magma sources (1) enriched mantle or lower crustal equivalent for HK magmas, and (2) Triassic igneous rocks in Gondwana-derived fragment thrust beneath C and N parts of W Sulawesi for CAK magmas. CA-TH granitoids mostly in N Sulawesi, formed in active subduction environment)

Maulana, A., A. Imai, K. Watanabe, T. Van Leeuwen, S. Widodo & Musri (2019)- Exhumation and tectonomagmatic processes of the granitoid rocks from Sulawesi, Indonesia: constrain from petrochemistry and geothermobarometry study. *Indonesian J. on Geoscience (IJOG)* 6, 3, p. 153-174.

(online at: <http://ijog.bgl.esdm.go.id/index.php/IJOG/article/view/536/284>)

(Sulawesi granitoids classified as calc-alkaline, metaluminous I-type. Emplacement depths of Mamasa Pluton 3.2-4.3 km; Masamba Pluton 8.2-10 km, Lalos-Toli and Sony Plutons 11.3 and 11.6 km, Gorontalo Pluton at 9.3 km deep. Mamasa and Masamba Plutons exhumed at 0.37 and 1.6 mm/year, Lalos-Toli and Sony Plutons at 1.4 and 2.7 mm/year. Gorontalo Pluton in N Sulawesi Province exhumed at 0.42 mm/year. Rapid exhumation of Sony Pluton attributed to active vertical movement of Palu-Koro Fault Zone since Pliocene)

Maulana, A., A. Jaya, U.R. Irfan & M. Farida (2019)- Field geological characteristic of Mesozoic Paremba Sandstone, Bantimala Complex, South Sulawesi. *Int. Conference on Geoscience, Makassar 2018, IOP Conference Series: Earth and Environmental Science* 279, 012029, p. 1-5.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/279/1/012029/pdf>)

(Jurassic? Paremba Sst in Bantimala Complex, S Sulawesi, occurs as tectonic slice within melange complex, sandwiched by schist and melanges. Strongly tectonized arkosic sandstone, siltstone and calcareous sandstone. Sandstone unit shows coarsening- and thickening upward trend with flaser, lenticular and parallel lamination)

Maulana, A., A. Jaya & A. Imai (2018)- Study on gold and base metal occurrence in Uluwai prospect, Western Latimojong Mountain, South Sulawesi. *Int. Conference Nuclear Technologies and Sciences (ICoNETS 2017), Makassar, IOP Conference Series: Journal of Physics: Conference Series* 962, p. 1-9.

(online at: <http://iopscience.iop.org/article/10.1088/1742-6596/962/1/012011/pdf>)

(Uluwai Cu-Au prospect in N part of South Arm of Sulawesi, along E part of Kalosi Fold Belt and Latimojong Mountain. Mineralization rel. simple sulphide ore mineral assemblage (pyrite, sphalerite, chalcocopyrite) in metasediments and greenschist)

Maulana, A., A. Jaya & K. Sitha (2017)- Field characteristic of metamorphic-hosted gold deposit in Sulawesi, Indonesia: An insight into Awak Mas prospect, South Sulawesi. *Int. Journal of Engineering and Science Applications (UNHAS)* 4, 2, p. 105-111.

(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/1385/351>)

(Metamorphic-hosted gold deposit in Awak Mas, S Sulawesi with two main styles of quartz vein mineralization. Gold mineralization considered as mesothermal deposit. Gold mainly hosted within Latimojong flysch sequence, also in basement schist associated with shear zones in Lamas ophiolitic sequences)

Maulana, A. & K. Sanematsu (2015)- Study on the critical metal and Rare Earth Element occurrences in Sulawesi. *Int. Journal of Engineering and Science Applications (UNHAS)* 2, 1, p. 41-46.

(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/145/101>)
(Scandium-bearing laterite Ni deposits in Sulawesi could be dominant source of Sc resources in future)

Maulana, A. & K. Sanematsu (2015)- An overview on the possibility of scandium and REE occurrence in Sulawesi, Indonesia. In: ICG 2015, 2nd Int. Conf. and 1st Joint Conference Faculty of Geology Universitas Padjaran and University of Malaysia Sabah, p. 151-156.

(online at: <http://seminar.ftgeologi.unpad.ac.id/wp-content/uploads/2016/02/An-overview-on-the-possibility-of-scandium-and-REE-occurrence-in.pdf>)

(Lateritic soil of ultramafic rocks of Sulawesi may be potential source of scandium, while weathered I-type granitic rocks could be potential source of rare earth elements (but no actual data to support this?))

Maulana, A., K. Sanematsu & M. Sakakibara (2016)- An overview on the possibility of Scandium and REE occurrence in Sulawesi, Indonesia. Indonesian J. on Geoscience (IJOG) 3, 2, p. 139-147.

(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/283/211>)

(Similar to Maulana & Sanematsu 2015. Sc concentrated in lateritic limonite layers in Soroaka ultramafic complex)

Maulana, A., Sufriadin, K. Sanematsu & M. Sakakibara (2019)- Study on Sc-bearing lateritic Ni deposits in ultramafic rocks from Sulawesi: a new paradigm in Indonesia metal mining industry. Proc. 2nd EPI Int. Conference Science and Engineering, Gowa 2018, IOP Conference Series: Materials Science Engineering 676, 012032, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1757-899X/676/1/012032/pdf>)

(Scandium enriched in limonite layer in weathering profile from ultramafic rocks in Soroako, especially in pyroxene-rich bedrock (harzburgite))

Maulana, A., T. van Leeuwen, R. Takahashi, S.L. Chung, K. Sanematsu, Huan Li & U.R. Irfana (2019)- Geochemistry and geochronology of VHMS mineralization in the Sangkaropi district, central-West Sulawesi, Indonesia: Constraints on its tectono-magmatic setting. Ore Geology Reviews 114, 103134, p. 1-17.

(Sangkaropi district at NE end of S Arm of Sulawesi one of few Volcanic hosted massive sulfide (VHMS) districts in Indonesia. Several small mineral occurrences (Sangkaropi, Billolo, Rumanga), some mined during Japanese occupation in 1942-1945. Mineralization hosted by felsic volcanics in bimodal association with basalt. Syngenetic banded massive and fragmented sulfides and epigenetic veins, stockwork and disseminations classified as 'Kuroko-type. Age of mineralization ~34 Ma (Eocene-Oligocene boundary), in continental margin arc setting, when stress regime changed from near-neutral to extensional and volcanism changed from being andesite dominated to bi-modal)

Maulana, A., K. Watanabe, A. Imai & K. Yonezu (2011)- Enrichment Rare Earth Elements (REE) contents in granitic rock from South Sulawesi, Indonesia. Proc. Int. Workshop and Conference on Earth Resources Technology 2011, p. 33-39.

Maulana, A., K. Watanabe, A. Imai & K. Yonezu (2011)- Geochemical composition variety of granitoid rocks from Sulawesi Island, Indonesia. Proc. Int. Symposium on Earth Science and Technology, Fukuoka 2011, p. 379-388.

(Geochemistry of 55 Tertiary granitoids from 9 areas in Sulawesi)

Maulana, A., K. Watanabe, A. Imai & K. Yonezu (2011)- Magnetic susceptibility of Sulawesi granitic rocks, Indonesia: implication for regional metallogenic genesis. Proc. 1st Asia Africa Mineral Resources Conference, Fukuoka 2011, P-06, p.

Maulana, A., K. Watanabe, A. Imai & K. Yonezu (2012)- Petrology and geochemistry of granitic rocks in South Sulawesi, Indonesia: implication for origin of magma and geodynamic setting. Int. J. Environmental Earth Sciences Engineering 6, 1, p. 1-6.

(online at: www.waset.org/journals/ijcee/v6/v6-1.pdf)

(Mio-Pliocene granitic rocks from Polewali, Masamba areas, SW Sulawesi dominated by granodiorite and granite. Calc-alkaline field with metaluminous affinity and typical of I-type granitic rock, produced from melting of upper continental crust in arc-related subduction environment, with later evidence of continent-continent between Australia-derived microcontinent and Sundaland to form continental arc)

Maulana, A., K. Watanabe, A. Imai & K. Yonezu (2013)- Origin of magnetite- and ilmenite-series granitic rocks in Sulawesi, Indonesia: magma genesis and regional metallogenic constraint. *Procedia Earth Planetary Science* 6, p. 50-57.

(online

at:

<https://www.sciencedirect.com/science/article/pii/S1878522013000088/pdf?md5=ea598413fc2b34e28401fe38cd0d938e&pid=1-s2.0-S1878522013000088-main.pdf>

(Sulawesi granitic rocks dominated by ilmenite series granites, but ratio of ilmenite/ magnetite series granites decreases from S to N. Occurrence of ilmenite-series with I-type characteristic granitic rocks on Sulawesi may be explained by assimilation between magma and crustal material with reduced C- and S-bearing sediments)

Maulana, A., K. Watanabe, A. Imai & K. Yonezu (2013)- Petrochemical characteristic and geothermobarometry study of the granitic rocks from Sulawesi, Indonesia: Implication on exhumation and tectonomagmatic process. *J. Earth System Science*, p. *(in press?)*

(online at: www.ias.ac.in/jess/forthcoming/JESS-D-12-00334.pdf)

(Analyses from five granite complexes in S and N Sulawesi suggests granitic rocks calc-alkaline character and I-type granite characteristics. Exhumation of granitic rocks in W Sulawesi Province commonly attributed to collision of Banggai-Sula microcontinent with E Sulawesi in Late Miocene- Pliocene)

Maulana, A., K. Watanabe and K. Yonezu (2016)- Petrology and geochemistry of granitoid from South Sulawesi, Indonesia: implication for Rare Earth Element (REE) occurrences. *Int. Journal of Engineering and Science Applications (UNHAS)* 3, 1, p. 79-86.

(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/280/164>)

(Late Miocene- Pliocene calc-alkaline I-type granitoids at Polewali and Masamba, 300-400 km N of Makassar, W Sulawesi, with average REE content 249 and 194 ppm. REE-bearing minerals zircon, monazite and apatite)

Maulana, A., K. Watanabe, K. Yonezu, G. Zhang & T. van Leeuwen (2016)- Exhumation and tectonomagmatic process of granitic rock from Sulawesi. *Proc. 14th Regional Conference Geology and Mineral Resources of SE Asia (GEOSEA XIV) and 45th Annual Conv. Indonesian Association Geologists (IAGI) (GIC 2016)*, Bandung, p. 362-364.

(In C and N parts of W Sulawesi Late Miocene- Pliocene granite plutons rise to 3000m altitude. P-T data suggest increasing depth of emplacement of plutons from CW to NW Sulawesi (~2.1 to ~11km) and more rapid exhumation (0.37- 2.7 mm/year. Most rapid uplift tied to Palu-Koro fault activity (see also Maulana, Imai et al. 2019))

Maulana, A., S. Widodo & Musri (2020)- Base metal occurrence in intrusives rocks from Sassak region, Toraja Province, South Sulawesi. *Int. Journal of Engineering and Science Applications (IJEScA; UNHAS)* 7, 1, p. 74-83.

(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/2467/660>)

(Study on base metals (Pb, Zn, Cu, Fe, Mn, Sc) in Doi River diorite intrusive rocks in Sasak area of Toraja Regency, S Sulawesi. Rel. high concentrations of manganese)

Maulana, A., K. Yonezu & K. Watanabe (2014)- Geochemistry of rare earth elements (REE) in the weathered crusts from the granitic rocks in Sulawesi Island, Indonesia. *J. of Earth Science (China)* 25, 3, p. 460-472.

(online at: <http://en.earth-science.net/PDF/20140603042501.pdf>)

(First study of geochemistry of rare earth elements in weathered crusts of I-type and calc-alkaline to high-K (shoshonitic) granites at Mamasa and Palu region, NW Sulawesi)

Maulana, J.P. (2011)- Source indication of oil seep from Paniki River, Kalukku, Mamuju, West Sulawesi based on geochemical characterization. Proc. Joint. 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-030, p. 1-10.

(Paniki River oil seep near Amberaro Village, 40km NE of Mamuju, SW Sulawesi, with oil that underwent heavy biodegradation. Common presence of bicadinane, oleanoids, oleanane, and taraxastane show oil probably derived from terrestrial higher plant source, probably from Eocene coals or carbonaceous clays)

Mawaleda, M., J.R. Husain, M. Forster, E. Suparka, C.I. Abdullah, N.I. Basuki & J. Hutabarat (2018)- Miocene tectonic of the Southeast Arm of Sulawesi, Indonesia: based on petrology data, geochemistry, and 40Ar/39Ar geochronology of metamorphic rocks from Rumbia Complex. Proc. Int. Conf. Earth Science, Mineral, and Energy, Yogyakarta 2018, IOP Conference Series: Earth and Environmental Science, 212, 012043, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/212/1/012043/pdf>)

(Rumbia Schist Complex in S part of SE Sulawesi dominated by metamorphics (mica schist, chlorite schist, glaucophane schist). Some glaucophane schist undergone retrogradation into chlorite schist. Protolith of glaucophane and chlorite schists is Oceanic Island Basalt (OIB). Ar/Ar dating suggests three major geological events in Miocene (23, 20 and 17 Ma), probably related to amalgamation of three microcontinents (Rumbia, Mekongga and Meluhu), to form SE Arm of Sulawesi (N.B.: First author is same as M. Musri ?))

Mawaleda, M., E. Suparka, C.I. Abdullah, N.I. Basuki, M. Forster, Jamal & Kaharuddin (2017)- Hydrothermal alteration and timing of gold mineralisation in the Rumbia Complex, Southeast Arm of Sulawesi, Indonesia. In: 2nd Int. Conferene Transdisciplinary Research on Environmental problems in Southeast Asia (TREPSEA), Bandung 2016, IOP Conference Series: Earth and Environmental Science, 71, 012030, p. 1-15.

(online at: <http://iopscience.iop.org/article/10.1088/1755-1315/71/1/012030/pdf>)

(Rumbia WNW-ESE trending high P-low T metamorphic schist complex of SE Sulawesi (mainly mica schist, some blueschist) with gold mineralization in two phases: (1) initial phase related to deformation and exhumation of HP metamorphic rocks (gold, silver, stibnite, chalcopyrite, galena, etc.; syn-tectonic, ~23 Ma; mainly in N and NW parts of Rumbia Complex); (2) hydrothermal mineralization associated with extensional phase at between ~15-7 Ma. Two possible tectonic scenarios (see also Musri et al. 2016)

Mawaleda, M., H. Umar, J.R. Husain, A. Maulana, A. Jaya, U.R. Irvan & D.D. Permana (2020)- Ultrahigh-pressure metamorphic rocks in the Bantimala Melange Complex and its implication to Cretaceous tectonics in the South Arm of Sulawesi. Proc. 3rd EPI Int. Conference Science and Engineering (EICSE), Makassar 2019, IOP Conference Series: Materials Science Engineering 875, 012055, p. 1-13.

(online at: <https://iopscience.iop.org/article/10.1088/1757-899X/875/1/012055/pdf>)

(Bantimala Melange Complex ~75 km N of Makassar, with High-and Ultrahigh-P metamorphics blueschist and eclogite. Bantimala eclogite is only known UHP metamorphic exposed in Sulawesi. Blueschist with glaucophane partially replaced by chlorite, indicating polymetamorphism as result of retrogradation. Ar40/Ar39 dating shows age spectrum of 100 -114 Ma (~Albian). 114 Ma, age interpreted as age of eclogite metamorphism, at peak of subduction, 100 Ma age interpreted as age of exhumation or collision at end of Cretaceous subduction in South Arm of Sulawesi or in E/SE Sundaland)

Mayall, M.J. & M. Cox (1988)- Deposition and diagenesis of Miocene limestones, Sengkang Basin, Sulawesi, Indonesia. *Sedimentary Geology* 59, p. 77-92.

(Porosity evolution of Late Miocene knoll-reef carbonate buildups of Kampung Baru gas field, SW Sulawesi)

McCaffrey, R., E.A. Silver & R.W. Raitt (1981)- Seismic refraction studies in the East Arm, Sulawesi- Banggai Islands region of Eastern Indonesia. In: A.J. Barber & S. Wirjosujono (eds.) *The geology and tectonics of Eastern Indonesia*, Proc. CCOP-IOC SEATAR Working Group Meeting, Bandung 1979, Geological Research Development Centre (GRDC), Bandung, Special Publ. 2, p. 321-325.

(online at: http://web.pdx.edu/~mccaf/pubs/mccaffrey_sulawesi_grdc_1981.pdf)

(Two seismic refraction lines in E Gorontalo basin and E of E arm of Sulawesi (lines not shown). Show block faulted basement stepping down in Gorontalo Basin oceanic lithosphere)

- McCaffrey, R. & R. Sutardjo (1982)- Reconnaissance microearthquake survey of Sulawesi, Indonesia. *Geophysical Research Letters* 9, 8, p. 793-796.
(online at: www.researchgate.net/publication/248810245_Reconnaissance_microearthquake_survey_Etc.)
(Zone of microearthquakes dipping to N from Batui Thrust zone suggests leading edge of Banggai Island block was subducted to at least 100 km depth. E Gorontalo Basin earthquake zone may connect with deep seismic zone under Celebes Sea Basin. Beneath W Gorontalo Basin narrow zone of earthquakes dips S, probably within lithosphere of Celebes Sea Basin subducted at N Sulawesi Trench. Shallow earthquakes near Lake Matano in C Sulawesi, possibly on Matano Fault, suggest E-W extension)
- McCaffrey, R., R. Sutardjo, R. Susanto, R. Buyung, B. Sukarman et al. (1983)- Micro-earthquake survey of the Molucca Sea and Sulawesi, Indonesia. *Bull. Geological Research Development Centre (GRDC)* 7, p. 13-23.
(Several hundred, mostly shallow, microearthquakes recorded below Molucca Sea and Tomini Gulf/Gorontalo)
- McDonald, R.C. (1976)- Limestone morphology in South Sulawesi, Indonesia. *Zeitschrift für Geomorphologie, N.F., Supplement Band 26, Karst processes*, p. 79-91. (online at: https://www.researchgate.net/publication/291275054_Limestone_morphology_in_South_Sulawesi_Indonesia)
(Discussion of karst genesis of isolated limestone hills of area E of Maros, S Sulawesi, based on 1975 fieldwork)
- Meeren, J. (2009)- A geothermobarometric study on garnet peridotite and granulite from the Palu region, Central Sulawesi, Indonesia. M.Sc. Thesis, University of Utrecht, p. 1-101. (Unpublished; see also below)
- Meeren, J. & H.L.M. van Roermund (2009)- A two stage exhumation model for HP rocks from the Palu Region, Central Sulawesi, Indonesia- a geothermobarometric study. *Proc. 8th Int. Eclogite Conference (IEC), Xining, China 2008*, 2p. (Abstract only)
(online at: https://www.researchgate.net/profile/Herman-Roermund-Van/publication/236862503_A_three_stage_Etc.)
(Garnet peridotite and granulite as thin tectonic slices (<10m) in Palu-Koro Fault zone, crosscutting Cretaceous Palu Metamorphic Complex. Palu garnet peridotite peak metamorphic conditions of ~1030°C/18 kbar and ~855 °C/ 10.2 kbar for retrograde assemblage. Palu granulite peak metamorphic conditions of ~655 °C/ 19 kbar. Palu granulite (microcontinental fragment) subducted in Cretaceous subduction system at Sundaland margin. After exhumation from 65 km to lower crustal levels, granulite stored in lower crust until Miocene upwelling asthenosphere invaded subcontinental lithosphere and caused heating in lower crust under C Sulawesi. Palu garnet peridotite started ascent to lower crustal levels from ~65 km in E Miocene. Final exhumation of Palu HP rock facilitated by transpression along Palu-Koro fault. Occurrence of HP rock in C Indonesia cannot be explained by simple collision event in subduction system of Cretaceous age)
- Meidji, I.A., J. Jatnika, L. Samatowa, A.I.W.S. Ramadani, M. Ramdhan, H.A. Efendi & H. Jayadi (2023)- Analyzing seismicity pattern of the Gorontalo region and its surroundings in the form of hypocenter relocation using Double Difference Method. *Jurnal Penelitian Pendidikan IPA (JPPIPA)* 9, 10, p. 8581-8587.
(online at: <https://jppipa.unram.ac.id/index.php/jppipa/article/view/5400/3732>)
(Relocation of hypocenters for 7 years of earthquake events show S-dipping slab of Sulawesi Sea subduction zone at depths from 50 to 200 km)
- Meilano, I., R. Salman, Susilo, H.A. Shiddiqi, P. Supendi, K. Lythgoe, C. Tay, K. Bradley et al. (2023)- The 2021 MW 6.2 Mamuju, West Sulawesi, Indonesia earthquake: partial rupture of the Makassar Strait thrust. *Geophysical J. International* 233, 3, p. 1694-1707.
(online at: <https://academic.oup.com/gji/article/233/3/1694/6961046>)
(January 2021 MW 6.2 earthquake in Mamuju and Majene regions of W Sulawesi killed >100 people and damaged 8000 buildings Event generated by fault that may continue to offshore E Makassar Strait Thrust belt)
- Melkybudiantoro, D., G.S. Hadi & S. Purnomo (2010)- Geochemistry characteristics of nickel laterite deposit of Bahodopi area, Central Sulawesi, Indonesia. *Proc. 39th Annual Conv. Indonesian Association Geologists (IAGI), Lombok, PIT-IAGI-2010-205*, p. 1-12.

(online at: https://www.iagi.or.id/web/digital/12/2010_IAGI_Lombok_Geochemistry-Characteristics-of-Nickel.pdf)

(Review of Fe-Ni laterite deposits overlying mafic/ultramafic rocks in Badohopi area of SE Arm by PT INCO)

Mesdag, F.T. (1914)- De goudmijn "Totok" te Totok, Noord-Celebes. Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Mijnbouwkundige Serie 1, 3, p. 191-203.

(The gold-mine 'Totok' at Totok, North Sulawesi'. Review of operations by 'Mijnbouw Maatschappij Totok' created 1897) of Totok gold mine, active since 1900 (closed 1921), after long history of small-scale local diggings. Also known as Ratatotok. Gold-bearing quartz veins hosted in Neogene foram-coral limestone, in area dominated by andesitic volcanics. Five separate gold ore bodies, linked to processing plants by narrow gauge rail system. Four open quarries, named Haies and Labongan Zuid, Noord and West (Labongan S, N and W). About 1000 laborers: 400 from Minahasa, 450 from Gorontalo, 70 from Sagi, 70 from Bolang Mongondu)

Michaux, B. (1996)- The origin of Southwest Sulawesi and other Indonesian terranes: a biological view. Palaeogeogr. Palaeoclim. Palaeoecology 122, p. 167-183.

(online at: www.academia.edu/26500010/The_origin_of_southwest_Sulawesi_and_other_Indonesian_terranes_a_biological_view)

(Present-day distribution of birds and moths used for reconstruction of tectonic histories of Indonesian islands. Sulawesi shows highest degree of endemism and appears to have been isolated from all other areas)

Milsom, J., Sardjono & A. Susilo (2001)- Short-wavelength, high-amplitude gravity anomalies around the Banda Sea, and the collapse of the Sulawesi Orogen. Tectonophysics 333, 1, p. 61-74.

(Ophiolitic rocks around Banda Sea commonly associated with strong gravity anomalies and steep gradients, but relationships not always straightforward. Bouguer gravity values and gradients over extensive E Sulawesi ophiolite generally low. Gravity variations and ophiolite distribution around Banda Sea compatible with extension in Sulawesi region following Oligo-Miocene collision with Australian-derived microcontinent)

Milsom, J., J. Thurow & D. Roques (2000)- Sulawesi dispersal and the evolution of the northern Banda Arc. Proc. 27th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta 1999, IPA99-G-023, p. 495-504.

(Bituminous U Triassic and Lw Jurassic in Buton, Buru, Seram and E Sulawesi suggest these were parts of single microcontinent that separated from Australia in Jurassic and collided with Eurasian margin to form Sulawesi orogen in Oligocene or E Miocene. Collision was followed by extension and dispersion, creating Banda Sea. Parts of former microcontinent became involved in new collision zones of Outer Banda arc)

Miyazaki, K., I. Zulkarnain, J. Sopaheluwakan & K. Wakita (1996)- Pressure-temperature conditions and retrograde paths of eclogites, garnet-glaucophane rocks and schists from South Sulawesi, Indonesia. J. Metamorphic Geology 14, p. 549-563.

(online at: www.academia.edu/5965180/Pressure_temperature_conditions_and_retrograde_paths_of_e_Etc.)
(High-P metamorphic rocks in Bantimala area 40 km NE of Makassar formed as Cretaceous subduction complex with fault-bounded slices of melange, chert, basalt, turbidite, shallow marine sedimentary rocks and ultrabasic rocks. Eclogites, garnet-glaucophane rocks and schists of Bantimala complex have estimated peak T of 580-630 °C and P=18-24 kbar, suggesting subduction to ~65-85 km and T gradient ~8°C/km)

Molengraaff, G.A.F (1902)- Rapport omtrent de concessie-terreinen der Exploratie- en Mijnbouw Maatschappij Kwandang Soemalata. p. (Unpublished consultant report)

(Report on the concession areas of the Kwandang Soemalata gold exploration-mining company' Survey of gold-silver deposits in Sumalatta area, N Sulawesi)

Molengraaff, G.A.F (1902)- Uber die Geologie der Umgegend von Sumalatta auf Nord-Celebes und uber die dort vorkommenden goldfuhrenden Erzgange. Zeitschrift fur Praktische Geologie 10, p. 249-257.

(online at: <https://babel.hathitrust.org/cgi/pt?id=uc1.31822032651069;view=lup;seq=265>)
(On the geology of the Sumalatta area on North Sulawesi and on the gold-bearing ore veins there'. On gold-bearing in Sumalatta coastal mountains of N Sulawesi. Highest parts of area mainly granites, intruded into

steeply dipping, bedded metamorphosed greywacke-like rocks (Dolokapa series crystalline schists). Metalliferous veins associated with rel. young andesitic magmas (Wubudu volcanic breccia, etc.)

Molengraaff, G.A.F & J.G. Bousquet (1902)- Opmerkingen omtrent de Donoeki-gang, gelegen in het concessie-terrein Monano. Private company, restricted circulation print?

(Remarks about the Donoeki vein in the Monano concession'. Evaluation of gold deposit in N Sulawesi, presumably as consultant for the Kwandang Soemalata mining company. Printed with 'Algemeene opmerkingen omtrent de landstreek, waarin de terreinen der Kwandang Soemalata Maatschappij (...) gelegen')

Monnier, C. (1996)- Mecanisme d'accrétion des domaines océaniques arrière-arc et géodynamique de l'Asie du sud-est. Petrologie et géochimie des ophiolites d'Indonésie (Sulawesi, Haute-Chaine Centrale, Cyclops, Seram et Meratus). Ph.D. Thesis, Université de Bretagne Occidentale, Brest, p. 1-605. *(Unpublished)*

(Mechanism of accretion of oceanic forearc domains and geodynamics of SE Asia', Petrology and geochemistry of Indonesian ophiolites (Sulawesi, Central Range, Cyclops, Seram and Meratus). Indonesian ophiolites formed in back-arc setting, based on petrology and geochemistry. Most are dismembered but show normal succession from peridotites and gabbros to pillow basalts)

Monnier, C., H. Bellon & J. Girardeau (1994)- Datation K40-Ar40 de l'ophiolite de l'île de Sulawesi, Indonésie. Comptes Rendus Académie Sciences, Paris 319, Ser. II, p. 349-356. *(online at: https://www.researchgate.net/publication/235954222_Datation_40K-40Ar_de_l'ophiolite_de_l'ile_de_Sulawesi_Indonesie)*

('K-Ar dating of the Sulawesi ophiolite'. Remnants of giant ophiolite nappe in Central E Sulawesi formed in M Eocene (44 ± 4 Ma). K/Ar ages for amphiboles in gabbro samples from SE Arm 47.4 and 41.2 Ma. Ages roughly correspond to age of opening of Celebes Sea and pre-Miocene marginal basin formation (not in agreement with Cretaceous age of supposedly overlying Boba/ Matano oceanic radiolarites and pelagic limestones? (Simandjuntak 1992); JTvG))

Monnier, C., J. Girardeau, R.C. Maury & J. Cotten (1995)- Back-arc origin for the East Sulawesi ophiolite (Indonesia). Geology (GSA) 23, 9, p. 851-854.

(online at: https://www.researchgate.net/publication/235764171_Back-arc_basin_origin_for_the_East_Sulawesi_ophiolite_eastern_Indonesia)

(E Sulawesi ophiolites probably formed in Eocene Paleo-Celebes Sea backarc basin and emplaced by N to S obduction of Eurasia/ Celebes Sea over 'Australian' E Sulawesi basement (age not in agreement with Cretaceous age of overlying Boba / Matano oceanic radiolarites/ pelagic limestones? (e.g. Simandjuntak 1992; JTvG))

Moss, S.J. & M.E.J. Wilson (1998)- Biogeographic implications of the Tertiary palaeogeographic evolution of Sulawesi and Borneo. In: R. Hall & J.D. Holloway (eds.) Biogeography and geological evolution of SE Asia, Backhuys, Leiden, p. 133-163.

(online at: http://searg.rhul.ac.uk/pubs/moss_wilson_1998%20Sulawesi-Borneo%20paleogeography.pdf)

(Series of paleogeographic maps of Borneo- Sulawesi region, from 50- 4 Ma. W Sulawesi accreted onto Borneo by Late Cretaceous, then separated in M-Late Eocene. E Sulawesi collided with W Sulawesi in M-L Oligocene. Late Miocene accretion of Australia-derived microcontinents onto E Sulawesi (Buton, also Sula Spur ?))

Moyle, A.J., B.A. Wake, S.H. Tuckey & J. Ariti (1997)- The Toka Tindung Gold Project, northern Sulawesi, Indonesia. Proc. World Gold '97 Conference, Singapore 1997, 2, p. 27-34.

(On discovery of Toka Tindung, Pajajaran, Blambangan and Araren low-sulphidation quartz-adularia vein and stockwork gold-silver deposits on N Minahasa Peninsula, N Sulawesi. Mineralized veins in Late Pliocene basaltic andesite volcanoclastics and flows. Part of E Miocene- Pleistocene Sulawesi-East Mindanao Arc. (First gold poured in 2011))

Mubroto, B. (1988)- A palaeomagnetic study of the East and Southwest arms of Sulawesi, Indonesia. Ph.D. Thesis, University of Oxford, p. 1-253. *(Unpublished)*

(Including paleomagnetic work on E Sulawesi Ophiolite, suggesting formation in Late Cretaceous at 17-24°S and since rotated CW about 60°)

Mubroto, B. (1994)- Palaeomagnetism of ophiolites of eastern Sulawesi; evidence for northward translation. In: J.L. Rau (ed.) Proc. 30th Session Committee Co-ord Joint Prospecting Mineral Res Asian Offshore Areas (CCOP), Bali 1993, 2, p. 179-189.

(online at: <https://repository.unescap.org/items/177e9366-1a15-4fc9-986f-15520603d2c3>)

(Indo-Australian, Eurasian and Pacific plates all interact in Sulawesi region. Paleomagnetic analysis of Cretaceous basalts from E Sulawesi Ophiolite Complex at Batusamping and Binsil (= Luwuk fold-thrust belt) of East Arm, suggests ophiolite was derived from N part of Indo-Australian oceanic plate, formed at spreading ridge at 17° ±4°S paleolatitude)

Mubroto, B., J.C. Briden, E. McClelland & R. Hall (1994)- Palaeomagnetism of the Balantak ophiolite, Sulawesi. Earth Planetary Science Letters 125, p. 193-209.

(Paleomag from Cretaceous-Paleogene lavas in Balantak Ophiolite on E tip of E Sulawesi indicates formation at 17±4° S and ~60° of CW rotation (~2000km S of present position)(= Indian Ocean lithosphere?). Supporting evidence for paleolatitude and N-ward movement of E arm from other lavas and Cretaceous Boba Cherts. Contrast between these results and subequatorial origin of contemporary rocks on Halmahera consistent with subduction of Indian Ocean lithosphere beneath Sunda margin in Late Mesozoic- Early Tertiary. Large differences in declination in E Sulawesi rocks indicate large clockwise and anticlockwise rotations of tectonic blocks only tens of km across)

Mudiana (1984)- Hydrogeological map of Indonesia, 1:250,000, Sheet 2101 Ujung Pandang (Makassar), 2109 Benteng and 2110 Sinjai, Sulawesi. Directorate of Environmental Geology, 1 map sheet.

(Hydrogeology of southern part of SW Arm of Sulawesi and Salayar Island. Four groundwater zones: (1) coastal plains, (2) stratovolcano areas, (3) karst areas (highest groundwater potential), (4) mountain range areas (rel. minor aquifers potential))

Muin, M.R., S. Pramumijoyo, I.W. Warmada & W. Suryanto (2016)- Neogene tectonics and paleomagnetism of the western and eastern of Palu Bay, Central Sulawesi, Indonesia. In: Southeast Asian Conference on Geophysics, Bali 2016, IOP Conference Series: Earth and Environmental Science 62, 012003, p. 1-6.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/62/1/012003>)

(Paleomagnetic work on 8 Neogene granites suggests similar rotation of both sides of Palu Bay during Neogene)

Muller, H.W., G. Riedmuller & B. Schwaighofer (1984)- Weathering products of andesitic rocks from Sulawesi, Indonesia. Clay Minerals 19, 1, p. 21-28.

(online at: http://www.minersoc.org/pages/Archive-CM/Volume_19/19-1-21.pdf)

(Weathered andesitic and overburden along Tondano river, N Sulawesi, indicate different weathering conditions. Andesite altered to 7A halloysite and allophane with some hematite, reflecting paleoclimate with more pronounced dry season and lower annual rainfall than today. Transported latosols of overburden with 10A- and 7A-halloysites, weathered under recent tropical climate)

Multan, R.A., B. Rochmanto & R. Langkoke (1999)- Analysis of sedimentary environment of chromite ore in Sawugi, Bungku Barat, Poso, Central Sulawesi. Proc. 28th Annual Convention Indonesian Association Geologists (IAGI), Jakarta, 2, p. 313-320.

(online at: <https://www.iagi.or.id/web/digital/65/23.pdf>)

(Distribution of chromite placer ores in Sawugi area, E coast of C Sulawesi, along beach in SE-NW direction)

Munasri (1995)- Cretaceous radiolarian biostratigraphy in the Bantimala and Barru areas, South Sulawesi, Indonesia. M.Sc. Thesis, University of Tsukuba, Japan, p. (Unpublished)

Munasri (2013)- Early Cretaceous radiolarians in manganese carbonate nodule from the Barru area, South Sulawesi, Indonesia. J. Riset Geologi dan Pertambangan (LIPI) 23, 2, p. 79-88.

(online at: www.geotek.lipi.go.id/riset/index.php/jurnal/article/view/92/52)

(E Cretaceous (Valanginian-Barremian) radiolaria from manganese carbonate nodule in dark reddish shale of Barru melange, 15 km SE of Barru. Assemblage with Pantanellium squinaboli, Cecrops septemporatus, Eucyrtidium parviporum, E. brouweri, Theocapsa laevis, Stichocapsa pseudodecora, Pseudodictyomitra lilyae, P. carpatica, Gongylothorax verbeeki, etc. Rocks accreted at subduction trench in M Cretaceous (Aptian). (Younger, Albian- E Cenomanian assemblages in chert-siliceous shale of Bantimala Complex (Wakita et al. (1994))

Musnajam, M., A.T.A. Karim, N. Nurfadillah, F.A. Ikhsan & A.E. Sejati (2020)- The facies and metamorphism types determination of metamorphic rock in the part of Mekongga Complex. *Geosfera Indonesia* 5, 2, p. 250-267.

(online at: <https://jurnal.unej.ac.id/index.php/GEOSI/article/view/17340/8453>)

(Description of mica schist in greenschist metamorphic facies from Mekongga Complex at Lambolemo village (no map; presumably in SE Sulawesi))

Musri, M., E. Suparka, C.I. Abdullah, N.I. Basuki & M.A. Forster (2016)- 40Ar/39Ar geochronology of Rumbia schist complex: new implications for timing and hydrothermal activity in the Southeast Sulawesi gold prospect, Indonesia. *Int. Journal of Engineering and Science Applications (UNHAS)* 3, 2, p. 145-152.

(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/viewFile/1086/234>)

(Rumbia Mountains with E-W oriented high-P/low-T, and medium-P/low-T metamorphic rocks (mica schist, glaucophane schist, greenschist). Host of gold deposits. Two periods of gold mineralization: (1) associated with tectonic deformation and metamorphic rocks exhumation (Ar/Ar age ~23 Ma); (2) related to post-tectonic hydrothermal activity (overprinting at ~6.8 Ma))

Musri, E. Suparka & B. Tambun (2011)- Model geologi alterasi dan mineralisasi hidrotermal daerah Latuppa, Palopo, Sulawesi Selatan. *Proc. 36th HAGI and 40th IAGI Annual Conv.*, Makassar, p. 1-18.

(online at: https://www.iagi.or.id/web/digital/10/2011_IAGI_Makassar_Model-Geologi-Alterasi.pdf)

(‘Geological model of alteration and hydrothermal mineralization in Latuppa area, Palopo, South Sulawesi’)

Muzani, M., L. Nabilla, R.V.E. Pratiwi & F. Tan (2025)- South Sulawesi Arm’s evolution in the past 50 million years and its impacts on the geology and geomorphology. *Geology Ecology and Landscapes* 9, 1, p. 67-79.

(online at: <https://www.tandfonline.com/doi/pdf/10.1080/24749508.2023.2165627>)

(Review of geological evolution of Sulawesi in simple sketches since 50 Ma, in five intervals, 50-40 Ma, 40-35 Ma, 30-25 Ma, 20-15 Ma and 10-5 Ma (mainly based on Hall (1997) reconstruction). SW Sulawesi shown as part of Sundaland margin all this time)

Nainggolan, D.A. (2006)- Perkembangan struktur geologi bawah permukaan berdasarkan hasil analisis data gaya berat di utara Kendari, Sulawesi Tenggara; implikasinya terhadap kemungkinan terdapatnya sumber daya geologi. *Jurnal Sumber Daya Geologi (JSDG)* 16, 5 (155), p. 270-284.

(‘The development of subsurface geological structure based on gravity data analysis in the north of Kendari, Southeast Sulawesi; implications for the possibility of the presence of geological resources’. Study area in SE Sulawesi mainly covered by ophiolite. Structure mainly NW-SE (also SW-NE?))

Nainggolan, D.A. & B.S. Widijono (2003)- Struktur kerak dan geodinamika daerah Luwuk dan sekitarnya Sulawesi Tengah berdasarkan analisis data gaya berat. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 13, 140, p. 18-29.

(‘Crustal structure and geodynamics of the Luwuk area, C Sulawesi, based on analysis of gravity data’. Gravity analysis of N part of E Arm of Sulawesi and S Tomini Bay. Gravity high over Togian Islands. Gravity low over Luwuk and adjacent areas, interpreted as Mesozoic sediments overlain by ophiolite sheets)

Natawidjaja, D.H. & M.R. Daryono (2015)- The Lawanopo Fault, central Sulawesi, East Indonesia. *Proc.4th Int. Symposium on earthquake and disaster mitigation, Bandung 2014, AIP Conference Proceedings* 1658, 030001, p. 1-23.

(online at: https://www.researchgate.net/publication/301365357_The_Lawanopo_Fault_central_Sulawesi_East_Indonesia)

(NW-SE trending Lawanopo fault of SE Sulawesi considered as active left-lateral strike-slip fault. Exposures of fault are clear, and it serves as tectonic boundary between different rock assemblages. Young fault, but no evidence of recent activity, consistent with lack of seismicity on fault)

Natawidjaja, D.H., M.R. Daryono, G. Prasetya, Udrek, P. L.F Liu, N.D. Hananto, W. Kongko, W. Triyoso et al. (2021)- The 2018 Mw7.5 Palu 'supershear' earthquake ruptures geological fault's multisegment separated by large bends: results from integrating field measurements, LiDAR, swath bathymetry and seismic-reflection data. *Geophysical J. International* 224, 2, p. 985-1002.

(online at: <https://academic.oup.com/gji/article/224/2/985/5932272>)

(September 2018 quake ruptured 177-km long multifault segments, bypassing two large releasing bends (offshore and inland). ~110-km submarine ruptures contributed to tsunami generation in Palu Bay. Rupture continued inland for another 67 km, mainly left-lateral strike-slip up to 6m, with 5-10% dip-slip. The 7 km sizeable releasing bend results in Palu pull-apart basin)

Ndoasa, R.P., M.A. Amir, H.D. Asmuruf & Rudianto (1994)- Penempatan ofiolit Barru dan pembentukan Selat Makasar. *Proc. 23rd Annual Conv. Indonesian Association Geologists (IAGI), Jakarta*, 1, p. 291-299.

(online at: <https://www.iagi.or.id/web/digital/62/26.pdf>)

('Emplacement of the Barru ophiolite and the formation of Makassar Straits'. UNHAS literature review)

Neben, S., K. Hinz & H. Beiersdorf (1998)- Reflection characteristics, depth and geographic distribution of bottom simulating reflectors within the accretionary wedge of Sulawesi. In: J.P. Henriot & J. Meinert (eds.) *Gas hydrate: relevance to world margin stability and climate change*, Geological Society, London, Special Publ. 137, p. 225-265.

(Seismic profiles across subduction zone N of Sulawesi bottom simulating reflectors (BSRs) across accretionary wedge. BSR correlated with heat flow data and indicate that where heat flow is high and BSR interrupted, active venting of methane may occur at sea floor. BSRs limited to central part of N Sulawesi subduction zone (between 121°30'E and 123°30'E In W part of area only short BSR segments found, which may be result of slope instability and slumping of sediments. On E-most profile, no bottom simulating reflectors found at all)

Ngakan, A.A., B. Priadi, K. Hasan, Surono & T.O. Simanjuntak (2000)- Sulawesi. In: H. Darman & F.H. Sidi (eds.) *An outline of the geology of Indonesia*, Chapter 8, Indonesian Association Geologists (IAGI), Special Publ., p. 101-120.

Niermeyer, J.F. (1909)- De onderzeese vorm van Celebes. *Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap* (2) 26, p. 612-621.

(online at: <https://resolver.kb.nl/resolve?urn=MMUBA13:001651001:pdf>)

('The undersea shape of Sulawesi'. Early bathymetric map around Sulawesi. No landmass on earth is surrounded by seas and cut by and embayments that are this deep and steep, except perhaps Halmahera. With 1:2.5m scale color bathymetry map)

Nishimura, S., T. Yokohama & Herry (1980)- Gravity measurements at South Sulawesi. In: *Physical geology of Indonesian island arcs*, Kyoto University, p. 35-41.

Nijholt, N., W.J.F. Simons, J. Efendi, D.A. Sarsito & R.E.M. Riva, (2021)- A transient in surface motions dominated by deep afterslip subsequent to a shallow supershear earthquake: The 2018 Mw7.5 Palu case. *Geochem. Geophysics Geosystems* 22, e2020GC009491, p. 1-16.

(online at: <https://agupubs.onlinelibrary.wiley.com/doi/pdfdirect/10.1029/2020GC009491>)

Nijholt, N., W. Simons, R. Riva, J. Efendi, D. Sarsito & T. Broerse (2024)- Triggered and recurrent slow slip in North Sulawesi, Indonesia. *Tectonophysics* 885, 230416, p. 1-12

(online at: <https://www.sciencedirect.com/science/article/pii/S004019512400218X>)

(20 years of GNSS measurements in NW Sulawesi reveal multiple periods of transient surface motion. Two fault zones with potential for major earthquakes and tsunamis: (1) Palu-Koro strike slip fault and (2) Minahassa

(Celebes Sea, North Sulawesi) subduction zone. Slow slip on Minahassa subduction interface in combination with deep afterslip on Palu-Koro fault most likely explanation for observed surface motions)

Noack, O. (1926)- Vergleichende petrographische Studien an Gesteinen der Minahassa in Nord-Celebes. Thesis Hohen Naturwissenschaftlichen Fakultät Vereinigten Friedrichs Universität, Halle, p. 1-41. *(Unpublished)*
('Comparative petrographic studies of rocks of the Minahassa in N Sulawesi'. Petrographic descriptions and chemical analyses of young volcanic rocks collected by Prof. F. Rinne in 1900. No illustrations)

Noble, R.A., D.M. Jessup, D. Burt & Djumlati (2000)- Petroleum system of the Senoro-1 discovery, East Sulawesi, Indonesia. AAPG Int Conference Exhibition, Bali 2000, American Assoc. Petroleum Geol. (AAPG) Bull. 84; 9, p. 1470. *(Abstract only)*
Senoro-1 1999 gas oil discovery in N Tomori petroleum system: U Miocene reefs, charged by E-M Miocene calcareous marine source rocks after burial by Pliocene synorogenic deposits of Tomori collision zone. Porous reefal facies of Mantawa Fm with gross gas-oil columns of 656' and 33'. Gas mixed thermogenic and biogenic; 89% methane, 2% CO₂, ~1% H₂S and wet hydrocarbon gases C₂+)

Norvick, M.S. & R.L. Pile (1976)- Field report on the Lariang and Karama geological survey West Sulawesi. BP Petroleum Indonesia, Report JKT/EXP/0071, p. 1-72.
(Unpublished, but commonly used comprehensive field survey report of W Sulawesi basins for Gulf/ BP)

Novian, M.I., B.S. Astuti & D.H. Barianto (2012)- Stratigrafi formasi Poh pada jalur Sungai Bun, Desa Bondat, Pagiman, Sulawesi Tengah. Proc. 41st Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 2012-SS-35, 1p. *(Abstract only)*
('Stratigraphy of the Poh Formation in Bun River section, Bondat Village, Central Sulawesi'. ~140m thick setion of coarsening upward calcareous claystone-sandstone section of 'Poh Formation'. Sedimentary structures parallel lamination, some flute casts and ripples, trough cross bedding and hummocky cross stratification. Lithics consists of fragments of ultramafic rocks, limestone and mollusc shells. Foraminifera suggest M Oligocene- Pliocene age)

Novian, M.I., D.H. Barianto, S. Husein & S.S. Surjono (2024)- Planktonic foraminifera biostratigraphy of the Pliocene Kintom and Bongka Formation, Central Sulawesi, Indonesia. J. Tropical Biodiversity and Biotechnology (JTBB) (UGM) 9, 4, jtbb94685, p. 1-20.
(online at: <https://journal.ugm.ac.id/jtbb/article/view/94685/40272>)
(Plio-Pleistocene planktonic foraminifera biostratigraphy.in ~500m of Matindok- Ondoondolu outcrop section in 'post-orogenic' sediments in East Arm of Sulawesi. Lower fine-grained 'flysch-type' part called Kintom Fm, containing latest Miocene and Pliocene planktonics. (Unconformably?) overlain by conglomerate-rich Bongka Fm 'molasse' of Late Pliocene age with serpentinite clasts, reworked Miocene microfauna, etc., . Clastics overlain by Luwuk Fm limestones (raised reef terraces) with Pleistocene planktonics)

Novian, M.I., D.H. Barianto, V.D. Mardiana N. & T. Sihombing (2012)- Paleogeografi Miosen daerah Luwuk, Sulawesi Tengah berdasarkan keberadaan konglomerat batu gamping dari Formasi Kintom dan Formasi Bongka. Proc. 41st Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 2012-GD-29, p. 12. *(Abstract only)*
('Miocene paleogeography of the Luwuk area, C Sulawesi, based on the presence of limestone conglomerates from the Kintom and Bongka Formations'. 'East Sulawesi Molasse' in N arm of Sulawesi with 65m thick conglomerate with mainly limestone clasts (sourced from Salodik Fm) and 5% ultramafic rocks. Age of limestone-rich conglomerate M-Late Miocene (= presumably early unroofing deposits in basal part of "Celebes Molasse"?)

Novian, M.I., D.H. Barianto & S.S. Surjono (2024)- Facies analysis and sequence stratigraphy of Plio-Pleistocene fan delta deposits in the East Arm Sulawesi, a case study of Biak Formation, Luwuk, Banggai. Proc. Int. Conference Geological Engineering and Geosciences, Yogyakarta 2023, IOP Conference Series: Earth and Environmental Science 1373, p. 012058, p. 1-11.
(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1373/1/012058/pdf>)

(Lithofacies of Plio-Pleistocene fan delta deposits, widespread in E Arm of Sulawesi, and reflecting tectonic uplift during Banggai-Sula continental collision. Formerly known as (middle part of?) 'Celebes Molasse', now as Bongka Fm in W and Biak Fm in E part of East Arm of Sulawesi)

Nugraha, A.M.S. (2016)- Late Cenozoic history of Sulawesi, Indonesia: the Celebes Molasse. Ph.D. Thesis Royal Holloway London University, p. 1-424.

(Celebes Molasse in SE Sulawesi unconformable over pre-Miocene rocks, post dating E Miocene Sula Spur collision. Three units: (1) serpentine-rich clastic unit (pre-Latest Miocene), (2) limestone unit (Latest Miocene-Holocene) and (3) quartz-rich clastic unit (Late Miocene-Pliocene))

Nugraha, A.M.S., R. Adhitama, A.D. Switzer & R. Hall (2023)- Plio-Pleistocene sedimentation and palaeogeographic reconstruction in the Poso Depression, Central Sulawesi, Indonesia: from a sea channel to a land bridge. *J. of Palaeogeography* 12, 3, p. 331-357.

(online at: <https://www.sciencedirect.com/science/article/pii/S209538362300055X>)

(Poso Depression was half-graben/ sea channel, connecting Gorontalo and Bone bays during Pliocene. Pliocene Puna Fm fan deltas (formerly called post-orogenic 'Celebes Molasse') sourced mainly from E Sulawesi ultrabasic rocks, with minor magmatic and metamorphic input from W Sulawesi. M-L Pliocene Poso Fm coral limestones 250m thick and accumulated on E basin margin. Unconformably overlain by Pleistocene Lage Fm shallow marine glaucofan-rich siliciclastics, associated with rapid exhumation/uplift of Pompangeo metamorphic complex, which led to land bridge connecting W and E Sulawesi at ~3 Ma. Most of present relief of Sulawesi created since 5-2 Ma)

Nugraha, A.M.S. & R. Hall (2017)- Light and heavy mineral constraints on the provenance of unconformity-bounded formations: an example from SE Sulawesi, Indonesia. American Geophysical Union (AGU) Fall Meeting, New Orleans, EP24B-06, 1p. *(Abstract only)*

(online at: <https://agu.confex.com/agu/fm17/meetingapp.cgi/Paper/219367>)

(Neogene sediments of Celebes Molasse in SE Arm of Sulawesi show unroofing series: (1) U Miocene Pandua Fm dominated by serpentinite and chrome spinel, less polycrystalline quartz and metamorphic, etc. lithics (mainly sourced from ultramafic rocks) and (2) latest Miocene-earliest Pleistocene Langkowala Fms poor in serpentinite and increasing metamorphic detritus including glaucofan/lawsonite (from exhumation of HP-LT metamorphic complexes). Two formations separated by angular unconformity)

Nugraha, A.M.S. & R. Hall (2018)- Late Cenozoic palaeogeography of Sulawesi, Indonesia. *Palaeogeogr. Palaeoclim. Palaeoecology* 490, p. 191-209.

(online at: http://searg.rhul.ac.uk/pubs/nugraha_hall_2018%20Sulawesi%20palaeogeography.pdf)

(New paleogeographic maps from E Miocene-Pleistocene (20-1 Ma), after Sula Spur- N Sulawesi volcanic arc collision. For most of Neogene, Sulawesi was shallow marine area with small islands surrounded by deeper marine areas. Onset of extension at ~15 Ma. Deep inter-arm bays began to form in Late Miocene and islands became larger. Pliocene increase in land area and elevation accompanied by major subsidence of inter-arm bays. Separate islands coalesced in Pleistocene to form distinctive K-shaped island known today)

Nugraha, A.M.S. & R. Hall (2018)- Late Cenozoic history of Sulawesi. Proc. 42nd Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA18-27-G, p. 1-22.

(Neogene stratigraphy of Sulawesi with five regional unconformities: (1) E Miocene (~23 Ma), (2) M Miocene (~15 Ma), (3) latest Miocene- earliest Pliocene (~6-5.3 Ma), (4) E Pleistocene (~1.8 Ma), and (5) M Pleistocene (~1 Ma). E Miocene collision between promontory of Sula Spur and N Sulawesi volcanic arc, causing ophiolite emplacement in E Sulawesi. M Pliocene unconformity in some areas of N Sulawesi. With 10 paleogeographic maps)

Nugraha, A.M.S. & R. Hall (2022)- Neogene sediment provenance and paleogeography of SE Sulawesi, Indonesia. *Basin Research*, 28, 5, p. 1714-1730.

(online at: <https://onlinelibrary.wiley.com/doi/epdf/10.1111/bre.12682>)

(Neogene of SE Sulawesi (formerly called 'Celebes Molasse') three provenance shifts: (1) due to E Miocene collision of Australian crust and North Sulawesi volcanic arc, accompanied by ophiolite emplacement in E

Sulawesi, change from pre- collision carbonates to ultramafic- rich immature sandstones of late E Miocene(?) Bungku Fm; (2) Late Miocene input of abundant metamorphic detritus (incl. blueschists) into Pandua Fm, indicating exhumation of Oligo-Miocene subduction zone material; (3) change from ophiolite/ blueschist- rich debris to quartz-rich Plio-Pleistocene Langkowala Fm, recording rise and progressive unroofing of quartzose metamorphic rocks of Mekongga-Rumbia complexes (= extension driven by Banda subduction rollback?)

Nugraha, A.M.S., R. Hall & M. Boudagher-Fadel (2022)- The Celebes Molasse: a revised Neogene stratigraphy for Sulawesi, Indonesia. *J. Asian Earth Sciences* 228, 105140, p. 1-28.

(online at: www.sciencedirect.com/science/article/pii/S1367912022000633)

(New stratigraphy of Late Neogene 'Celebes Molasse'. Different units of different ages, environment of deposition and composition. Unconformities in (1) E Miocene (c. 23 Ma), (2) M Miocene (c. 15 Ma), (3) Mio-Pliocene (c. 6-5.3 Ma), and (4 and 5) Pleistocene (c. 1.8 and 0.1 Ma). Resulting megasequences from E Miocene collision of Sula Spur microcontinent followed by extension, driven by subduction rollback, causing both uplift and subsidence (in contrast to previous interpretations of multiple collisions))

Nugraha, A.M.S., R. Hall & M. Boudagher-Fadel, J.A. Todd & A.D. Switzer (2023)- Neogene history of fluvial to shallow marine successions in the Kendari Basin, SE Sulawesi, Indonesia. *The Depositional Record (IAS)* 9,2, p. 300-334.

(online at: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/dep2.196>)

(Kendari Basin at S end of SE Arm of Sulawesi most complete Neogene sequence in Sulawesi (youngest clastic parts formerly known as 'Celebes Molasse'). Oldest sediments Burdigalian-Langhian Bungku Fm shallow marine carbonates and deltaic siliciclastics. Unconformably overlain by U Miocene fluvial, tidal and shallow marine Pandua Fm, rich in serpentinite debris. Overlain by ~6- 5.3 Ma subaerial unconformity (uplift event) and fluvial quartz-rich Langkowala Fm and age-equivalent transgressive Pliocene Eemoiko Fm landwards-backstepping carbonate platform)

Nugraha, A.M.S., J. Hennig-Breitfeld, R. Puspita, A.D. Switzer & R. Hall (2024)- Detrital zircons and heavy minerals from the Palu Formation, Sulawesi, Indonesia: constraints on exhumation of the Palu Metamorphic Complex and drainage evolution. *J. Geological Society, London* 181, 3, jgs2023-118, p. 1-10.

(online at: <https://www.lyellcollection.org/doi/full/10.1144/jgs2023-118>)

(Pleistocene Palu Fm coarse clastics around Palu City (previously assigned to 'Celebes Molasse' are alluvial-fluvial deposits that record rapid uplift in Neck and west Central Sulawesi. Clasts mainly igneous and metamorphic rocks, likely mainly from exposed Palu Metamorphic Complex. Youngest zircons Pliocene in age (~2.5- 3.0 Ma). Most zircons Neogene in age (peaks at 3.9 and 6.9 Ma). Lesser peaks at ~42 Ma, ~92 Ma (Late Cretaceous), 120 Ma (E Cretaceous), ~181 Ma (E Jurassic) and ~210-220 Ma (Late Triassic). (Palu Fm apparently unrelated to 'Celebes Molasse' as originally defined in East Arm of Sulawesi by Sarasin cousins in 1901: younger, different provenance, different tectonostratigraphic significance; JTvG))

Nugroho, S., I. Hardjana, A.D. Susanto & C.C. Bautista (2005)- Notes on the discovery of the Riska deposit, North Sulawesi- Indonesia. In: S. Prihatmoko et al. (eds.) Indonesian mineral and coal discoveries, IAGI Special Issue 2005, p. 31-44.

(On Riska high-sulphidation epithermal gold deposit 20 km SE of Kotamobagu, discovered by Newmont in 1998. Hosted by Plio-Pleistocene andesitic pyroclastics)

Nur, I., A. Idrus, S. Pramumijoyo, A. Harijoko & A. Imai (2011)- Mineral paragenesis and fluid inclusions of the Bincanai epithermal silver- base metal vein at Baturappe area, South Sulawesi, Indonesia. *J. Southeast Asian Applied Geology (UGM)* 3, 1, p. 34-44.

(online at: <http://geologic-risk.ft.ugm.ac.id/fresh/jsaag/vol-3/no-1/jsaag-v3n1p034.pdf>)

(Baturappe prospect in S part of Sulawesi island, is hydrothermal mineralization district of >20 epithermal silver-base metal deposits, hosted in late M Miocene Baturappe Fm basaltic-andesitic volcanic rocks)

Nur, I., A. Idrus, S. Pramumijoyo, A. Harijoko, Y. Juyanagi & A. Imai (2009)- Characteristics of epithermal quartz veins at Baturappe area, Gowa, South Sulawesi: implication to base metal exploration. *Proc. International Seminar on Geology of the Southern Mountains of Java, Yogyakarta* 2009, 1, p. 179-186.

Nur, I., A. Idrus, S. Pramumijoyo, A. Harijoko, Sufriadin, A.H.S. Jaya & U.R. Irfan (2009)- Geologi endapan urat logam dasar Pb daerah Baturappe Kabupaten Gowa, Sulawesi Selatan. Proc. 38th Annual Conv. Indonesian Association Geologists (IAGI), Semarang, p. 629-637.

(online at: https://www.iagi.or.id/web/digital/26/2009_IAGI_Semarang_Geologi-Endapan-Urat.pdf)

(*'Geology of the Baturappe area Pb deposits, Gowa Regency, S Sulawesi'. Quartz-Pb veins in M Miocene basaltic-andesitic volcanic-intrusion complex. Oldest rock unit in outcrop late Middle-Miocene basalt lava (K-Ar ages ~12.4-12.8 Ma)*)

Nur, I., A. Idrus, S. Pramumijoyo, A. Harijoko, K. Watanabe & A. Imai (2011)- Hydrothermal alteration zoning around the Baturappe epithermal silver-base metal deposit, South Sulawesi, Indonesia. Proc. Int. Symposium on Earth Science and Technology, Fukuoka 2011, p. 305-312.

Nur, I., A. Idrus, S. Pramumijoyo, A. Harijoko, K. Watanabe, A. Imai, Sufriadin, A. Jaya & U.R. Irfan (2013)- Elemental mass balance of the hydrothermal alteration associated with the Baturappe epithermal silver-base metal prospect, South Sulawesi, Indonesia. Jurnal Penelitian Enjiniring (JPE), p. 31-43.

(online at: <http://repository.unhas.ac.id/handle/123456789/6138>)

Nur, I., R.I. Irfan, Sufriadin & A. Ilyas (2016)- Mineralogical and geochemical characteristics of the Volcanogenic Massive Sulfide deposits in Sangkaropi District, North Toraja, Indonesia. Int. J. Smart Material and Mechatronics 3, 2, p. 236-241.

(online at: [https://www.researchgate.net/profile/Ulva-](https://www.researchgate.net/profile/Ulva-Irfan/publication/314979673_Mineralogical_and_Geochemical_Characteristicsof_the_Volcanogenic_Etc./links/5441110c0cf2743200000000.pdf)

[Irfan/publication/314979673_Mineralogical_and_Geochemical_Characteristicsof_the_Volcanogenic_Etc.](https://www.researchgate.net/profile/Ulva-Irfan/publication/314979673_Mineralogical_and_Geochemical_Characteristicsof_the_Volcanogenic_Etc./links/5441110c0cf2743200000000.pdf))
(*Kuroko-type volcanogenic massive sulphide (VMS) deposits in Sangkaropi mineral district, N Toraja, S Sulawesi. Formed in Oligocene (~35-22.5) Ma. Host rocks mainly altered tuff and dacitic volcanic breccia. Mineralizations mainly massive disseminated sulphides, with veins and sulphide stringers. Quartz and barite main gangue minerals. Ore minerals chalcopyrite, galena, sphalerite, etc., with azurite and malachite as supergene minerals. Hydrothermal alteration consistent with inner zones of Kuroko-type alteration zones*)

Nur, I., Y. Jayanagi, A. Idrus, S. Pramumijoyo, A. Harijoko & A. Imai (2010)- Mineralogy and microthermometry of the epithermal base metal veins at Baturappe area, South Sulawesi, Indonesia. Proc. 39th Annual Conv. Indonesian Association Geologists (IAGI), Lombok, p. 1-7.

(online at: https://www.iagi.or.id/web/digital/12/2010_IAGI_Lombok_Mineralogy-and-Microthermometry.pdf)

(*Baturappe area, S Sulawesi, hydrothermal quartz-Pb veins in basalt and porphyritic basalt host rocks. Microthermometric study of fluid inclusions in quartz indicates temperature formation of veins between ~230°-280°C. Minimum formation depth about 300- 550m*)

Nur, I., Sufriadin & A. Ilyas & U.R. Irfan (2019)- Hydrothermal alteration associated with vein-type sulphide mineralization at Lappadata Prospect, South Sulawesi, Indonesia: a preliminary study. Proc. 2nd EPI Int. Conference on Science and Engineering, Gowa 2018, IOP Conference Series: Materials Science and Engineering 676, 012033, p. 1-9.

(online at: <https://iopscience.iop.org/article/10.1088/1757-899X/676/1/012033/pdf>)

(*Epithermal vein-type sulphide mineralization hosted by porphyritic basalt and limestone members of Eocene - Oligocene Salo Kalupang Fm in Lappadata area, Bone Regency, S Sulawesi*)

Nur, I., P. Taba, A. Idrus, U.R. Irfan, Sufriadin, S. Widodo, A.V. Anas, M.R. Ardian & A.D. Anjelina (2024)- The genesis and potential utilization of zeolite in the Moncongloe Area, Maros, South Sulawesi, Indonesia. Gospodarka Surowcami Mineralnymi (Mineral Resources Management; Krakow, Poland) 40, 3, p. 5-22.

(online at: <https://gsm.min-pan.krakow.pl/pdf-190532-122616?filename=The-genesis-and-potential.pdf>)

(*Zeolite mineralization in porphyritic rhyolite and green tuff in marine volcano-sedimentary sequence of Miocene Camba Fm in SW Sulawesi. Thickness of zeolite-bearing layers 6.8 m. Zeolite is of phillipsite type, which formed as alteration product of K-feldspar phenocrysts as well as fine crystalline ground mass and volcanic glass*)

- Oostingh, C.H. (1935)- Enige opmerkingen over A. von Kutassy's beschrijving van jong-Tertiaire mollusken uit Oost-Celebes. De Ingenieur in Nederlandsch-Indie (IV) 2, 4, p. IV.30- IV.31.
(online at: <https://www.stichtingblauwelijn.nl/assets/files/1935-04.pdf>)
(Questions validity and argues there are inconsistencies of Mio-Pliocene age determinations based on molluscs from E Sulawesi sediments by Kutassy in Von Loczy (1934))
- Osimo, G. (1908)- Di alcuni foraminiferai dell' Eocene superiore di Celebes. Rivista Italiana Paleontologia 14, 1-2, p. 28-54.
(online at: www.biodiversitylibrary.org/item/51504#page/44/mode/1up)
(*'On some foraminifera from the Upper Eocene of Celebes'. Larger forams from marl near Dongala, N Sulawesi, collected by Italian BPM geologist Dr. Guido Bonarelli, and sent to the Geological Museum in Turin. With Lepidocyclus tournouieri, L. provalei, Linderina, Sphaerogypsina, Baculogypsina bonarelli, Miogypsinoidea complanata, and Heterostegina glabra (= Spiroclypeus?) (N.B.: this assemblage does not look like Eocene age; more likely latest Oligocene; JTvG)*)
- Otofuji, Y., F. Hehuwat, S. Sasajima, S. Nishimura & A. Dharma (1981)- Paleomagnetic evidence for clockwise rotation of the Northern arm of Sulawesi, Indonesia. Earth Planetary Science Letters 54, p. 272-280.
(North arm of Sulawesi clockwise rotation of >90°. Rotational motion began no later than M Miocene and probably terminated before initiation of Plio-Pleistocene volcanic activity)
- Paalvast, L. (2007)- UHP Metamorphism in Central Indonesia- A geothermobarometric and geochronological study on the (U)HP rocks of the Bantimala and the Luk-Ulo complex, Indonesia. M.Sc. Thesis University of Utrecht, p. 1-108.
(*P-T estimates of Early Cretaceous HP and UHP metamorphic rocks in Bantimala, SW Sulawesi (eclogites) and Luk-Ulo, Central Java (glaucophane eclogites), largely confirm earlier work of Miyazaki (1996). Rocks of Bantimala complex subducted to at least 100 km depth; rocks of Luk-Ulo complex subducted to at least 85 km. P-T paths suggest ocean-continent collisional setting, i.e. in fossil subduction zone, possibly parts of same subduction zone. Granulites of Bantimala and Luk-Ulo resemble P-T conditions normally found at base of crust and are interpreted as originating from base of crust of overriding plate)*)
- Pachri, H., A.M. Imran & M. Al Izza Hizbullah (2024)- The contribution of morphology to the quantitative potential of nickel laterite deposits highly weathered ultramafic rocks in the Southeast Arm Region of Sulawesi Island, Indonesia. J. Lingkungan dan Bencana Geologi (JLBG) 15, 3, p. 158-171.
(online at: <https://jlbgeologi.esdm.go.id/index.php/jlbgeologi/article/view/523/258>)
(*Nickel laterite profiles and morphology in Pomala and Sorowako in SE Sulawesi correlated to steepness of slopes, with maximum thickness and Ni content on gentle slopes (7-15% grade). (conclusion not wrong, but this has been noted by multiple authors before since 1950s? or before, but no references to these papers; JTvG)*)
- Paju, J.A., Y.S. Purnama, B. Nugroho, A. Bachtiar & F. Peera (2006)- Sedimentology of Mallawa clastics and its implication to hydrocarbon occurrences in western part of West arm Sulawesi. Proc. 35th Annual Conv. Indonesian Association Geologists (IAGI), Pekanbaru 2006, PITIAGI2006-012, p. 1-18.
(online at: https://www.iagi.or.id/web/digital/15/2006_IAGI_Pekan-Baru_Sedimentology-Of-Mallawa.pdf)
(*(Eo-Oligocene Mallawa Fm (should be spelled Malawa Fm? (Sukanto, 1982); JTvG) clastics with coal in S part of West Arm of Sulawesi up to 400m thick. Unconformably overlies flysch deposits of Balangbaru and Marada Fm and unconformably overlain by Tonasa Limestone and thick Camba Fm volcanics. Malawa Fm interfingers with volcanic sequence of Langi Fm to E. Mainly fluvial- tidal deposits. Probably equivalent of fluvio-deltaic Lower Toraja Fm in N of Sulawesi West Arm)*)
- Panggabean, H. & Surono (2011)- Tektono-stratigrafi bagian Timur Sulawesi. Jurnal Sumber Daya Geologi (JSDG) 21, 5, p. 239-248.
(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/150>)
(*'Tectonostratigraphy of East Sulawesi'. Sulawesi four geological provinces: (1) W Sulawesi volcanic, (2) C Sulawesi metamorphic, formed since Cretaceous subduction; (3) E Sulawesi ophiolite, result of extension in Pacific Ocean in Cretaceous- Eocene and (4) fragments of microcontinents in E Sulawesi, which separated*)

from N Australia margin. E and SE Sulawesi areas of latest Oligocene- M Miocene collision between continental and ophiolitic basement blocks)

Panjaitan, S. (2009)- Penelitian paleomagnetik dan gaya berat kaitannya dengan pembentukan formasi batuan di Sulawesi Selatan serta hubungannya dengan selat Makasar dan Kalimantan. *Jurnal Sumber Daya Geologi (JSDG)* 19, 5, p. 297-212.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/214/204>)

('Paleomagnetic and gravity investigations tied to rock formations in S Sulawesi and its relations to Makassar Straits and Kalimantan'. Paleomagnetism and GPS analysis indicate CCW rotation and N-ward drift of S Sulawesi since Triassic: (1) Triassic Ultramafics (92° CCW rotation, paleolatitude -26.5°S); (2) Cretaceous melange complexes (30° CCW rotation, paleolatitude -16.1°S); (3) Eocene- M Miocene- Tonasa Limestone Fm (CCW rotation 80°, paleo latitude -14.8°S); (4) M-L Miocene Camba Fm (81° CCW rotation, paleolatitude -12.5°S); (5) M Miocene Tacipi Limestone (80° CCW rotation, paleo latitude 4.5°S); (6) Pleistocene Walanae Fm sandstone (0°- 2° CCW rotation, paleo latitude -3.5°S). Kalimantan derived from Asia in Triassic)

Panjaitan, S. & S. Hutubessy (2002)- Sifat fisik batuan di daerah Palopo dan Makale, Sulawesi Selatan. *Jurnal Sumber Daya Geologi (JSDG)* 7, 124, p. 2-10.

(Physical properties of Pretertiary rocks in area of Palopo and Makale, NE part of SW Arm of Sulawesi)

Panjaitan S. & B. Mubroto (1993)- Indikasi tektonik berdasarkan data paleomagnetik di daerah Soppeng, Sulawesi selatan. *Proc. 22nd Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 1, p. 83-91.*

(online at: <https://www.iagi.or.id/web/digital/61/12.pdf>)

('Tectonic indications from paleomagnetic data in the Soppeng area, S Sulawesi'. Paleomagnetic data from M Miocene- Pliocene Camba and Walanae Fms in SW Sulawesi suggest N-ward movement of SW Sulawesi from 12.5° S to 3.3° S and ~60° CW (CCW?) rotation between M Miocene- Pleistocene)

Panjaitan, S. & J. Nasution (2004)- Potensi minyak bumi dan gas alam lepas pantai cekungan Sengkang, Sulawesi Selatan, tinjauan analisis gayaberat. *Jurnal Sumber Daya Geologi (JSDG)* 14, 1 (145), p. 3-12.

('Oil and gas potential of the Sengkang basin S Sulawesi, from gravity analysis'. Gravity anomalies interpreted as anticlines and Tacipi limestone buildups)

Pardiana, D., M. Harayanto, D. Ramdani, F. Ginting, D. Setyandhaka et al. (2015)- Bakan gold mine and 2014 exploration results update. In: N.I. Basuki (ed.) *Proc. Indonesian Soc. Economic Geologists (MGEI) 7th Annual Convention, Balikpapan 2015, p. 101-119.*

(Bakan gold mine 200km SW of Manado in N Arm of Sulawesi operational since 2013. Cluster of epithermal high-sulphidation gold occurrences hosted by Plio-Pleistocene dacitic tuffs that are unconformable over Miocene andesitic lavas and sandstones. Mineralization similar to North Lanut mine)

Parkinson, C.D. (1991)- The petrology, structure and geologic history of the metamorphic rocks of Central Sulawesi, Indonesia. Ph.D. Thesis, University of London, p. 1-337. *(Unpublished)*

(Includes description of metamorphic sole below obducted E Sulawesi ophiolite in C Sulawesi)

Parkinson, C.D. (1991)- Counterclockwise P-T-t paths from Sulawesi meta-basites: implications for subduction zone metamorphism. *Proc. Symposium on the dynamics of subduction and its products, Yogyakarta-Karangasambung 1991, Research Development Centre Geotechnology, Indonesian Institut of Sciences (LIPI), Bandung, p. 225-226. (Abstract)*

Parkinson, C.D. (1996)- The origin and significance of metamorphosed tectonic blocks in melanges: evidence from Sulawesi, Indonesia. *Terra Nova* 8, 4, p. 312-323.

(Block-bearing melange ('knockers' in sheared mudstone) of C Sulawesi Peluru Melange Complex overlain by E Sulawesi ophiolite nappe, with Mowomba metamorphic sole sequence at base (formed at E-dipping subduction zone). Most blocks are ophiolite, also blueschist, etc. Matrix serpentinite and red phyllite. Direct genetic relationship between high-grade tectonic blocks in melange and amphibolites in metamorphic sole. High-grade tectonic blocks originated in thin, thermally zoned metamorphic sheet welded to oceanic hanging wall plate at

inception of subduction. Break-up at depth by tectonic erosion led to dispersal of fragments into newly developed serpentinite melange wedge)

Parkinson C. (1998)- An outline of the petrology, structure and age of the Pompangeo Schist Complex of Central Sulawesi, Indonesia. *The Island Arc* 7, 1-2, p. 231-245.

*(online at: www.academia.edu/30194293/An_outline_of_the_petrology_structure_and_age_of_the_P_Etc.)
(C Sulawesi Pompangeo Schist is metamorphosed accretionary complex, with phyllitic marble, phyllite, schist and quartzite, all of terrigenous- marine origin. Along E margin schists interthrust with unmetamorphosed Early Jurassic sandstone (may be Cretaceous?; JTvG), which may be parent material. Schists unconformably overlain by Albian-Cenomanian pelagic sediment. Synmetamorphic NNW-SSE striking and W dipping isoclinal folding. E-W metamorphic gradient, representing rel. low T gradient of 15°C/ km. K-Ar ages ~108-114 Ma. Correlative metamorphic rocks may underlie W Sulawesi Neogene magmatic province. Pompangeo and Bantimala schists probably generated in same subduction system responsible for C Kalimantan Mesozoic arc)*

Parkinson, C.D. (1998)- Emplacement of the East Sulawesi ophiolite: evidence from sub-ophiolite metamorphic rocks. *J. Southeast Asian Earth Sciences* 16, 1, p. 13-28.

(online at: https://www.academia.edu/30194294/Emplacement_of_the_East_Sulawesi_Ophiolite_evidence_from_subophiolite_metamorphic_rocks)

(E Sulawesi Ophiolite age still debated (E Cretaceous??), ~15 km thick, lava geochemistry suggesting back-arc or supra-subduction origin. Metamorphic sole at base ESE composed of isoclinally folded, thin garnet and epidote amphibolite and basal greenschist metaclastics, with Oligocene K/Ar ages (33-28 Ma; = cooling/ overthrust ages). Metamorphic sole sequence can be traced laterally for ~500 km across SE Sulawesi. Between basal metamorphic sole and underlying Pompangeo schist (~110 Ma metamorphism; = Sundaland basement?; similar to Latimodjong and Bantimala Complexes in C Sulawesi) are Peluru melange and imbricated continental margin sediments (which include 'Matano Fm' Cretaceous pelagic limestones. E-dipping tectonite fabrics in amphibolite and underlying basement mica schist and overlying peridotite indicate orthogonal E to W emplacement of ophiolite in C Sulawesi. Followed by W Sulawesi arc volcanism in E Miocene and collision of Banggai-Sula Platform in Late Miocene)

Parkinson, C.D. & T. Dooley (1996)- Basin formation and strain partitioning along strike-slip fault zones. *Bull. Geological Survey of Japan* 47, 8, p. 427-436.

(online at: https://www.gsj.jp/data/bull-gsj/47-08_02.pdf)

(On strike-slip fault zones, with examples from Sulawesi: series of curvilinear sinistral strike-slip fault zones (Palo-Kuro, Poso, Matano and Lawanopo), formed after Late Miocene collision of Sula Platform and E Sulawesi Ophiolite)

Parkinson, C.D. & I. Katayama (1999)- Present-day ultrahigh-pressure conditions of coesite inclusions in zircon and garnet: evidence from laser Raman microspectroscopy. *Geology (GSA)* 27, p. 979-982.

(Coesite is high-pressure polymorph of quartz and occurs as inclusions in deeply subducted, metamorphosed crustal rocks in several Eurasian collisional orogens, including in zircons in eclogites from Bantimala Complex, S Sulawesi. It is primary indicator mineral of ultrahigh-pressure metamorphism)

Parkinson, C.D. & I. Katayama (1999)- Metamorphic microdiamond and coesite from Sulawesi, Indonesia; evidence of deep subduction at the SE Sundaland margin. *American Geophysical Union (AGU), 1999 Fall Meeting, EOS Transactions* 80, 46, Supplement, p. 1181. *(Abstract only)*

(In situ diamond grains identified by laser Raman spectroscopy within quartz pseudomorphs after coesite in E Cretaceous (130-120 Ma) garnet in jadeite quartzite of Bantimala complex, C Sulawesi. Indicate ultrahigh-pressure conditions (>4 GPa) and subduction of continental crust to depths within diamond stability field, followed by rapid exhumation)

Parkinson, C.D., K. Miyazaki, K. Wakita, A.J. Barber & D.A. Carswell (1998)- An overview and tectonic synthesis of the Pre-Tertiary very-high pressure metamorphic and associated rocks of Java, Sulawesi and Kalimantan, Indonesia. *Island Arc* 7, p. 184-200.

(online at: www.academia.edu/26104720/An_overview_and_tectonic_synthesis_of_the_pre_Tertiary_Etc.)

Pearson, D.F. & N.M. Caira (1999)- The geology and metallogeny of central North Sulawesi. In: G. Weber (ed.) Proc. PACRIM '99 Congress, Bali 1999, Australasian Institute of Mining and Metallurgy (AusIMM), Parkville, 4, 99, p. 311-326.

(N Arm Sulawesi gold and base metal mineralisation styles: porphyry Cu-Au; porphyry-related gold and base metal veins; high-sulphidation Cu-Au-As; low-sulphidation epithermal Au; hydrothermal breccias; and sediment-hosted Au mineralisation. Different Miocene and Pliocene porphyry systems recognised whilst most remaining epithermal mineralisation Pliocene or later. Central N Arm of Sulawesi Miocene magmatic island arc on E Tertiary oceanic basaltic basement, overprinted by Pliocene arc. Structural fabric dominated by SSE arc-normal and ESE arc-parallel faults, established during Miocene under dextral wrench regime. Intersections of major fault sets favoured sites for Miocene porphyry Cu-Au)

Perdana, M.J. & H. Amijaya (2010)- Identification of geochemical degradation of oil seep from Paniki River, Kalukku, Mamuju, West Sulawesi. Proc. 34th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA10-SG-036, p. 1-10.

(Oil seeps in Paniki River, Kalukku, 40 km NE of Mamuju, W. Sulawesi, considered to have originated from Eocene coals or carbonaceous clays of Toraja Fm. GCMS work suggests severe biodegradation)

Perdana, M.J. & H. Amijaya (2011)- Source indication of oil seep from Paniki River, Kalukku, Mamuju, West Sulawesi, based on geochemical characterization. Proc. 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-030, p. 1-10.

(online at: https://www.iagi.or.id/web/digital/10/2011_IAGI_Makassar_Source-Indication-of-Oil.pdf)

(Many oil and gas seeps in W Sulawesi area. Paniki River seep oil biodegraded. Common bicadinane, oleanoids, oleanane, and taraxastane show oil probably derived from higher land plants. No gammaceranes)

Perello, J.A. (1994)- Geology, porphyry Cu-Au, and epithermal Cu-Au-Ag mineralization of the Tombulilato district, North Sulawesi, Indonesia. J. Geochemical Exploration 50, p. 221-256.

(N Sulawesi Tombulilato district island arc-type volcano-sedimentary pile with >3400m of Late Miocene(?) - Pleistocene volcanics, interbedded with marine and continental sediments. Sequence intruded by high-level stocks and dikes, cut by Late Pliocene- Pleistocene diatreme breccias, some associated with Cu mineralization. Main compressive deformation event in Pliocene. Mineralization between 2.9 - 0.9 Ma as part of district-scale hydrothermal system. Uplift and erosion removed ~2 km of rock in last 3 Myr)

Permana, A.P. & S.S. Eraku (2020)- Analisis kedalaman laut purba batu gamping Gorontalo berdasarkan Kandungan fosil foraminifera bentonik. Bioeksperimen, Jurnal Penelitian Biologi 6, 1, p. 17-23.

(online at: <https://journals.ums.ac.id/index.php/bioeksperimen/article/view/10428/5388>)

(‘Analysis of the depth of the ancient sea of Gorontalo limestone based on the content of benthonic foraminifera fossils’ Four benthic foraminifera species identified in limestone of unspecified age in highlands of Gorontalo, N Sulawesi. (50% misidentified;waste of time; JTvG)

Permana, A.P., M. Kasim & F.K. Mamonto (2021)- Analisis lingkungan purba batugamping daerah Limboto Barat Kabupaten Gorontalo. Jurnal Geosapta 7, 2, p. 97-102.

(<https://ppjp.ulm.ac.id/journal/index.php/geosapta/article/view/10681/pdf#>)

(‘Analysis of limestone depositional environment inf the West Limboto area, Gorontalo Regency’. Foraminifera from 7m thick coralline limestone section in W Limboto area, Gorontalo, N Sulawesi, presumably of E Pliocene age. (Most benthic foram identifications are wrong and so is brackish lagoon- estuary paleoenvironmental interpretation; not good; JTvG))

Permana, A.P., S. Pramumijoyo & Akmaluddin (2019)- Uplift rate of Gorontalo Limestone (Indonesia) based on biostratigraphy analysis. News of the National Academy of Sciences of the Republic of Kazakhstan, Geology and Technical Sciences 6 (438), p. 6-11.

(online at: <http://www.geolog-technical.kz/images/pdf/g20196/6-11.pdf>)

(Measured limestone section of 24m near Limboto Lake. Age around Miocene-Pliocene boundary (5.8 Ma), elevation 70m, paleobathymetry 338.661m or 324.825m (???) ; bizarre precision!), giving uplift rate of ~70m/Million years)

Permana, A.P., S. Pramumijoyo & Akmaluddin (2019)- Analysis of microfacies and depositional of limestone in Yosonegoro area, Gorontalo Province, Indonesia. Bull. Iraq Natural History Museum 15, 4, p. 443-454.

(online at: <https://jnhm.uobaghdad.edu.iq/index.php/BINHM/article/view/367>)

(Measured limestone section of 24m near Limboto Lake given new name, Limboto Limestone Formation. Outer shelf- upper slope paleoenvironments. Age??)

Permana, A.P., S. Pramumijoyo & Akmaluddin. (2020)- Paleobathymetry analysis of limestone in Bongomeme region based on content of benthic foraminifera fossil, Gorontalo District, Indonesia. Bull. Iraq Natural History Museum 16, 1, p. 1-14.

(online at: <https://jnhm.uobaghdad.edu.iq/index.php/BINHM/article/view/417/300>)

(Benthic foraminifera in reefal coral rudstones suggest paleobathymetry middle-outer shelf (27.45- 91.5m (!!)) in Bongomeme 1, while in Bongomeme 2 and 3 is middle shelf (29.28-45.75m). Age unknown? (N.B.: foram identifications and conclusions debatable; JTvG))

Permana, A.P., S. Pramumijoyo, Akmaluddin & D.H. Bariato (2021)- Planktonic foraminiferal biostratigraphy of the Limboto Limestone, Gorontalo Province, Indonesia. Kuwait J. Science 48, 1, p. 116-126.

(online at: <https://journalskuwait.org/kjs/index.php/KJS/article/view/6916/427>)

(64m thick section of Limboto Limestone NW of Limboto Lake in N Sulawesi with latest Miocene (N17 or M13b-M14)- earliest Pliocene (PL1) planktonic foraminifera. Previously mapped as Late Pliocene- Pleistocene Clastic Limestone Formation?)

Permana, H. (2013)- Kompleks batuan malihan. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 127-152.

('Metamorphic rock complexes'. Chapter 7 in 'Geology of Sulawesi' book. Brief review of metamorphic rocks of Sulawesi. Nine main metamorphic complexes (Malino, Pompangeo, Mengkoka, Mendoke-Rumbia-Kabaena, Palu-Koro, Latimojong-Karossa, Matano, Bantimala-Barru and Buton), mainly of Cretaceous age, and associated with Triassic-age ultramafic rocks)

Permana, H., S.A. Awdia, A. Patonah & S. Solihin (2023)- Dynamic recrystallization study of the ultramafic rock of the Malili-Wasuponda melange complex (South Sulawesi) and Wolo Cape (Southeast Sulawesi), Indonesia. Proc. 4th Int. Conference Geoscience and Earth Resources Engineering, Bandung, 2022, IOP Conference Series: Earth and Environmental Science 1288, 012003, p. 1-10.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1288/1/012003/pdf>)

(Ultramafic rocks of Wasuponda melange complex and Wolo Cape areas, SE Sulawesi, undergone dynamic recrystallization under P from ~13 MPa to 52 MPa. Main recrystallization of Malili-Wasuponda peridotite at 52 MPa, while peridotite of Wolo Cape formed at stress of 30-32 MPa)

Permana, H. & Surono (2013)- Kompleks ofiolit. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 213-224.

('Ophiolite complexes'. Chapter 9 in Geology of Sulawesi book. Brief review of major ophiolite complexes of East and SE Arms of Sulawesi and peridotites in Palu-Koro zone and Bantimalu- Barru melanges. E Sulawesi ophiolite overlain by E Cretaceous radiolarian cherts (Valanginian- Cenomanian)

Permanadewi, S. & Baharuddin (2012)- Cooling of granitic rocks in the Palu region, Middle Sulawesi: zircon and apatite fission track constraints. Jurnal Sumber Daya Geologi (JSDG) 22, 3, p. 131-136.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/112/104>)

(Zircon and apatite FT data suggest two cooling episodes of Oligocene granitic rocks in Palu region, C Sulawesi: (1) in south cooling around 30 Ma, (2) in north ('neck' area) rapid cooling due to local uplift, possibly in response to overthrust at ~6 Ma (Late Miocene))

- Permanadewi, S. & H. Samodra (2022)- Analisis petrografi dan geokimia batuan diorit-granodiorit-granit di Daerah Gorontalo, Sulawesi. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 23. p. 235-246.
(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/718/492>)
(*'Petrographic and geochemical analysis of the diorite-granodiorite-granite rocks in the Gorontalo area, Sulawesi'. Gorontalo diorite-granodiorite-granite group intermediate-acid plutonic igneous rocks calc-alkaline magma series in subduction tectonic setting with estimated partial melting depth at depths of 114-160 km*)
- Permanadewi, S. & H. Utoyo (1994)- Perbandingan umur hasil pentarikan Kalium-Argon batuan granitik, daerah Bora, Sulawesi Tengah dengan hornblenda dan biotit sebagai mineral penentu. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 4, 36, p. 16-20.
(*'Results of K- Ar dating of granitic rocks in Bora area, C Sulawesi, comparing hornblende and biotite data'. K-Ar dates of granitic rocks from Bora area, S of Palu, using biotite ~16.2-16.4 Ma, hornblende ~16.5-16.9 Ma (near E-M Miocene boundary)*)
- Pezzati, G. (2016)- Basin development in Gorontalo Bay, Sulawesi. Ph.D. Thesis, Royal Holloway London University, p. 1-257. (*Unpublished*)
- Pezzati, G., R. Hall, P. Burgess & M. Perez-Gussinye (2014)- The Poso Basin in Gorontalo Bay, Sulawesi: extension related to core complex formation on land. *Proc. 38th Annual Conv. Indonesian Petroleum Association (IPA)*, Jakarta, IPA14-G-297, p. 1-12.
(*Seismic analysis and literature research suggest possible E Miocene origin for Gorontalo Bay, following Sula Spur collision. In W part of Gorontalo Bay two subbasins, northern Tomini Basin and southern Poso Basin. Poso Basin much younger than Tomini Basin; its development may be related to extension associated with development of metamorphic core complexes onshore*)
- Pholbud, P., R. Hall, E. Advokaat, P. Burgess & A. Rudyawan (2012)- A new interpretation of Gorontalo Bay, Sulawesi. *Proc. 36th Annual Conv. Indonesian Petroleum Association (IPA)*, Jakarta, IPA12-G-029, p. 1-23.
(online at: www.researchgate.net/publication/259672211_A_new_interpretation_of_Gorontalo_Bay_Indonesia)
(*Interpretation of ages of seismic horizons of Gorontalo Bay difficult due to absence of wells. Two age scenarios for rifting-subsidence timing: Eocene- Recent or Miocene-Recent. Most of subsidence young and tied to slab rollback of N Sulawesi subduction zone*)
- Piccoli, G., E. Robba & S. Sartono (1994)- Mixed fossil molluscs from Tana Toraja (South Sulawesi, Indonesia). In: *Studies on ecology and palaeoecology of benthic communities*, Proc. 5th Paleobenthos Symposium, Rome 1992, *Boll. Societa Paleontologica Italiana*, Modena, Special Volume 2, p. 221-226.
- Pieters, P.E. (2010)- Geological study of Lariang and Karama Basins, Tately Budong-Budong N.V. PSC, West Sulawesi. Report Tately Budong-Budong N.V., p. 1-52. (*Unpublished*)
- PND- Patra Nusa Data (2009)- Opportunities (I), Bone Basin. *Inameta J.* 8, Sept. 2009, p. 23-27.
(online at: www.patranusa.com)
(*Overview of Bone Basin, S Sulawesi, in conjunction with tender round*)
- Poedjoprajitno S. (2012)- Morphostructure control towards the development of Mahawu Volcanic Complex, North Sulawesi. *Jurnal Geologi Indonesia* 7, 1, p. 39-54.
(online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/365)
(*Development pattern of N Sulawesi Mahawu, Linau, Tompusu and Kasurutan volcanic cones irregular, except Mahawu Volcano Complex showing linear pattern interpreted as NW-SE fault controlling rise of magma*)
- Polve, M., R.C. Maury, H. Bellon, C. Rangin, B. Priadi, S. Yuwono, J.L. Joron & R. Soeria-Atmadja (1997)- Magmatic evolution of Sulawesi (Indonesia): constraints on the Cenozoic geodynamic history of the Sundaland active margin. *Tectonophysics* 272, p. 69-92. (online at: [https://doi.org/10.1016/S0040-4015\(97\)00030-8](https://doi.org/10.1016/S0040-4015(97)00030-8))

https://www.academia.edu/64006209/Magmatic_evolution_of_Sulawesi_Indonesia_constraints_on_the_Cenozoic_geodynamic_history_of_the_Sundaland_active_margin

(Paleocene magmatic activity limited to Makassar area (61-59 Ma). Major Eocene (50-40 Ma) event with tholeiitic pillow lavas and basaltic dikes of back-arc basin affinity in all areas, possibly equivalent to Celebes Sea basaltic basement. Oligocene- Miocene island-arc tholeiites and calc-alkaline series (mainly 30-15 Ma) Widespread K-rich magmatic event between 13-10 Ma. Calc-alkaline activity resumed only in N Arm in Late Miocene (9 Ma) and still active in Manado region. K-rich activity continued in S until Pleistocene (0.77 Ma). Most recent event in C Sulawesi 6.5- 0.6 Ma granites and acid tuffs, probably strong continental imprint)

Polve, M., R.C. Maury, P. Vidal, B. Priadi, H. Bellon, R. Soeria-Atmadja, J.L. Joron & J. Cotten (2001)- Melting of lower continental crust in a young post-collision setting: a geochemical study of Plio-Quaternary acidic magmatism from Central Sulawesi (Indonesia). Bull. Societe Geologique France 174, p. 305-317.

(online at: www.researchgate.net/publication/286188049_Melting_of_lower_continental_crust_in_a_Etc.)

(Acid, potassic, calc-alkaline magmas in C part of Sulawesi West arm from 6.5-0.6 Ma (dacites, rhyolites, granites. Chemical signatures consistent with Australian granulites and Indian Ocean sediments suggest magmas derived from anatexis of lower crust of Australian origin (Banggai-Sula?) after M Miocene collision with W Sulawesi Sundaland margin and possibly breakoff of subducted Molucca Sea slab)

Pouyet, S. & G. Braga (1993)- *Thalamoporella sulawesiensis* n. sp. (Bryozoa, Cheilostomata) from the Eocene of Sulawesi. Neues Jahrbuch Mineralogie Geologie Palaontologie, Monatshefte 1993, 2, p. 88-96.

(Bryozoa from limestone at Salubarani, Tanah Toraja region. Age presumably Eocene, but age doubtful?)

Prahastomi, M., A. Fahrudin, L.D. Santy & R. Adlan (2022)- Depositional facies model and reservoir quality of Paleogene Limestone in Labengki Island, Southeast Sulawesi. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 23, 3, p. 189-196.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/507/487>)

(Eocene- E Oligocene Tampakura Fm limestones in Labengki Island, Kendari Basin, off SE Sulawesi, deposited in rimmed carbonate shelf setting with extensive development of high energy facies. Composed of (oolitic) grainstone, boundstone and floatstone. Locally dolomitized (N.B. No fossil evidence ever presented to justify Paleogene age of Tampakura ooidal and dolomitized limestones in SE Sulawesi area?. Oolitic Eocene carbonates virtually or entirely absent in the Tertiary of SE Asia; possibly Late Triassic age?; JTvG)

Pratama, A., A. Idrus, I.W. Warmada & Saifullah (2024)- Lithological control to the gold mineralization in the Main Ridge Complex of the Bakan Gold District, Northern Sulawesi, Indonesia. Proc. 2nd Int. Conference Geological Engineering and Geosciences (ICGOES), Yogyakarta 2022, IOP Conference Series: Earth and Environmental Science 1378, 012030, p. 1-11.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1378/1/012030/pdf>)

(N Sulawesi Main Ridge volcanics complex in Sulawesi North Arm with Late Neogene tuff units. Highest gold mineralization in dacite tuffs and diatreme breccia)

Priadi, B. (1993)- Geochimie du magmatisme de l'Ouest et du Nord de Sulawesi: tracages des sources et implications geodynamiques. Doct. Thesis, Universite Paul Sabatier, Toulouse III, p. 1-293. (Unpublished)

(‘Geochemistry and magmatism of W and N Sulawesi’. Study of petrology and geochemistry of magmatic rocks of SW, C and N Sulawesi. S Sulawesi different history from rest of island, with Jurassic tholeiitic magmatism. Calc-alkaline magmatism rare, tholeiitic and potassic magmatism more common. Old cycle in S only (55-60 Ma), calc-alkaline magmatism in S and C at 30 -17 Ma. In S-most sector highly potassic magmatism between 11-3 Ma and in C part acid calc-alkaline magmatism at 6-0.5 Ma. In N Sulawesi calc-alkaline magmatism continuation of Philippine Arc (incl. 22 Ma date) with ~15 Ma change from subduction to collision regime)

Priadi, B. (1996)- Kompleks granitoid Neogen di Sulawesi Tengah: tinjauan geokimia. Buletin Geologi (ITB) 26, 2-3, p.

(‘Neogene granitoid complex in C Sulawesi’. Neogene granitoid (5.5-3.2 Ma) along C Sulawesi Palu-Koro Fault associated with Late Miocene-Recent potassic calc alkaline (KCA) magmatism. Correlated with collision of Banggai-Sula micro-continent with Sulawesi in M Miocene, but details about genesis still limited)

Priadi, B. (2011)- Sulawesi magmatic arcs. In: N.I. Basuki (ed.) Proc. Seminar Sulawesi Mineral Resources 2011, Manado, MGEI/IAGI, p. 111-120.

(Magmatic arc products in Sulawesi mostly in W and N Arms. Oldest magmatism exposed in S part indicates Late Jurassic age (Lamasi Volcanics at E side of S arm; 159-137 Ma), with characteristics of back arc or marginal-basin magmatism (possibly part of dismembered E Sulawesi ophiolite). Paleogene- M Miocene mostly subduction-related magmatism, but W and N arms not connected until Eocene. Local Paleocene non subduction-related magmatism in N Arm may represent S-ward obducted parts of Sulawesi Sea. M Miocene-Recent magmatism different magmatic affinities, correlated with E-M Miocene collision of Banggai-Sula microcontinent, affecting melting of lower continental crust, producing magma with potassic calc-alkaline affinity in Palu-Tolitoli areas. Collision also halted subduction in S, with M Miocene- Recent alkaline/shoshonitic post-subduction magmatism in Makassar-Toraja area)

Priadi, B (2013)- Magmatisme Sulawesi. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 113-126.

(Magmatism of Sulawesi'. Chapter 6 in Geology of Sulawesi book. Review of Sulawesi magmatism in Pre-Tertiary, Paleogene, Neogene and Quaternary)

Priadi, B., H. Bellon, R.C. Maury, M. Polve, R. Soeria-Atmadja & J.C. Philippet (1994)- Magmatic evolution in Sulawesi in the light of new 40K-40Ar age data. Proc. 23rd Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, 1, p. 355-369.

(online at: <https://www.iagi.or.id/web/digital/62/30.pdf>)

(W Sulawesi volcanic episodes: Jurassic (~150 Ma) back arc basin magmatism, Paleocene subduction-related magmatism (~60 Ma), Oligocene- M Miocene (40-~15 Ma; well-developed in N Sulawesi; also in W and C Sulawesi) subduction-related magmatism and Miocene-Recent (~13-0 Ma) collision-related magmatism)

Priadi, B., R.C. Maury, R. Soeria-Atmadja, M. Polve & H. Bellon (1991)- Tertiary and Quaternary magmatism in Central Sulawesi: chronological and petrological constraints. In: E.P. Utomo et al. (eds.) Proc. The Silver Jubilee LIPI- Symposium on the Dynamics of subduction and its products, Yogyakarta-Karangsambung 1991, Research and Development Center for Geotechnology, Indonesian Institut of Sciences (LIPI), Bandung, p. 165-187.

(same title as Priadi et al. (1994), below)

Priadi, B., M. Polve, R.C. Maury, R. Soeria-Atmadja & H. Bellon (1993)- Geodynamic implications of Neogene potassic calc-alkaline magmatism in Central of Sulawesi: geochemical and isotopic constraints. Proc. 22nd Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 1, p. 59-81.

(Potassic calc-alkaline magmatism of C Sulawesi mostly acidic, ranging in age fom 6.5 Ma- Recent. Isotopic character similar to Australian blocks, suggesting result of collision between two 'Australian' blocks, Banggai Sula in E and western block that is either microcontinent of Australian origin or ancient volcanic arc that incorporated large volume of sediment)f

Priadi, B., M. Polve, R.C. Maury, H. Bellon, R. Soeria-Atmadja, J.L. Joron & J. Cotten (1994)- Tertiary and Quaternary magmatism in Central Sulawesi: chronological and petrological constraints. J. Southeast Asian Earth Sciences 9, 1-2, p. 81-93.

(online at: www.academia.edu/24640566/Tertiary_and_quaternary_magmatism_in_Central_Sulawesi_Etc.)

(Four main magmatic events in C Sulawesi: (1) Late Eocene and Oligocene island arc tholeiites and calc-alkaline intrusions. (2) Lamasi Volcanics: 33-15 My K-Ar ages, but may not be magmatic ages. MORB-type affinity and anomalies indicative of BABB affinity. Origin still enigmatic. (3) Important shoshonitic affinity event at 10.1-11.9 Ma, probably post-subduction associations emplaced in S Sulawesi in Late Miocene and might derive from melting of mantle material after mantle metasomatised during former episode of subduction. (4) Last event 6.5- 0.6 Ma granitic rocks, rhyolites and widely distributed rhyolitic Barupu tuff pyroclastics (0.6 Ma). All magmatic rocks K-rich calc-alkaline composition, lacking basaltic and intermediate magmas (SiO₂ >60%) and high enrichments in incompatible elements and radiogenic Sr isotopic signature. This is consistent with strong crustal imprint by melting of underthrust continental crust in collisional context)

Priadi, B., R. Soeria-Atmadja, R. Maury, H. Bellon & M. Polve (1997)- The occurrence of back-arc magmatism in Sulawesi: geochemical constraints on geodynamic reconstruction. Proc. 26th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 390-403.

(online at: <https://www.iagi.or.id/web/digital/64/30.pdf>)

(Two volcanic units along E edge of S arm of Sulawesi: (1) Kalamiseng Fm pillow lava-breccia, with Miocene (~17-22 Ma K-Ar ages), but may be older; (2) Lamasi Volcanics in NE part of S Sulawesi K-Ar ages suggest 3 episodes of activity, including oldest ages of Sulawesi volcanics: (1) 'Palopo ophiolite' 'back-arc' micro-gabbro cut by dikes; Late Jurassic-earliest Cretaceous (~159-137 Ma) and subduction-related (2) Oligocene Lamasi-Songka volcanics (~33-28 Ma) and (3) M Miocene Lamasi- Pohi Volcanics (~15.4 Ma) volcanics. In N part of W Sulawesi and N Sulawesi mainly Eocene (~34-50 Ma) Tinombo Fm mostly back arc basin chemistry and Paleogene K-Ar ages. Younger volcanics less common and subduction related)

Priadi, B., I.G.B.E. Sucipta & J. Sopaheluwakan (2009)- Post-collisional granitoids in Central Sulawesi, Indonesia. In: 11th Regional Congress Geology Mineral Energy Resources of SE Asia (GEOSEA 2009), Kuala Lumpur, p. 45. (Abstract only)

(online at: <https://gsm.org.my/articles/702001-101669/>)

(Neogene potassic calc-alkaline granitoids and dacitic-rhyolitic volcanics along Palu-Koro FZ of C Sulawesi)

Priadi, B., I.G.B.E. Sucipta, H. Utoyo, J. Sopaheluwakan, W. Sudarsono & Widiasmoro (1996)- Kompleks granitoid Neogen di Sulawesi Tengah, tinjauan geokimia. Buletin Geologi (ITB) 26, 2/3, p. 129-141.

(online at: https://www.researchgate.net/publication/288030831_Kompleks_Granitoid_Neogen_Di_Sulawesi_Tengah_Tinjauan_Geokimia)

(*'Geochemistry of Neogene granitoid complexes in Central Sulawesi'. At least three groups of Late Miocene-Recent granitoids along Palo-Kuro Fault Zone, of potassic calc-alkaline magmatic affinity: (1) Coarse-grained granitoids with K-feldspar megacrysts (Granitoid-C, 8.4- 3.7 Ma), (2) Medium-grained, gneissic and mylonitized granitoids (Granitoid-B, 5.5-3.2 Ma), and (3) Fine-grained, biotite-poor granitoids (Granitoid-A, 3.1-1.8 Ma). Also older group of gneissic granitoids (Granitoid-D, 96.4 Ma)*)

Priadi, B., I.G.B.E. Sucipta, H. Utoyo, J. Sopaheluwakan & Sudarsono (1999)- Distribution of Neogene granitoid along the Palu-Koro fault zone, Central Sulawesi. In: H. Darman & F.H. Sidi (eds.) Tectonics and sedimentation of Indonesia, FOSI-IAGI-ITB Regional Seminar to commemorate 50th anniversary of Van Bemmelen's Geology of Indonesia, Bandung 1999, p. 72-74.

(*Late Miocene- Recent potassic calc-alkaline magmatism along left-lateral Palu-Koro fault zone, possibly tied to collision of Banggai-Sula collision. Three groups of granitoids aged between ~8.4- 1.7 Ma, with possible contributions of continental material (SiO₂ >60%). Also gneissic granitoid of Cretaceous (96.4 Ma age)*)

Priadi, B., H. Utoyo, Sudarsono, Widiasmoro, J. Sopaheluwakan, A. Kadarusman & D. Sukarna (1995)- Petro-geochemical variations of granitoids along Palu-Koro Fault Zone, Central Sulawesi. Proc. 6th Int. Congress Pacific Neogene Stratigraphy and IGCP-355, PUSPITEK-Serpong, p. 34-36.

Prihatmoko, S. & H. Lubis (1992)- Porfiri Au-Cu pada tubuh breksi di prospek Bulagidun, Lengan Utara, Sulawesi. Proc. 21st Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 1, p. 233-240.

(online at: <https://www.iagi.or.id/web/digital/51/14.pdf>)

(*'Au-Cu porphyry at breccia bodies in the Bulagidun prospect, North Arm Sulawesi'. Three Au-Cu-bearing breccia bodies discovered by BHP in 1987 in remote N Sulawesi, SW of Manado. Diorite-tonalite intrusives invaded andesitic lava (9.4 Ma). Latest alteration 8.75 Ma. Possibly high Au porphyry Cu system, but presence of tourmaline unusual)*)

Priyanto, B. & M.R. Fitriannur (2008)- Neogene tectonic and sedimentary control to hydrocarbon generation in Banggai Basin, Eastern Sulawesi. Proc. 37th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 1, p. 54-65.

(online at: https://www.iagi.or.id/web/digital/14/2008_IAGI_Bandung_Neogene-Tectonic-and-Sedimentary.pdf)

(Literature review of Banggai Basin, formed as result of Miocene collision of Banggai-Sula microplate and E Sulawesi. Basin stratigraphy two distinct periods: (1) continental margin rift to collision, and (2) latest Miocene-Pliocene foreland basin molasse sequence. Numerous oil and gas seeps in NW Taliabu, wet gas seeps near Falabisahaya in Mangole, oil and gas from Dongkala-1, gas from Minahaki-1 and Matindok-1. Source, reservoir and seal rocks all within Miocene sequence. No new data)

Purawardi, R. (2008)- Karakteristik bijih kromit Barru, Sulawesi Selatan. J. RISET Geologi dan Pertambangan (LIPI) 18, 1, p. 1-13.

(online at: <https://jrisetgeotam.brin.go.id/index.php/jrisgeotam/article/view/3/13>)

('Characteristics of Barru chromite ore, S Sulawesi'. Barru District asymmetric structural axes N-S and NW-SE trending. Chromite as podiform deposits in Triassic(?) serpentinitized ultrabasic rocks, mostly at fault zones and around contact zone with dacitic rock)

Purnamaningsih, D. Sukarna & H. Panggabean (1995)- The geology, mineral and energy resources of northern West Sulawesi. In: J. Ringis (ed.) Proc. 31st Session Committee Co-ord. Joint Prospecting Mineral Resources in Asian Offshore Areas (CCOP), Kuala Lumpur 1994, 2, p. 20-35.

(online at: <https://repository.unescap.org/server/api/core/bitstreams/4198bc42-86c9-49fe-843e-60aebca03e54/content>)

(N part of W Sulawesi recently re-mapped. Covers Lariang and Karama sub-basins. Basement of unnamed M Cretaceous or older high-grade metamorphics, possibly part of accretionary complex along Eurasian continent, overlain by thick flysch-type, low-metamorphic, Upper Cretaceous Latimojong Fm. Unconformably overlain by Middle to-Late Eocene clastics and Nummulites limestones and Oligocene- M Miocene Tonasa Lst carbonate platform, up to 2500m thick, in S of area. Late Oligocene- E Miocene (29-22 Ma) Lamasi island arc volcanics, etc. Plio-Pleistocene thin-skinned W-directed thrusting= Majene foldbelt. With three simple, hard-to-understand paleogeographic maps)

Purnomo, E., S.P. Tony & A. Luthfi (1999)- Relative age indicator of Sulawesi collision zone, eastern arm of Sulawesi. In: H. Darman & F.H. Sidi (eds.) Tectonics and sedimentation of Indonesia, FOSI-IAGI-ITB Regional Seminar to commemorate 50th anniversary of Van Bemmelen's Geology of Indonesia, Bandung 1999, p. 76-78. *(Extended Abstract)*

(Batui collision zone between S part of East Arm of Sulawesi and Banggai Sula microcontinent. Syn-collisional bathyal Poh Fm marls (between pre-collision Salodik Fm carbonates-clastics and post-rift Celebes molasse) with planktonic foraminifera of E Pliocene age)

Puspita, S.D., R. Hall & C.F. Elders (2005)- Structural styles of the offshore West Sulawesi fold belt, North Makassar Straits, Indonesia. Proc. 30th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, 1, p. 519-542.

(Offshore W Sulawesi Fold Belt (WSFB) three structural provinces, S, C and N, controlled by basement structures and differing in amount and character of Cenozoic sediment. Central High (with onlap of sediments from Kalimantan, little sediment from W Sulawesi, and fold-thrust belt extending short distance offshore) separates S and N provinces, which extend W into deep water and display different deformation styles, sediment thickness and sediment types. Palu-Lariang region likely source of sediments in N; Karama-Kalosi region probable source for S. Deformation propagating W from onshore Sulawesi and began in Pliocene. N Makassar Straits underlain by thinned continental crust)

Putra, P.S., Aswan, K.A. Maryunani, E. Yulianto & W. Kongko (2019)- Field survey of the 2018 Sulawesi tsunami deposits. Pure and Applied Geophysics 176, p. 2203-2213.

(online at: <https://www.academia.edu/download/101901132/s00024-019-02181-920230506-1-zdvito.pdf>)

(Deposits of destructive tsunami after Mw 7.5 Palu earthquake on 28 September 2018, in Palu Bay, NW Sulawesi. Tsunami height was ~5-8 m with maximum inundation distance of 310m. Tsunami deposits generally 1-6 cm thick, max. 26 cm, with fining upward sequences)

Putra, P.S., Aswan, K.A. Maryunani, E. Yulianto, S.H. Nugroho, R.N.F. An Nahar, I. Amanda et al. (2022)- Characterization of sedimentary features of the 2018 Palu tsunami event, Sulawesi, Indonesia. Pure and Applied Geophysics 179, 5, p. 1561-1582.

(Tsunami deposits of 2018 Palu earthquake sampled along two transects on E coast of Palu Bay. Deposits generally fining upward, except for seaward sites at Kayumalue. Foraminifera dominated by benthic species. Dominant sources of tsunami deposits transitional to inner neritic zones, with minor contribution from pre-tsunami sediments)

Putri, N.S., M. Mawaleda, A. Jaya & I. Setiawan (2021)- Hydrothermal alteration, ore mineralization, and fluid inclusion characteristics of Tarra Prospect, Awak Mas deposit, Luwu Area, South Sulawesi, Indonesia. *Int. Journal of Engineering and Science Applications (IJEScA; UNHAS)* 8, 2, p. 67-73.
(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/3274/790>)
(Tarra part of Awak Mas gold prospect in S part of Latimojong Complex, W Sulawesi. Host rock of gold mineralization meta-sedimentary rocks of Latimodjong Fm. Two types of alteration)

Qi, D.R., T.G. Lan, Q. Shu, Y. Feng & S.H. Zhou (2024)- Nickel enrichment during lateritization of ophiolitic ultramafic rocks: A case study from the Kelurahan Pondidrha laterite profile in Sulawesi, Indonesia. *Ore Geology Reviews* 170, 106140, p. 1-13.
(online at: <https://www.sciencedirect.com/science/article/pii/S0169136824002737>)
(Nickel in newly discovered Ni-bearing laterite profile in Kelurahan Pondidrha area in SE Sulawesi highest contents in saprolitic layer rather than more weathered lateritic layer)

Querubin, C.D. & S. Walters (2011)- Geology and mineralization of Awak Mas: a sedimentary hosted gold deposit, South Sulawesi, Indonesia. In: N.I. Basuki (ed.) *Proc. Sulawesi Minerals Resources Seminar 2011, Manado 2011, MGEI/IAGI*, p. 211-229.
(See also updated version Querubin & Walters 2012)

Querubin, C.D. & S. Walters (2012)- Geology and mineralization of Awak Mas: a sedimentary hosted gold deposit, South Sulawesi, Indonesia. *Majalah Geologi Indonesia (IAGI)* 27, 2, p. 69-85.
(online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/736)
(Awak Mas gold project in S part of C Sulawesi Metamorphic Belt, SSW of Palopo, explored since 1987. Hosted in intensely folded (WSW to SW-directed thrusting?, generally 15-50°N-dipping) Late Cretaceous Latimojong Fm flysch-type phyllites, slates, volcanics, limestones and schists, overlying basement metamorphic rocks and intruded by late diorite-monzonite plugs and stocks. T-P regime suggests either subduction or massive thrusting environment. ~N-S trending oblique normal faults and extensional fractures local controls to mineralization)

Rachman, R.S., S.A. Wibisono & R. Hidayat (2023)- Identifikasi lingkungan pengendapan batubara berdasarkan analisis petrografi organik pada Formasi Toraja, Sulawesi Barat. *Jurnal Geosapta* 9, 2, p. 87-93.
(online at: <https://ppjp.ulm.ac.id/journal/index.php/geosapta/article/view/15577/pdf>)
(‘Identification of coal depositional environment based on organic petrographic analysis of the Toraja Formation, West Sulawesi’. Coal in (Eocene) Toraja Fm has lignite-bituminous rank. Depositional environment fluvial with mire conditions that are ever wet)

Radja, V.T. (1970)- Geothermal energy prospects in South Sulawesi, Indonesia. *Geothermics* 2, 1, p. 136-149.
(Indonesia geothermal potential large and genetically linked to volcanism. Preliminary appraisal of S Sulawesi suggests potential for 9 geothermal fields)

Rafianto, R.I. (2011)- Developing Indonesian nickel deposits: challenges and opportunities. *Proc. 36th HAGI and 40th Annual Conv. Indonesian Association Geologists (IAGI), Makassar 2011*, p. 1-7.
(online at: https://www.iagi.or.id/web/digital/10/2011_IAGI_Makassar_Developing-Indonesian-Nickel.pdf)
(General review. Netherlands Indies Geological Survey nickel surveys in SE Sulawesi in early 1900s. First small scale mining by Bonitra MC (a joint venture between Dutch Oost Borneo Maatschappij and German Krupp Industries) at Pomala in 1935-1941, and in 1942-1945 by Japanese Sumitomo Mining. Mining by foreign companies INCO, etc. and Indonesia state company ANTAM since early 1970s. Etc.)

Rafianto, R., F. Attong, A. Matano & M.E. Syam Noor (2011)- The serpentine-related nickel sulfide occurrences from Latao, SE Sulawesi: a new frontier of nickel exploration in Indonesia. In: N.I. Basuki (ed.) Proc. MGEI/IAGI Seminar Sulawesi Mineral Resources 2011, Manado, p. 267-288.

(online at: https://www.academia.edu/9614095/TheSerpentine_RelatedNickelSulfideOccurrencesfromLatao_SESulawesi_aNewFrontierofNickelExplorationinIndonesia)

(Latao area nickel evaluation project since 1970 at W coast of SE Arm of Sulawesi. Rel. unimportant podiform chromite, but Ni Co sulphides mineralizations in serpentinized ultramafic rocks. (Cretaceous) ultramafics obducted over Triassic metasediments and metamorphic rocks)

Rafianto, R., F. Attong, A. Matano & M.E. Syam Noor (2012)- Kehadiran sulfida nikel yang berkaitan dengan serpentin di Latao, Sulawesi Tenggara: suatu frontier baru eksplorasi nikel di Indonesia. *Majalah Geologi Indonesia (IAGI)* 27, 2, p. 87-107.

(online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/768)

(The presence of nickel sulfide related to serpentine in Latao, SW Sulawesi: a new frontier of nickel exploration in Indonesia'. Same as Rafianto et al. 2011)

Rafianto, R. & G.H. Tutuko (2010)- 40 years PT INCO exploration: evolution in method and understanding nickel mineralization in Sulawesi. Proc. 39th Annual Conv. Indonesian Association Geologists (IAGI), Lombok, PIT-IAGI-2010-095, p. 1-15.

(online at: https://www.iagi.or.id/web/digital/12/2010_IAGI_Lombok_40-Years-P.T.-Inco-Exploration.pdf)

(History of INCO exploration and mining of nickel laterites since 1969 in E Sulawesi ultramafic ophiolite complex, focused on Sorowako area. Largest deposits highest nickel grades in Sorowako area in central part of E Sulawesi. Best nickel laterite deposits on crests and flanks of hills over ultramafic bedrocks (N.B.: little or nothing on geologic setting, and no mention of Ni evaluations in same area in 1920s-1950s; JTvG))

Rahardiawan, R. & L. Arifin (2013)- Struktur geologi Teluk Bone- Sulawesi Selatan. *J. Geologi Kelautan* 11, 3, p. 141-147.

(online at: <http://ejournal.mgi.esdm.go.id/index.php/jgk/article/view/238/228>)

(Geologic structure of Bone Bay, South Sulawesi'. Bone Bay water depth 50-2000m. Seafloor morphology strongly influenced by active faults, incl. flower structures)

Rahardiawan, R., T. Naibaho & L. Arifin (2011)- Struktur dan stratigrafi Cekungan Spermonde, Sulawesi Selatan: studi pendahuluan seismik 2D. *Majalah Geologi Indonesia (IAGI)* 26, 2, p. 83-91.

(online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/765)

(Structure and stratigraphy of the Spermonde Basin, offshore SW Sulawesi: preliminary study of 2D seismic'. Five seismic stratigraphic sequences assumed to be of Eocene- Pliocene age)

Raharjanti, N.A., I.W. Warmada & H.T.B.M. Petrus (2021)- Ore characterization of LSE gold deposit in "X" Pit, Toka Tindung Project, North Sulawesi. Proc. Int. Conference Geological Engineering and Geosciences, Yogyakarta 2021, IOP Conference Series: Earth and Environmental Science 851, 012043, p. 1-10.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/851/1/012043>)

(Toka Tindung is low sulphidation epithermal Au-Ag deposit in N Sulawesi associated with Pliocene-Pleistocene volcanics and controlled dominantly by NNW trending faults. Mineralization as sheeted vein type quartz with colloform texture. Ore minerals sulfides (pyrite, sphalerite). Three alteration zones)

Raharjo, S., R. Seago, E.W. Jatmiko, F.B. Hakim & L.D. Meckel (2012)- Basin evolution and hydrocarbon geochemistry of the Lariang-Karama basin: implications for petroleum system in onshore West Sulawesi. Proc. 36th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA12-G-135, p. 1-22.

(Lariang-Karama basins onshore W Sulawesi M Eocene extensional half-grabens. Mild basin inversion in M Miocene at ~12 Ma, but extension continuing until Plio-Pleistocene inversion/ uplift at ~2 Ma. Fine siliciclastic turbidites in M Miocene in Tike-1 well thought to be distal equivalents to sediments of Kutei in Kalimantan. Most shortening taken up by NW-SE oriented strike-slip faults, compartmentalizing series of folds and thrusts. Oil-gas seeps over major fold structures and along faulted, E margin of coastal Karama basin, generated from M-L Eocene fluvio-deltaic coals and carbonaceous shale. Oils paraffinic, low sulfur, moderately low wax to

waxy. Source of two oil seeps from Lariang Basin dominated by terrestrial higher plant material with minor algal input; seeps from Karama Basin mixed algal-terrestrial, probably open marine/deep lacustrine source)

Rahman, M.R., A. Zainuri & I.N. Manyoe (2019)- Analisis stratigrafi dan rumusan sejarah geologi daerah Limbato dan sekitarnya, Kabupaten Gorontalo Utara, Provinsi Gorontalo. Jurnal Azimut 2, 1, p. 65-71.

(online at: <https://ojs.unitas-pdg.ac.id/index.php/azimut/article/view/435/286>)

(‘Stratigraphic analysis and account of the geological history of the Limbato area and its surroundings, North Gorontalo District, Gorontalo Province’. *Stratigraphy of Limbato area 4 unofficial units: M Miocene granodiorite (subduction), Late Miocene- E Pliocene volcanic breccias, M. Pliocene andesite units and alluvial deposits. Volcanism stopped in E Pliocene, followed by renewed M Pliocene andesite magmatism*)

Raivel, R. & F. Firman (2020)- Karakteristik endapan nikel laterit di bawah Molasa Sulawesi daerah Tinanggea, Sulawesi Tenggara. Jurnal GEOMining (Teknik Pertambangan Unkhair) 1, 1, p. 25-37.

(online at: <https://ejournal.unkhair.ac.id/index.php/geomining/article/view/2156/1537>)

(‘Characteristics of laterite nickel deposits under Sulawesi Molasse, Tinanggea area, SE Sulawesi’. *Nickel laterite formed by weathering of lherzolite ultramafic rocks. Ni elements only in saprolite zone, with highest Ni grade at top of saprolite (2.0-2.9%), with average thickness of 3 m*)

Raivel, R., M. Mawaleda & A. Jaya (2020)- Petrografi batuan sekis Kompleks Rumbia, Lengan Tenggara Sulawesi. Jurnal GEOMining (Teknik Pertambangan Unkhair) 1, 2, p. 63-71.

(online at: <https://ejournal.unkhair.ac.id/index.php/geomining/article/view/2404/1614>)

(‘Petrography of schist rocks of the Rumbia Complex, SE Arm of Sulawesi’ *Rumbia Schist Complex with mica schists mostly in N, chlorite schist in E, W and S. Chlorite-muscovite schist, chlorite-epidote schist and tremolite-actinolite schist in E part of Rumbia Schist Complex, with different foliation orientations*)

Ramadhan, A. (2024)- Geologi dan diagenesis batugamping Formasi Tokala daerah Tudua, Kecamatan Bungku Tengah, Kabupaten Morowali, Provinsi Sulawesi Tengah. Skripsi/ thesis, Universitas Hasanuddin, Gowa, Makassar, p. 1-120..

(parts online at: <https://repository.unhas.ac.id/id/eprint/43889/>)

(‘Geology and diagenesis of Tokala Formation, Tudua Area, Bungku Tengah District, Morowali Regency, Central Sulawesi Province’. (this is supposedly a study of Triassic-Jurassic ‘Tokala Limestone’ in E Sulawesi, but some thin section images clearly show some pelagic limestone with Late Cretaceous planktonics JTvG))

Rangin, C., R.C. Maury, M. Polve, H. Bellon, B. Priadi, R. Soeria-Atmadja, J. Cotten & J.L. Joron (1997)- Eocene to Miocene back arc basin basalts and associated island arc tholeiites from Northern Sulawesi (Indonesia): implications for the geodynamic evolution of the Celebes basin. Bull. Societe Geologique France 168, 5, p. 627-635.

(online at: [www.researchgate.net/publication/279767395_Eocene_to_Miocene_back-arc_basin_basalts_and_asso Etc.](http://www.researchgate.net/publication/279767395_Eocene_to_Miocene_back-arc_basin_basalts_and_asso_Etc.))

(Most of N arm of Sulawesi is on Eocene oceanic crust (back arc basin basalts), intruded by younger arc volcanics. Similar geochemistries with Celebes Sea suggest N Sulawesi volcanic arc was built on same oceanic crust. N arm rotated clockwise 25°)

Ratman, N. (1976)- Geologic map of Tolitoli Quadrangle, North Sulawesi 2016-2116-2117, scale 1: 250, 000. Geological Research Development Centre (GRDC), Bandung.

(Geologic map of westernmost part of North Arm of Sulawesi. Oldest rocks ?Mesozoic Malino Metamorphic Complex, overlain by ?Eocene- E Oligocene Tinambo Fm clastics and volcanics, overlain by Miocene and younger clastics and volcanics. Several undated granitoid complexes)

Ratman, N. & S. Atmawinata (1993)- Geology of the Mamuju Quadrangle, Sulawesi. Scale 1: 250, 000. Geological Research Development Centre (GRDC), 2nd Edition, p. 1-25.

(SW Sulawesi map between 2-3° S. Metamorphic basement overlain by low-metamorphic Upper Cretaceous clastics. Eocene clastics and limestone, Late Oligocene- Early Miocene andesitic volcanics, Mio-Pliocene volcanoclastics. Large Late Miocene- E Pliocene granitic intrusive)

Reminton, C.H. (1995)- The challenge of petroleum exploration in the Gorontalo frontier basin, North Sulawesi- Indonesia. American Assoc. Petroleum Geol. (AAPG) Bull. 79, p. 81 (*Abstract only*)
(*Gorontalo Basin untested frontier basin. Airborne Laser Fluorescence survey showed fluors on water surface in Tomini Bay. Oil and gas seeps onshore and offshore of Tomini Bay suggest mature Paleogene source rocks*)

Reijzer, J. (1920)- Geologische aantekeningen betreffende de Zuidelijke Toraja-landen, verzameld uit de verslagen der mijnbouwkundige onderzoekingen in Midden-Celebes. Jaarboek Mijnwezen Nederlandsch Oost-Indie 47 (1918), Verhandelingen 1, p. 154-209.

(*online at: <https://resolver.kb.nl/resolve?urn=MMKB31:037114000:pdf>*)

'*Geologic notes on the southern Toraja lands, compiled from reports of mining investigations in Central Sulawesi*'. With two maps. Three areas with oil indications, presence of red and black Cretaceous shales (*koperlei formatie*), small Eocene coal-bearing basins, Eocene- E Miocene reefal limestones, Neogene 'Celebes Molasse', etc.)

Retgers, J.W. (1895)- Mikroskopisch onderzoek van gesteenten uit Nederlandsch Oost-Indie, F. Gesteenten van Celebes en Onderhoorigheden (ingezonden door den controleur A.E.A.F. Eerdmans). Jaarboek Mijnwezen Nederlandsch Oost-Indie 24 (1895), Wetenschappelijk Gedeelte, p. 124-139.

(*Brief petrographic descriptions of rocks collected government official Eerdmans, mainly in S Sulawesi, incl. leucitites near Malawa and common limestones and augite-andesites. No figures or locality details*)

Rianto, A., J. Soesilo, E. Hartono & A.W. Nugroho (2018)- Geological study of graphite petrogenesis in Southeast Sulawesi. Proc. 47th Annual Conv. Indonesian Association Geologists (IAGI), Pekanbaru 2018, p. 1-8.

(*online at: https://eprints.upnyk.ac.id/17532/1/Full%20Paper-Professional-Graphite_Anton%20Riyanto%20dkk.pdf*)

(*Kolaka area with graphite minerals in metamorphic rocks of (1) Mekongga Complex (Carboniferous) and (2) Pompangeo Complex (Cretaceous-Paleogene)*)

Rinne, F. (1900)- Skizzen zur Geologie der Minahassa in Nord-Celebes. Zeitschrift Deutschen Geologischen Gesellschaft, Berlin 52, 2, p. 327-347.

(*online at: <https://www.biodiversitylibrary.org/item/148377#page/371/mode/1up>*)

(*'Notes on the geology of the Minahasa, North Sulawesi*'. Early description of volcanics-dominated NE tip of Sulawesi (work done in 1898 on behalf of 'Mijnbouw Maatschappij Oost Totok', while Rinne was Professor at the Technischen Hochschule Hannover, Germany)

Rinne, F. (1900)- Beitrag zur Petrographie der Minahassa, Nord-Celebes. Sitzungsberichte Preussischen Akademie Wissenschaften, Berlin, 1900, 1, p. 474-503.

(*'Contribution to the petrography of the Minahassa, North Sulawesi*'. Petrographic description of volcanics and plutonic rocks of NE Sulawesi: diorite, diabase, dacites, andesites, basalt. Also granite near Gorontalo)

Rivai, T.A., K. Yonezu, Syafrizal, K. Sanematsu, D. Kusumanto, A. Imai & K. Watanabe (2019)- A low-sulfidation epithermal mineralization in the River Reef Zone, the Poboya Prospect, Central Sulawesi, Indonesia: vein textures, ore mineralogy, and fluid inclusions. Resource Geology 69, 4, p. 385-401.

(*online at: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/rge.12206>*)

(*Poboya gold prospect along NNW-SSE Palu-Koro Fault Zone in central part of W Sulawesi Arc. Geology of area Palu Metamorphic Complex overlain by Paleogene-Neogene Tinombo Fm volcanosedimentary rocks, Celebes Molasse and Late Cenozoic granites. Low-sulfidation epithermal deposit in River Reef Zone, Poboya Prospect, illustrates gold potential of W Sulawesi Arc, particularly along Palu-Koro Fault Zone*)

Rivai, T.A., K. Yonezu, Syafrizal & K. Watanabe (2015)- Preliminary investigation on the quartz veins and host rocks at the River Reef Zone, the Poboya gold deposit, Central Sulawesi, Indonesia. Proc. Int. Symposium on Earth Science and Technology, Fukuoka 2015, p. 258-263.

(*online at: www.researchgate.net/publication/363171779_Preliminary_investigation_on_the_Quartz_Etc.*)

(River Reef zone gold-bearing quartz veins of Poboya gold deposit, ~12 km NE of Palu, hosted in granite, biotite-chlorite schist and amphibolite schist)

Rivai, T.A., K. Yonezu, K. Watanabe, Syafrizal, K. Sanematsu & D. Kusumanto (2017)- Characteristics of a Se-rich low-intermediate sulphidation epithermal deposit in the River Reef, the Poboya prospect, Central Sulawesi, Indonesia. 14th Biennial Meeting Society for Geology Applied to Mineral Deposits (SGA), Quebec, p. 1-5.

*(online at: www.researchgate.net/publication/325467011_Characteristics_of_a_Se-rich_Low_Sulphid_Etc.)
(Se-bearing Au-Ag low-intermediate sulphidation epithermal mineralisation in River Reef Zone of Poboya prospect, 12 km NE of Palu, C Sulawesi. Hosted in metamorphic and igneous rocks)*

Robinson, G.P., B.T. Setiabudi, D.N. Sunuhadi, J.M. Hammarstrom, S. Ludington, A.A. Bookstrom, S.A. Yenie & M.L. Zientek (2013)- Porphyry copper assessment for Tract 142pCu7026, West Sulawesi, Indonesia. In: J.M. Hammarstrom et al., Porphyry copper assessment of Southeast Asia and Melanesia, U.S. Geological Survey, Scientific Investigations Report 2010-5090-D, Appendix G, p. 126-136.

(online at: http://pubs.usgs.gov/sir/2010/5090/d/sir2010-5090d_text.pdf)

(W Sulawesi magmatic arc part of 1200-km-long Sulawesi- Sangihe magmatic arc, active since M Miocene-Pliocene. W-dipping subduction zone. Displacement of W Sulawesi arc system over Makassar Straits/ Celebes Sea in response to Banggai-Sula microcontinent collision, resulting in Pliocene-Pleistocene uplift of composite arc system. No known porphyry copper deposits, but Malala porphyry molybdenum (4.14 Ma) in N)

Robinson, G.P., B.T. Setiabudi, D.N. Sunuhadi, J.M. Hammarstrom, S. Ludington, A.A. Bookstrom, S.A. Yenie & M.L. Zientek (2013)- Porphyry copper assessment for Tract 142pCu7027, North Sulawesi-Sangihe-Indonesia. In: J.M. Hammarstrom et al., Porphyry copper assessment of Southeast Asia and Melanesia, U.S. Geological Survey, Scientific Investigations Report 2010-5090-D, Appendix H, p. 137-148.

(online at: http://pubs.usgs.gov/sir/2010/5090/d/sir2010-5090d_text.pdf)

(Two known porphyry copper-gold deposits in S-C part of N Sulawesi tract: Tapadaa (3.75 Ma) and Tombulilato (3.0 Ma))

Rompo, I., F. Ismail, S.T.J.B. Santoso, M.F. Rosana, E.T. Yuningsih (2023)- Petrogenetic of igneous complex of Iloa Nanasi gold deposit, Gunung Pani, Gorontalo, Indonesia. J. Geoscience Engineering Environment Technology (JGEET) 8, 4, p. 312-323.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/14250/5942>)

(Iloa Nanasi Au-Ag deposit at W flank of Gunung Baganite, a part rhyodacite dome in Gn.Pani district, Gorontalo Province (exploited since 1890s by Dutch; Van Schelle 1889, etc.). Late Miocene granodiorite, etc., basement. Pliocene Pani volcanic complex mainly dacite-rhyodacite, tuff, breccia. Hydrothermal alteration and mineralization centered in porphyritic rhyodacite host rocks. Low sulfidation epithermal system, dominated by hydrothermal crackle breccia, intense quartz veining and high-density fracturing. Etc.)

Rosianna, I., E.D. Nugraha, H. Syaeful, S. Putra, M. Hosoda, N. Akata & S. Tokonami (2020)- Natural radioactivity of laterite and volcanic rock sample for radioactive mineral exploration in Mamuju, Indonesia. Geosciences (MDPI) 10, 9, 376, p. 1-13.

(online at: <https://www.mdpi.com/2076-3263/10/9/376>)

(Mamuju area in W Sulawesi with anomalously high U and Th concentrations and has been target of uranium and thorium exploration since 2012 (with Japanese co-operation))

Rosianna, I., E.D. Nugraha, H. Tazoe, H. Syaeful, A.G. Muhammad, I.G. Sukadana, F.D. Indrastomo et al. (2023)- Uranium isotope characterization in volcanic deposits in a high natural background radiation area, Mamuju, Indonesia. Geosciences (MDPI) 13, 12, 388, p. 1-13.

(online at: <https://www.mdpi.com/2076-3263/13/12/388>)

(Mamuju area in W Sulawesi with anomalously high natural radioactive levels, in laterite and in volcanic rocks of E Pliocene Adang Volcanic Complex. $^{234}\text{U}/^{238}\text{U}$ mineralization ages 0.91–1.1 Ma and classified as recent mineralization. Adang volcanic complex divided into several small volcanoes (Ampalas, Mamuju, Takandeang,

Sumare, Tapalang), with lava domes, lavas, volcanic breccias, etc. Rocks silica undersaturated with common leucite. K-Ar ages of volcanics ~ 4.1–2.8 Ma. Stratabound and structure bound uranium mineralization)

Rudyawan, A. (2015)- Neogene stratigraphy, structure and magmatism of the Central North Arm of Sulawesi, Indonesia. Ph.D. Thesis. Royal Holloway University of London, p. 1-484. *(Unpublished)*

Rudyawan, A., R. Hall & L. White (2014)- Neogene extension of the Central North Arm of Sulawesi, Indonesia. American Geophysical Union (AGU), Fall Meeting 2014, San Francisco, Abstract T43A-4681, 1p. *(Abstract + Poster)*

*(poster online at: www.researchgate.net/publication/279763598_Neogene_Extension_of_the_Central_Etc.)
(Sulawesi North Arm more than simple oceanic arc. Paleogene granites suggest basement of evolved arc crust or continental crust, but few inherited zircon ages. Neogene granites with Paleozoic and Proterozoic inherited zircon cores, suggesting melting of Australian continental crust. Two periods of sedimentation: M Miocene and Late Miocene-Pliocene. Two major fault trends: E–W Neogene basin-bounding faults and young NW-SE strike-slip faults. Record indicates arc-continent collision and underthrusting of Australian crust in E Miocene (~22 Ma), with later extensional episodes. Metamorphic core complex formed on land in M Miocene (~15 Ma), and later extension linked to initiation of S-ward subduction of Celebes Sea in latest Miocene- E Pliocene (~5 Ma))*

Rusmana, E., A. Koswara & T.O. Simandjuntak (1993)- Geology of the Luwuk Quadrangle, Sulawesi. Map 1:250,000 scale, Geological Research Development Centre (GRDC), Bandung, p. 1-17. (2nd Ed. of 1984 map) *(NE part E arm of Sulawesi and Togian islands. Prior to Late Miocene- Pliocene overlap assemblage two distinct terranes (1) Banggai-Sula (Triassic-Jurassic clastics overlain by Eocene-M Miocene carbonates and clastics (reportedly with Nummulites, Lacazinella, Fasciolites; Stratigraphic Lexicon Indonesia) and (2) E Sulawesi (along N coast of E arm: S-directed thrust imbricates of metamorphics, ultramafic rocks (supposedly Cretaceous oceanic crust), Late Cretaceous Matano Fm pelagic sediments). Oldest rocks on Togian Islands are supposedly Cretaceous-Paleocene Lamusa Fm brownish-red limestones)*

Rusmana, E. & D. Sukarna (1985)- Tinjauan stratigrafi lengan tenggara Sulawesi dibandingkan dengan daerah sekitarnya. Proc. 14th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta 1985, p. 61-70. *(‘Review of stratigraphy of SE arm of Sulawesi and comparison with surrounding areas’. SE Arm with rocks of Late Paleozoic- Holocene age. Two basement terranes: (1) Tinondo block continental terrane: ?Permian or Triassic Mekonga Metamorphics overlain by Late Triassic Meluhu Fm clastics with Halobia- Daonella (?) and Tamborasi (?) Lst member; (2) Hialu block oceanic terrane, with?Triassic ophiolites overlain by Late Triassic (Tinala Fm w. Halobia, ammonites?) to Cretaceous (Masiku-Matano Fms with Globotruncana, radiolaria) Fm deep-sea sediments; separated by NW-SE Lasalo Fault. First paper to propose SE arm of Sulawesi is continental block of ‘Australian’ origin? (Suroño 1998))*

Rusmana, E., Sukido, D. Sukarna, E. Haryanto & T.O. Simandjuntak (1993)- Geology of the Lasusua-Kendari Quadrangle, Sulawesi (2112-2212), 1:250 000, Geological Research Development Centre (GRDC), Bandung, p. 1-16.

(E Sulawesi map between 3-4° S, E side Bone Bay. Two geologic provinces, separated by Lasalo fault. Tinondo Province in SW has ?Carboniferous metamorphics and intrusives, overlain by Triassic- Jurassic Meluhu/ Tokala Fms sediments, unconformably overlain by Eocene- M Miocene calcilutes? Remnants of ophiolites along Bone Bay shoreline. Hialu oceanic province in NE is widespread ?Cretaceous ophiolite, overlain by Late Cretaceous Matano Fm pelagic deposits, unconformably overlain by Late Miocene- Pliocene Celebes Molasse)

Rustiadi (1985)- Unsur perak (Ag) di dalam beberapa mineral sulfida dai endapan jenis Kuroko di daerah Sangkaropi, Sulawesi. J. Riset Geologi dan Pertambangan (LIPI) 6, 1, p. 32-41.

(Sangkaropi sulphide ores in SW Sulawesi NE of Rantepao resemble Kuroko ore deposits of Japan (submarine volcanogenic massive sulphides). Sphalerite, galena, pyrite and chalcopyrite most common)

Rutten, L. (1914)- Studien uber Foraminiferen aus Ost-Asien, 5. Einige Foraminiferen aus dem Ostarm von Celebes. Sammlungen Geologischen Reichs-Museums Leiden (1), 9, p. 307-320.

(online at: www.repository.naturalis.nl/document/552393)

(‘Studies on foraminifera from East Asia, 5. Some foraminifera from the East Arm of Sulawesi’. Samples collected by W. Hotz and J. Wanner include Eocene Alveolina wichmanni limestones at Biak Poh and Toeny. At Lengketeng also with numerous Alveolina wichmanni and Nummulites bagelensis. Footnote, p. 318-319: ‘it is remarkable that the Eocene fauna of Celebes is more similar to samples from New Guinea than Java and Borneo’. Lower part of Celebes Molasse includes marls with poor Globigerina and limestones without Lepidocyclina, Miogypsina, etc., suggesting Late Miocene or younger age)

Rutten, L. (1924)- Over de foraminiferenfauna en den ouderdom van kalksteen uit Zuid-Celebes afkomstig uit de groep der vischresten-bevattende gesteenten. Jaarboek Mijnwezen Nederlandsch-Indie 52 (1923), Verhandelingen, p. 173-183.

(‘On the foraminifera fauna and the age of limestones from South Sulawesi from the group of fish-bearing rocks’. Larger forams from limestones associated with fish fossils in S Sulawesi (described by Brouwer 1924) with non-diagnostic Heterostegina only. Spirochypeus and Lepidocyclina (N.) brouweri n.sp. in nearby samples suggest E Miocene age)

Rutten, L.M.R. (1927)- Chapters 33-39 on the geology of Celebes (Sulawesi). In: L.M.R. Rutten (1927) Voordrachten over de geologie van Nederlandsch Indie, Wolters, Groningen, p. 520-635.

(online at: <https://resolver.kb.nl/resolve?urn=MMKB02:000119126:pdf>)

(Historic early review of geology of Sulawesi in Rutten's classic ‘Lectures’ book)

Rutten, L. (1934)- Tertiaire foraminiferen van Oost Celebes. Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie 10, p. 286-289.

(‘Tertiary foraminifera from E Sulawesi’. Part of Von Loczy (1934) E Sulawesi mapping report (well west of Rutten (1914) localities). Four localities with older Paleogene, but none with Alveolina, like in East Arm. North Boengkoe valley locations with mainly small but also some large Nummulites, incl. N. bagelensis, small Discocyclina dispansa and possible Pellatispira fragment))

Ryacudu, R., S. Tossin & E. Purnomo (1998)- Ampana strike-slip fault and its significance for hydrocarbon entrapment in the eastern arm of Sulawesi, Indonesia. In: J.L. Rau (ed.) Proc. 34th Session Coord. Comm. Coastal Offshore Geoscience Programmes E and SE Asia (CCOP), Taejon, Korea 1997, 2, Technical Reports, p. 1-21.

(Ampana strike-slip fault is NW-SE trending fault, cutting across E arm of Sulawesi, probably linked to S Sorong fault)

Saefudin, I. (1994)- Umur apatit dan zirkon batuan granitik daerah Palu dan sekitarnya, Sulawesi Tengah. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 4, 36, p. 9-15.

(‘Ages of apatite and zircon in granitic rocks of the Palu area and surroundings, C Sulawesi’. Apatite and zircon age analyses from 5 granitic rocks in neck of Sulawesi area. Granodiorite near Palu town E Oligocene age from both zircon and apatite methods (~29.5 Ma). Granites in ‘neck’ further N gave different results for apatite and zircon methods: apatite ages ~6.2- 8.3 Ma (Late Miocene) zircon ages from same rock ~9.5- 11.8 Ma (late M Miocene). Differences in ages caused by annealing process of apatite)

Safani, J., K. Ibrahim, W. Deni, A. Rubaiyin, F. Firdaus & H. Harisma (2023)- Interpreting structural configuration of the Sengkang Basin of Indonesia using edge detection and 3-D Euler deconvolution to satellite gravity data. Turkish J. Earth Sciences 32, 7, 5, 894-914.

(online at: <https://journals.tubitak.gov.tr/earth/vol32/iss7/5/>)

(East Walanae and West Walanae Fault Zones two active fault segments in S arm of Sulawesi, and responsible for formation of Sengkang Basin. Sengkang Basin two main blocks, E and W. Three subbasins in East Sengkang Basin identified from gravity data)

Safurddim, A.M. Imran, U.R. Irfan, R. Amelia & A.L. Adlyansyah (2018)- Characteristics of Paremba Sandstones in Bantimala Complex: the implication of oil exploration in Eastern Indonesia. Int. Journal of Engineering and Science Applications (UNHAS), 5, 2, p. 117-126.

(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/1754/464>)

(Jurassic? Paremba shallow marine sandstone in Bantimala tectonic complex, 60km NE of Makassar. In Bontorio River steeply dipping conglomerates, sandstones, siltstone, claystone and fossiliferous limestone. Conglomerates with clasts of schist and quartzite. Sandstones arkose and litharenite with load casts, sole marks, slump structure, parallel lamination and ripple lamination. Paremba sandstones low-grade metamorphic. Provenance recycled orogenic tectonic environment. Porosity <1%, indicating not suitable as oil and gas reservoirs)

Safruddim, A.M. Imran, U.R. Irfan & M. Farida (2025)- Geochemistry of the sandstone of Mallawa Formation in the Southern arm of Sulawesi, Indonesia: Implications for provenance and tectonic setting. *Ore and Energy Resource Geology* 18, 100096, p. 1-15.

(“Comprehensive and unprecedented research results on the Mallawa Formation sandstones through geochemical analysis, which has not been conducted previously”. “Eocene Mallawa sst with SiO₂ as most abundant component, reflecting the presence of detrital quartz, chert, feldspar fragments, and other mineral contents”. Result: provenance of Mallawa Sst from siliceous-clastics and intermediate to felsic igneous rocks. (unfortunately, none of this seems unprecedented; JTvG))

Safruddim, A.M. Imran, U.R. Irfan & M. Farida (2025)- The depositional environment of the Mallawa Formation in the Southern Arm of Sulawesi, Indonesia, utilizing palynomorphs. *Proc. 4th Int. Conference Geological Engineering and Geosciences (ICGOES 2024)*, Yogyakarta, IOP Conference Series: Earth and Environmental Science 1517, 012003, p. 1-9.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1517/1/012003/pdf>)

(Eocene Mallawa Fm quartz-rich sandstones, shales and coal at Tellumpanuae in Mallawa District, Maros, western S Sulawesi. Palynomorph analysis suggest delta plain setting influenced by marine incursions. Presence of Proxapertites operculatus, Palmaepollenites kutchensis, Florschuetzia trilobata, Cicatricosisporites eocenicus, Meyerispollenites naharkotensis, etc. suggest M-L Eocene age)

Safruddim, A.M. Imran, U.R. Irfan & M. Farida (2025)- The provenance of quartz-rich sandstone in Paleogene clastic rock of Mallawa Formation from the southern arm of Sulawesi. *Proc. Int. Conference on Geosciences and Geotechnology (ICOGEST 2024)*, Makassar, IOP Conference Series: Earth and Environmental Science 1525, 012010, p. 1-9.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1525/1/012010/pdf>)

(Eocene Mallawa Fm clastics in S Sulawesi include mudstone, feldspathic wacke, lithic arenite and subarkose arenite. Provenance of rel quartz-rich, immature sandstones from volcanic and metamorphic rocks (Bantimala and Barru basement complexes? (field photos look remarkably like Tanjung Fm in Barito Basin?; JTvG))

Sahabuddin, A.M. Imran, F. Arifin & A. Jaya (2013)- Biostratigrafi foraminifera planktonik satuan batupasir Formasi Pasangkayu Cekungan Lariang, Sulawesi Barat. *J. Penelitian Geosains (Hasanuddin University)* 9, 2, p. 111-120.

(online at: <http://repository.unhas.ac.id/handle/123456789/16805>)

(‘Planktonic foraminifera biostratigraphy of the sandstone unit of the Pasangkayu Formation, Lariang Basin, West Sulawesi’. Pasangkayu Fm in W Sulawesi Pasangkayu area with upper M Miocene- E Pliocene planktonic foraminifera (N14-N19; G. nepenthes-Gr siakensis to Gr tumida- Sphaeroidinellopsis subdehiscens zones))

Salama, T.H., S. Maryati & I.N. Manyoe (2021)- Studi mekanisme sedimentasi Formasi Dolokapa. *Gorontalo. Jambura Geoscience Review* 3, 2, 97-111.

(online at: <https://ejurnal.ung.ac.id/index.php/jgeosrev/article/view/8475/3139>)

(‘Study of the sedimentation mechanism of the Dolokapa Formation, Gorontalo’ (N Sulawesi). Miocene Dolokapa Fm in E Sumalata District interbedded sands-shales formed as turbidity currents in deep-sea depositional environment. Overall upward thickening. Sedimentary structures include rip up-clasts, parallel lamination, graded bedding, convolute bedding, slumps and Nereites trace fossils)

Samodra, S., S.S. Surjono, D.H. Amijaya & W. Suryanto (2018)- Petroleum system of Matarombeo Basin, South-East Arm Sulawesi, Indonesia. *The 12th South East Asian Technical University Consortium (SEATUC) Symposium, Yogyakarta2018, OS05-17, p. 1-6.*

(online at: https://www.researchgate.net/publication/370496681_Petroleum_System_of_Matarombeo_Basin_South-East_Arm_Sulawesi_Indonesia)

(Matarombeo Basin in SE arm of Sulawesi, between Matano Fault, Lawanopo Fault and Tolo Trust (onshore + offshore?). Cretaceous-Oligocene ophiolite series thrust over Mesozoic continental margin sediments. Source rocks are organic rich claystone and marl from Meluhu and Tokala Formations (no information on sample locations, no details on stratigraphy, etc. - JTvG)

Samodra, S.B., S.S. Surjono, D.H. Amijaya & W. Suryanto (2024)- Sebaran batuan karbonat di Cekungan Matarombeo, Lengan Tenggara Sulawesi. *Geosfera: Jurnal Penelitian Geografi* 3, 2, p. 130-142.

(online at: <https://ejurnal.ung.ac.id/index.php/geojpg/article/view/29077/9904>)

(‘Distribution of carbonate rocks in the Matarombeo Basin, Southeast Arm of Sulawesi’. Five carbonate formations in . In Matarombeo Basin: Tokala (Triassic-Jurassic), Matano (Cretaceous), Tampakura (Eocene), Eomoiko (Oligo-Miocene) and Buara Formations. Tampakura and Eomoiko Formation are main potential hydrocarbon reservoirs and can be recognized in seismic sections as reef buildups)

Sandi, I.N., A.P. Permana & M. Kasim (2024)- Analisis provenance batupasir Formasi Dolokapa, Kabupaten Gorontalo Utara berdasarkan data geokimia XRF. *EnviroScientiae* 20, 1, p. 27-32.

(online at: <https://ppjp.ulm.ac.id/journal/index.php/es/article/view/18843/9859>)

(‘Provenance analysis of the Dolokapa Formation Sandstone, North Gorontalo Regency, based on XRF geochemical data’. Miocene Dolokapo Fm sandstones in E Sumalata District are Fe-shale and Fe-sand chemistry, and originated from oceanic island arc tectonic setting)

Sanjaya, I., Jamal, M.L. Fatturahkman, Hermansyah, A.S. Arifin, S. Maryanto & Hyeong Soo Kim (2024)- Evaluating the natural hydrogen system in Ampana Basin, Central Sulawesi; an implication for natural hydrogen exploration in Indonesia. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 25, 3, p. 135-149.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/896/560>)

(Study of natural hydrogen gas generation from serpentinization of ultramafic rocks in Ampana Basin, E Sulawesi. Include geochemical analysis of abiogenic hydrogen-methane gas seepages at Tanjung Api outcrop of serpentinized hartzburgite and at Pulodalagan hot spring. Suspected relationship of seeps with active faults)

Santos, F.R., P. Sulistiono & N.E.W. Litaay (1999)- Totopo West, a low sulphidation epithermal system in North Sulawesi. *Proc. 28th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta*, 2, p. 203-215.

(online at: <https://www.iagi.or.id/web/digital/65/14.pdf>)

(Totopo West 55km W of Gorontalo, with gold in epithermal vein system at NW margin of Pliocene rhyodacitic caldera, along regional NE-trending faults. Associated dacite porphyry K/Ar ages (2.1-2.4 Ma and 2.8-3.3 Ma))

Santoso, B. & Subagio (2016)- Pendugaan mineral kromit menggunakan metode Induced Polarization (Ip) di daerah Kabaena Utara, Bombana Sulawesi Tenggara. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 17, 3, p. 179-192.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/17/11>)

(‘Prediction of chromite minerals using Induced Polarization (Ip) method in the area of North Kabaena, Bombana, SE Sulawesi’. In N Kabaena island chromite present in Cretaceous ultramafic peridotites and as alluvial deposits. Electric methods used to predict distribution)

Santy, L.D. (2016)- The Mesozoic source rock identification in Tomori Basin, East Arm of Sulawesi and its implication for petroleum play. *Proc. IPA 2016 Technical Symposium, Indonesia exploration: where from-where to, Indonesian Petroleum Association (IPA), Jakarta*, 28-TS-16, p. 1-19.

(Tomori Basin at S side of East arm of Sulawesi is Miocene foreland basin in collision zone between Sundaland/ E Sulawesi Ophiolite and Banggai-Sula microcontinent. Source rock analysis of onshore E Sulawesi Mesozoic Tokala, Nanaka and Tetambahu shales show hydrocarbon source potential: TOC 0.32- 3.46% and mainly type III kerogen. Rock-eval Tmax measurements suggests immature to marginally mature (428- 432°C), but vitrinite reflectance Ro 0.56- 0.76%) and TAI data (2-2.5) suggest sediments early mature to peak mature)

Sapiie, B., M.A. Nugraha, R.K. Wardana & A. Rifiyanto (2017)- Fracture characteristics of melange complex basement in Bantimala Area, South Sulawesi, Indonesia. Indonesian J. on Geoscience (IJOG) 4, 3, p. 121-141.
(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/405/242>)
(*Analysis of fractures in Pre-Tertiary melange complex of Bantimala area South Sulawesi, Indonesia. Common fracture orientations NW-SE, W-E, NNE-SSW and ENE-WSW, different in each lithology. Fracture intensity in schists higher than in other lithologies*)

Saputro, S.P., S. Godang, B. Priadi, N.I. Basuki & B. Himawan (2022)- Geochemical study of Al-Fe-Ti enrichment in rock weathering: implications for the recognizing of igneous protolith and the enrichment of REE in soil profile. Applied Geochemistry 140, 105259, p. 1-19.
(*Study of lateritic weathering profile of M-L Miocene Adang Volcanic Complex basaltic rocks in drill core from Mamuju district, W Sulawesi*)

Saputro, S.P. & B. Priadi (2016)- Penyebab serta sumber high-K pada batuan vulkanik dan plutonik di Tanah Toraja, Sulawesi Selatan bagian utara: terkait kerak, evolusi magma, dan rezim tektonik. In: R. Hidayat et al. (eds.) Proc. Seminar Nasional Kebumihan 9, Dept. Teknik Geologi, Gadjah Mada University, Yogyakarta, p. 412-420.
(online at: <https://repository.ugm.ac.id/273523/>)
(*'Causes and sources of high-K in volcanic and plutonic rocks in Tana Toraja, N part of South Sulawesi: associated crust, magma evolution and tectonic regime'. Mio-Pliocene high-K volcanics and plutonics in Tana Toraja area, S Sulawesi, formed in post-subduction tectonic regime, with magma interacting with crust, creating 'continental affinity'*)

Saragih, R.Y., I. Haryanto, E. Sukiyah, N.N. Ilmi & E. Sunardi (2018)- The sinistral strike-slip fault as Ampana Basin controller in Central Sulawesi. J. Geological Sciences Applied Geology (UNPAD) 2, 4, p. 1-11.
(online at: <http://jurnal.unpad.ac.id/gstag/article/view/18289/8590>)

Sarasin, F. (1901)- Uber die geologische Geschichte des Malayischen Archipels auf Grund der Thierverbreitung. Verhandlungen Schweizerischen Naturforschenden Gesellschaft 83, p. 69-85.
(online at: <https://www.e-periodica.ch/digbib/view?pid=sng-005:1900:83#80>)
(*'On the geological history of the Malay Archipelago based on the animal distribution'. No figures*)

Sarasin, F. (1905)- Tiergeographisches, biologisches un anthropologisches aus Celebes. Proc. 6th International Congress of Zoology, Bern 1904, p. 147-159.
(*'Animal geographic, biological and anthropological considerations from Celebes/ Sulawesi'*)

Sarasin, P. & F. Sarasin (1895)- Reiseberichte aus Celebes 3. Reise durch Zentral-Celebes vom Golf von Boni nach dem Golf von Tomini. Zeitschrift Gesellschaft Erdkunde Berlin, 30, p. 311-352.
(*'Journey across Central Celebes from the Gulf of Bone to the Gulf of Tomini'. Travel description in January-February 1895, including first visit by geologists/naturalists to Lake Poso*)

Sarasin, P. & F. Sarasin (1898)- Materialien zur Naturgeschichte der Insel Celebes. C.W. Kreidel's Verlag, Wiesbaden, vol. 1. Die Susswasser-Mollusken von Celebes, p. 1-102.
(online at: www.archive.org/details/materialienzurna01sara)
(*'Materials for the natural history of the island of Sulawesi, 1. The fresh-water molluscs of Celebes island'. Volume 1 of 5 of classic work on late 1800's geographic- geological travels in Sulawesi by Swiss cousins Paul and Fritz Sarasin*)

Sarasin, P. & F. Sarasin (1899)- Materialien zur Naturgeschichte der Insel Celebes. C.W. Kreidel's Verlag, Wiesbaden, 2. Die Land-Mollusken von Celebes, p. 1-244.
(online at: www.archive.org/details/materialienzurna02sara)
(*Volume 2 of Sarasin work: 'The land molluscs of Celebes island'*)

Sarasin, P. & F. Sarasin (1901)- Materialien zur Naturgeschichte der Insel Celebes. C.W. Kreidel's Verlag, Wiesbaden, 3. Ueber die geologische Geschichte der Insel Celebes auf Grund der Thierverbreitung, p. 1-169.
(online at: www.archive.org/details/materialienzurna03sara)
(Volume 3 of Sarasin work: 'On the geological history of Celebes island based on the animal distribution')

Sarasin, P. & F. Sarasin (1901)- Materialien zur Naturgeschichte der Insel Celebes. C.W. Kreidel's Verlag, Wiesbaden, 4. Entwurf einer geographisch-geologischen Beschreibung der Insel Celebes, p. 1-344.
(online at: www.archive.org/details/materialienzurna04sara)
(Volume 4 of Sarasin work: 'Geographic- geologic description of Celebes island'. With appendix of rock descriptions by C. Schmidt)

Sarasin, P. & F. Sarasin (1905)- Reisen in Celebes ausgeführt in den Jahren 1893-1896 und 1902-1903. C.W. Kreidel Verlag, Wiesbaden, vol. 1, p. 1-381 and vol. 2, p. 1-390. (online at: <http://resolver.staatsbibliothek-berlin.de/SBB00007B3500010000> and <http://resolver.staatsbibliothek-berlin.de/SBB00007B3500020000>)
(*'Travels in Sulawesi in the years 1893-1896 and 1902-1903'. Mainly geographic travel accounts across S Sulawesi by Sarasin cousins, with some geological observations*)

Sarasin, P. (1912)- Zur Tektonik von Celebes. Zeitschrift Deutschen Geologischen Gesellschaft, Berlin, 64, Monatsberichte, p. 226-245.
(online at: https://www.zobodat.at/pdf/Z-dtsch-Geol-Ges_64_0226-0245.pdf)
(*'On the tectonics of Sulawesi', by Swiss naturalist Paul Sarasin. No figures. See also critical discussion in Abendanon (1915)*)

Sardjono (2013)- Gayaberat. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 259-276.
(*'Gravity'. Chapter 11 in Geology of Sulawesi book*)

Sarmili, L. (1998)- Formation of the Tolo accretionary prism in relation to reactivation of the Palukoro Fault, Sulawesi. In: J.L. Rau (ed.) Proc. 33rd Annual Session Coord. Comm. Coastal and Offshore Geoscience Progr. East and Southeast Asia (CCOP), Shanghai 1996, 2, p. 104-113.
(*New bathymetric map of N Banda Sea between Buru and SE Sulawesi. General NW-SE directions, e.g. Tampomas Ridge and Hamilton slope. To W of N Banda Sea, N-S trending, 150 km long Tolo prism, well developed in N and centre, possibly due to large amount of sediment from Sulawesi island (i.e. Celebes molasse). To S, width of prism decreases and disappears in Buton Trough. Recent sediments deformed, and upper and lower thrust units appear faulted. As consequence of convergence, prism seems oriented NW-SE parallel to Hamilton fracture zone which continues to join Lawanopo and Palu-Koro strike-slip faults on-land*)

Sarmili, L. (2015)- Opening structure of the Bone Basin on South Sulawesi in relation to process of sedimentation. Bulletin of the Marine Geology 30, 2, p. 97-107.
(online at: <http://ejournal.mgi.esdm.go.id/index.php/bomg/article/view/79/80>)
(*Seismic profiles of Bone basin between SW and SE Arms of Sulawesi show by uplifted basement highs on both sides and flat-lying young sediments in middle, indicating opening of basin*)

Sarmili, L., D. Indriati & T. Setiawan (2016)- Proses sedimentasi Cekungan Bone berdasarkan penafsiran seismik refleksi di perairan Teluk Bone, Sulawesi Selatan. J. Geologi Kelautan 14, 1, p. 37-52.
(online at: <http://ejournal.mgi.esdm.go.id/index.php/jgk/article/view/338/267>)
(*'Sedimentation processes in Bone Basin, based on interpretation of seismic reflection in waters of Bone Bay, South Sulawesi'. Deep marine Bone Basin between S and SE arms of Sulawesi formed in Paleogene-Neogene. Initial Bone Basin formed by Cretaceous subduction, then developed as intra-montane basin. May be underlain by oceanic crust in Paleogene. Quaternary deposits influenced by reactivation of Walanae Fault. Six main seismic sequences A-F. Unit B Oligocene limestone, Unit C Late Oligocene- E Miocene volcanics, etc.)*)

Sarsito, D.A., S. Susilo, A. Rudyawan, N.A. Muhammad, H. Andreas & D. Pradipta (2019)- Walanae fault kinematic deduced from geometric geodetic GNSS GPS monitoring. Proc. International Symposium on Global Navigation Satellite System, Bali 2018, E3S Web of Conferences 94, 04008, p. 1-7.

(online at: https://www.e3s-conferences.org/articles/e3sconf/pdf/2019/20/e3sconf_ismss2018_04008.pdf)
(On GPS velocities measured along Walanae Fault sinistral strike slip system in S Sulawesi, which consists of four strands, with different slip rates)

Sarsito, D.A., Susilo, W.J.F. Simons, H.Z. Abidin, B.Sapiie, W. Triyoso & H. Andreas (2017)- Newly velocity field of Sulawesi island from GPS observation. Proc. Int. 6th Symposium on Earth hazard and disaster mitigation (ISEDMD) 2016, AIP Conference Proceedings 1857, 1, 040005, p. 1-6.

(New GPS velocity observations in agreement with previous results: CW rotation of North Arm, Tomini Gulf opening and left-lateral strike slip of Palu-Koro fault. SW Sulawesi moves as part of Eurasian-Sunda Block with some compression at Makassar Straits (6.25mm/yr to W). Palu-Koro Fault rapid strike slip faulting)

Sarsito, D.A., Susilo & W.J.F. Simons (2018)- Simple deformation modelling using GNSS GPS data at Minahasa subduction. In I. Meilano et al. (eds.) Int. Symposium Earth Hazard and Disaster Mitigation (ISEDMD 2017), AIP Conference Proceedings 1987, 020094, p. 1-7.

(online at: <https://repository.tudelft.nl/islandora/object/uuid%3Af5c57782-068a-4e1f-9aa8-0fde97910adf/datastream/OBJ/download>)

(N Sulawesi Trench or Minahasa subduction zone between oceanic crust of Sulawesi Sea and North Sulawesi Arm. Yearly GNSS GPS campaigns from 1997-2008 shows subduction movement of 4-5 cm/yr with locking depth of ~50 km and dip angle of 30°)

Sarsito, D.A., Susilo, W.J.F. Simons, H.Z. Abidin, B.Sapiie, W. Triyoso & H. Andreas (2017)- Rotation and strain rate of Sulawesi from geometrical velocity field. Proc. Int. 6th Symposium on Earth hazard and disaster mitigation (ISEDMD) 2016, AIP Conference Proceedings 1857, 1, 040006, p. 1-6.

(Sulawesi characterized by rapid rotation in several different domains and compression-strain pattern varies depending on type and boundary conditions of microplate)

Sartono, S., K.A.S. Astadiredja & H. Murwanto (1991)- East Arm Sulawesi: Banggai microplate- Sunda subduction zone collision. Proc. 20th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 376-395.

(online at: [https://www.iagi.or.id/web/digital/49/20th-\(10-12-Des-1991\)-25.pdf](https://www.iagi.or.id/web/digital/49/20th-(10-12-Des-1991)-25.pdf))

(Review of E Sulawesi Triassic and younger stratigraphy and tectonic history scenario for Sulawesi. Accepts presence of Permo-Carboniferous rocks in E Sulawesi. Pretertiary rocks in E Sulawesi (with ophiolite) and Banggai Sula (with pink granites) similar age range, but of different origin. Several tectonic melange complexes (incl. Cretaceous-age) and olistostromes)

Sartono, S., I. Hendrobusono, B. Suprpto & H. Murwanto (1989)- Sedimen lengseran gravitasi Eosen-Miosen bawah di Tana Toraja, Sulawesi Selatan (Indonesia). Proc. 18th Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, p.

(Eocene- Lower Miocene gravity sedimentation in Tana Toraja, South Sulawesi (Indonesia))

Sasajima, S., S. Nishimura, K. Hirooka, Y. Otofujii, T. Van Leeuwen & F. Hehuwat (1978)- Paleomagnetic results and fission track ages obtained from the Western and Northern Sulawesi, East Indonesia. In: M. Kono (ed.) Rock magnetism and paleogeophysics, Tokyo, 5, p. 73-80.

(online at: <https://peach.ifst.ous.ac.jp/rprep/Rock%20Magnetism%20and%20Paleogeophysics%20vol5%201978.pdf>)

(Reconnaissance paleomagnetic work combined with fission track age dating of U Cretaceous- Pliocene rocks mainly from Biru area, E of Makassar, SW Sulawesi. M Miocene and younger rocks similar position as present-day. Probable 45° CCW rotation between 63-13 Ma (authors suggest probably between 19-13 Ma, but no explanation why; JTvG), possibly in tandem with Malay Peninsula and W Borneo from which Haile (1978) reported similar 35-50° CCW rotations)

Sasajima, S., S. Nishimura, K. Hirooka, Y. Otofujii, T. Van Leeuwen & F. Hehuwat (1980)- Paleomagnetic reconnaissance from Northern arm of Sulawesi, Indonesia. In: S. Nishimura (ed.) Physical geology of Indonesian Island arcs, Kyoto University, p. 23-34.

Sasajima, S., S. Nishimura, K. Hirooka & Y Otofujii (1981)- Paleomagnetic studies combined with fission-track datings on the western arc of Sulawesi, east Indonesia. In: A.J. Barber & S. Wirjosujono (eds.) The geology and tectonics of Eastern Indonesia, Proc. CCOP-IOC SEATAR Working Group Meeting, Bandung 1979, Geological Research Development Centre (GRDC), Bandung, Special Publ. 2, p. 305-311.

(Same as Sasajima et al. (1980). SW arm of Sulawesi 40° CCW rotation since Paleocene- E Miocene)

Sasajima, S., S. Nishimura, K. Hirooka, Y. Otofujii, T. Van Leeuwen & F. Hehuwat (1980)- Paleomagnetic studies combined with fission-track datings on the Western Arm of Sulawesi, East Indonesia. Tectonophysics 64, p. 163-172.

(Paleogene- E Miocene paleomagnetic pole for SW Sulawesi very different from that in M Miocene- Recent. This suggests possibly 19-13 Ma major tectonic event caused ~40-45° of CCW rotation. Postulated collision followed by welding of E and W Sulawesi in Pliocene (Katili, 1978) may be cause. Our data does not support hypothesis that W Sulawesi derived from dispersal of Gondwanaland)

Satyana, A.H. (2006)- Docking and post-docking tectonic escapes of Eastern Sulawesi: collisional convergence and their implications to petroleum habitat. Proc. Jakarta 2006 International Geoscience Conference Exhib., Indonesian Petroleum Association (IPA), PG-16, p. 1-4. *(Extended Abstract only)*

(Summary of Sulawesi tectonic history of docking of microcontinents (Buton at 11 Ma, Sula at 5 Ma), followed by escape towards free edges, creating arc-polarity reversal, large strike slip faults, local extension, etc.)

Satyana, A.H. (2011)- Sulawesi: where two worlds collided- geologic controls on biogeographic Wallace's Line. Proc. Joint 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-065, p. 1-16.

(online at: www.academia.edu/16757400/SULAWESI_WHERE_TWO_WORLDS_COLLIDED_GEOLOGIC_CONTROLS_ON_BIOGEOGRAPHIC_WALLACES_LINE)

(On Cenozoic geological history controlling present-day Wallace's Line, which separates Asian and Australian fauna and flora. Sulawesi island shows mixture of Oriental and Australasian faunas)

Satyana, A.H. (2024)- Exploring natural hydrogen and abiotic methane in Indonesia: Case and idea from Tanjung Api gas seeps, East Arm of Sulawesi – Building a geologic hydrogen system in a collision zone. Proc. 48th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA24-G-328, p. 1378-1396.

(manuscript online at: https://tektonesia.org/wp-content/uploads/2024/07/satyana-2024-ipa_hydrogen-east-sulawesi.pdf)

(Tanjung Api ("Cape of Fire") is natural gas seep near Ampana in E Arm of Sulawesi, emitting significant volumes of H₂ and methane. H₂ generated from serpentinization of peridotite at base of East Sulawesi Ophiolite and migrated to surface along faults. Methane is thermogenic gas, but altered by biodegradation, oxidation or thermochemical sulfate reduction (see also Van Gorsel & Subroto 2022))

Satyana, A.H. (2025)- Paleogene to Neogene volcanisms of eastern margin of Sundaland. Petrotectonic evolution and its implications to petroleum exploration in the Makassar Straits, South Arm of Sulawesi. Proc. 49th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA25-G-388, p. 1-30.

(Different tectonic settings created different types of volcanic deposits and magmatic intrusions in Makassar Straits and S Sulawesi. (1) M Paleocene-E Eocene Langi and Bua arc volcanics (incl. Rangkong-1 well); (2) Eocene Salokalupang Fm, (3) E Miocene Kalamiseng volcanics, (4) E Miocene Camba I arc volcanics; (5) most extensive volcanics are M-L Miocene- Pliocene Camba II (= Enrekang) non-arc volcanics ('syn-collisional'). Post-M Miocene volcanics marked by high potassium (K) contents (high-K alkaline and shoshonitic rocks); (6) Late Miocene Walanae volcanics; (7) E-M Pleistocene post-collisional Lompobatang and Barupu acidic volcanism. Paleocene- E Miocene volcanism subduction-related, M Miocene- Pleistocene syn-post-collisional)

Satyana, A.H., T. Faulin & S.N. Mulyati (2011)- Tectonic evolution of Sulawesi area: implications for proven and prospective petroleum plays. Proc. Joint 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-064, p. 1-30.

(online at: https://www.iagi.or.id/web/digital/10/2011_IAGI_Makassar_Tectonic-Evolution-of-Sulawesi.pdf)

(Substantial review of Cenozoic tectonic evolution, basins and hydrocarbons of Sulawesi. Sulawesi formed by collision between drifted part of SE Sundaland and drifted microcontinents of Indian-Australian Plate. Collision took place during Oligocene-early Pliocene. Etc.)

Satyana, A.H. & M.E.M. Purwaningsih (2011)- Collision of microcontinents with Eastern Sulawesi: records from uplifted reef terraces and proven-potential petroleum plays. Proc. 35th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA11-G-219, p. 1-25. *(online at:*

https://www.academia.edu/108221125/Collision_of_micro_continents_with_eastern_Sulawesi_records_from_uplifted_reef_terraces_and_proven_potential_petroleum_plays)

(Sulawesi is assemblage of collided terranes. Buton-Tukang Besi micro-continent collided with SE Sulawesi/Muna Block from E Miocene- Late Miocene. Collision overthrust Kapantoreh ophiolitic suture (here interpreted as oceanic crust originally located between Muna and Buton), shortened and uplifted Buton. Tukang Besi single microcontinent with Buton, and separated from Buton as response to post-collisional tectonics. Banggai-Sula microcontinent collided with Sulawesi E Arm in M Miocene- E Pliocene. Post-collisional uplifts exhumed micro-continent in Buton, Wakatobi (Tukang Besi), and Luwuk (Banggai) areas and uplift of Quaternary reef terraces)

Savitri, K.P. (2016)- Geology and geothermal setting of Tompaso geothermal system, Indonesia, with comparisons of andesite alteration patterns with Wairakei, New Zealand. M. Sc. Thesis, Victoria University of Wellington, N.Z., p. 1-120.

(online at: <https://core.ac.uk/download/pdf/45830521.pdf>)

(On Tompaso geothermal system near Tondano caldera in N Sulawesi. Typical volcanic arc geothermal system)

Schepmann, M.M. (1907)- Mollusken aus posttertiären Schichten von Celebes. Sammlungen Geologischen Reichs-Museums Leiden, Ser. 1, 8, E.J. Brill, p. 153-203.

(online at: <http://repository.naturalis.nl/document/552420>)

(Molluscs from the post-Tertiary beds of Sulawesi'. Descriptions of molluscs from Kajoe raji, Manado area, N Sulawesi, collected by Fennema. Mainly gastropods (15 species of Conus, 7 species of Pleurotoma, 10 species of Drillia, 6 species of Mitra, 19 species of Turricula, 11 species of Nassa, 13 species of Cypraea, etc. spp.) and some pelecypods (Venus, Spondylus, Chlamys, etc.))

Schlaich, E.P. & J.R.J. Ten Berge (1941)- Rapport over het geologisch onderzoek van het Jong Tertiäre Pompanoea bekken (ZW Celebes). BPM- Balikpapan Geological Report *(unpublished)*

(Report on geological survey and shallow core hole drilling in Young Tertiary of Pompanoea (= Sengkang) Basin, SW Sulawesi)

Schmidt, C. (1901)- Untersuchung einiger Gesteinssuiten, gesammelt in Celebes von P. und F. Sarasin. In: P. & F. Sarasin, Materialien zur Naturgeschichte der Insel Celebes, 4, Kreidel, Wiesbaden, Appendix, p. 1-28.

(Investigations of some rock suites, collected in Sulawesi by P. & F. Sarasin'. Brief rock descriptions. No figures)

Schreuder, S. (1854)- Bijdragen tot de geologische en mineralogische kennis van Nederlandsch Indie door de Ingenieurs van het Mijnwezen in Nederlandsch Indie, VIII. Onderzoekingen naar steenkool in de afdeeling Maros of Noorderdistrikten van het gouvernement Celebes en onderhoorigheden. Natuurkundig Tijdschrift voor Nederlandsch-Indie 7, p. 388-395.

(Investigations of coal in the Maros or Northern Districts districts, (SW) Sulawesi'. Brief report of 1850 investigation of (Eocene-age) coal in the Maros area, North of Makassar. Generally poor quality coal seams, associated with common (Nummulites-)limestone and volcanic rocks. Tests of coal from test pit at Kantissan in steamship Vesuvius in 1852 showed poor results. Not much locality or geological detail; no figures)

Schubert, R.J. (1913)- Beitrag zur fossilen Foraminiferenfauna von Celebes. Jahrbuch Koningliche Kaiserliche Geologische Reichsanstalt, Vienna, 62 (1912), 4, p. 127-150.

(online at: www.landesmuseum.at/pdf_frei_remote/JbGeolReichsanst_063_0127-0150.pdf)

('Contribution to the fossil foraminiferal fauna of Sulawesi'. Foraminifera from North Arm and N part of East arm of Sulawesi, collected by Koperberg. Mainly young Miocene- Pliocene. Some E-M Miocene carbonates with Miogypsina spp., Lepidocyclina)

Sendjaja, P. (2013)- Petrologi dan geokimia batuan vulkanik di Kepulauan Togean, Teluk Tomini, Propinsi Sulawesi Tengah: implikasinya terhadap tatanan tektonik Pulau Sulawesi. Ph.D. Thesis, Institut Teknologi Bandung (ITB), p. 1- . *(Unpublished)*

('Petrology and geochemistry of volcanic rocks in Togean Islands, Tomini Bay, Central Sulawesi: implications for the tectonic structure of Sulawesi'. Volcanic rocks from Togean Islands 3 types:(1) Una-Una (adakitic subduction volcanics from partial melting of Celebes Sea slab at 70-85 km depth), (2) Togean (both adakites, basaltic-trachyandesite and result of partial melting of Sulawesi Sea slab in amphibole-eclogite zone) and (3) Walea (tholeiitic basaltic-andesite and tholeiite basalt, interpreted as upper part of ophiolite, formed around 6 Ma from seafloor spreading due to rollback of oceanic crust of Banggai-Sula microcontinent)

Sendjaja, P. & I.G.B.E. Sucipta (2008)- Adakite rock From Una-Una island, Central Sulawesi. Proc. 37th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 1, p. 212-228.

(online at: https://www.iagi.or.id/web/digital/14/2008_IAGI_Bandung_Adakite-Rock-From.pdf)

(Pyroclastics and lavas from Una-Una Island in Tomini Gulf adakitic geochemical signature: SiO₂ >60%, MgO <3%, low Y and HREE relative to normal island arc volcanics, high Sr and Nb enrichment. Tectonically, adakites formed by partial melting of young oceanic crust. Crust presently being subducted at nearby trench may be <25 Ma old)

Sendjaja, P., E. Suparka, C.I. Abdullah & E. Sucipta (2020)- Characteristic of the Mount Colo Volcano, Una-Una Island, Central Sulawesi Province: tectonic evolution and disaster mitigation. Proc. 3rd Int. Conf. TREPSEA, Gorontalo 2018, IOP Conference Series: Earth and Environmental Science 589, 012005, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/589/1/012005/pdf>)

(Colo volcano on Una-Una island, Gulf of Tomini, C Sulawesi, with magma of basaltic-trachyandesite to trachydacite composition of calc-alkaline, high-K calc-alkaline and shoshonite affinities. Since M Miocene (15 Ma) Celebes Sea Plate subducted under North Arm of Sulawesi, producing adakite-type volcanics. During Banggai-Sula microcontinent collision, volcanic activity in Una-Una Island and surrounding islands continued. 1983 eruption of Mt Colo produced abundant pyroclastic material with acid silica and still adakitic composition)

Sendjaja, P., E. Suparka, C.I. Abdullah, E. Sucipta & T. Hasenaka (2011)- A petrology and geochemistry of the volcanic rocks from the Togean Islands, Central Sulawesi, Indonesia: estimation of subduction component at a complex tectonic regime. Proc. Joint. 36th HAGI and 40th Annual Conv. Indonesian Association Geologists (IAGI), Makassar, JCM2011-166, p. 1-13.

(online at: https://www.iagi.or.id/web/digital/10/2011_IAGI_Makassar_Apetrology-and-Geochemistry.pdf)

(Una-Una volcano typical adakitic rocks. Mio-Pliocene volcanics of Togean islands further to E in Tomini Gulf quite different. Volcanic rocks from Walea Kodi and Walea Bahi Islands lower SiO₂ and low Sr content than Una-Una. Compositions seem similar to volcanic rocks from Sangihe region)

Senduk, K. G. & M. Abdurrachman (2023)- Volcanostratigraphy in the Lokon Volcano area and its surroundings, North Sulawesi. Bulletin of Geology (ITB) 7, 2, p. 1144-1154.

(online at: <https://buletingeologi.com/index.php/buletin-geologi/article/view/279/88>)

(Lokon Volcano active Quaternary volcano in Celebes- Sangihe volcanic arc. Area with nine geomorphological domains, six volcano systems. 18 rock units, including lava flows, pyroclastic flows, pyroclastic falls and mudflows. No age dating or discussion of historic events)

Septiana, S., A. Idrus, F. Zaccarini, G. Garuti & L.D. Setijadji (2021)- Ore mineralogy of podiform-type chromite deposit in Tedubara area and its vicinity, Kabaena Island, Indonesia. Proc. International Conference Geological Engineering and Geosciences, Yogyakarta 2021, IOP Conference Series: Earth and Environmental Science 851, 012044, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/851/1/012044/pdf>)

(Chromite deposits of podiform type on Kabaena Island, SE Sulawesi. Platinum Group Minerals (laurite; RuS₂) occur enclosed in chromite crystals. Fractured and brecciated)

Serhalawan, Y. & P.F. Chen (2024)- Seismotectonics of Sulawesi, Indonesia. *Tectonophysics* 883, 230366, p. (preprint online at: <https://essopenarchive.org/users/578676/articles/620477-seismotectonics-of-sulawesi-indonesia>)

Setiawan, I., S. Indarto, A.F. Ismayanto & Sudarsono (2012)- Karakter dan tipe mineralisasi hidrotermal di wilayah Bombana berdasarkan studi mineralogi dan geokimia. *Jurnal Sumber Daya Geologi (JSDG)* 22, 3, p. 155-168.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/115/107>)

('Character and the type of hydrothermal mineralization in the Bombana area based on a study of mineralogy and geochemistry'. Bombana gold mineralization in metamorphic rocks of Rumbia Mts, with no obvious connection with magmatism. Area with metamorphic and ultramafic rocks (garnet- glaukophane- amphibole schist, peridotite, serpentinite, metasediments, etc.). Gold mineralization of epithermal-mesothermal type, resulting from hydrothermal processes, formed after metamorphism. Ore minerals gold, pyrite, chalcopyrite, goethite, lepidocrocite and cinnabar, commonly associated with quartz veins/ K-Ar age of plagioclase of meta-andesite 85± 2 Ma)

Setiawan, N.I., Y. Osanai, N. Nakano & T. Adachi (2014)- Metamorphic evolution of garnet-biotite-muscovite schist from Barru Complex in South Sulawesi, Indonesia. *J. Southeast Asian Applied Geology (UGM)* 6, 2, p. 68-78.

(online at: <http://jurnal.ugm.ac.id/jag/article/download/7219/5658>)

(Mid-Cretaceous garnet-biotite-muscovite schist from Denedenge River in Barru Complex, 30 km N of Bantimala, SW Sulawesi. Bordered in N by ultramafic rocks and in S by Late Cretaceous turbidites. Foliation of schist varies from N80°E to N30°E, dipping 30-60° to E (SE). Garnet, biotite, muscovite, quartz, rutile and plagioclase represent peak P-T condition of this rock, estimated at T= 501-562°C and P= 0.89-0.97 GPa. Within geothermal gradient P-T path of eclogite from Bantimala Complex. Wakita 1994 K-Ar age ~106 Ma)

Setiawan, N.I., Y. Osanai, N. Nakano & T. Adachi (2013)- Jadeite jade from South Sulawesi in Indonesia and its geological significance. In: N.I. Setiawan et al. (eds.) *Proc. International Conference Geological Engineering*, Gadjah Mada University, Yogyakarta 2013, ER05, p. 40-56.

(online at: http://lib.ugm.ac.id/digitasi/upload/4244_jhon-mu.140108-nugroho.pdf)

(Jadeite abundant in high-P garnet-jadeite-quartz metamorphic rock in E Cretaceous Bantimala subduction complex of S Sulawesi. Rock mainly jadeite, garnet, quartz, phengite, epidote, with minor glaucophane and rutile. Rock experienced peak P-T condition at 2.2-2.5 GPa and 500-540 °C and subsequently retrogressed)

Setiawan, N.I., Y. Osanai, N. Nakano, T. Adachi, K. Yonemura, A. Yoshimoto (2016)- Prograde and retrograde evolution of eclogites from the Bantimala Complex in South Sulawesi, Indonesia. *J. Mineralogical and Petrological Sciences* 111, 3, p. 211-225.

(online at: https://www.jstage.jst.go.jp/article/jmps/111/3/111_150907/_pdf)

(Evolution of high-P metamorphic rocks from Bantimala Complex, S Sulawesi. Early Cretaceous K-Ar ages of 113-136 Ma probably reflect time of exhumation cooling. Eclogites and glaucophane occur as tectonic blocks in sheared serpentinites. Garnet rims in eclogite formed at peak P-T conditions of 2.3-2.7 GPa and 615-680 °C. Very low geothermal gradient during prograde path suggests subduction of old and cold oceanic crust)

Setiawan, N.I., Y. Osanai, N. Nakano, T. Adachi, K. Yonemura, A. Yoshimoto, L.D. Setiadji, K. Mamma & J. Wahyudiono (2013)- Geochemical characteristics of metamorphic rocks from South Sulawesi, Central Java, and South and West Kalimantan in Indonesia. *Proc. 5th AUNS/SEED-Net Regional Conference Geological Engineering*, p. 263-280.

(online at: www.seed-net.org/download/GeoE013_revised_060513.pdf)

(Metamorphic rocks in Cretaceous metamorphic complexes of C Java, S Kalimantan and S Sulawesi are mainly HP metamorphics. Protoliths are metabasics (basalts, andesite) and meta-sediments. Eclogites and blueschists from S Sulawesi with MORB and within-plate basalt signatures. Eclogites and blueschists from C Java mostly

within-plate basalt signatures, amphibolites and garnet amphibolites are MORB. Metatonalites from Nangapinoh, Schwaner Mts of W Kalimantan are calc-alkaline rocks from volcanic-arc environment, some adakitic in nature, one sample of 233 ± 3 Ma age (Late Triassic) (non-metamorphosed granites Cretaceous, 77-157 Ma)

Setiawan, N.I., Y. Osanai, N. Nakano, T. Adachi, K. Yonemura, A. Yoshimoto, L.D. Setiadji, K. Mamma & J. Wahyudiono (2013)- Geochemical characteristics of metamorphic rocks from South Sulawesi, Central Java, and South and West Kalimantan in Indonesia. *Asean Engineering J. (UTM)*, C, 3, 1, p. 107-127.
(online at: www.seed-net.org/wp-content/uploads/2015/12/GEOCHEMICAL-CHARACTERISTIC...)
(same paper as Setiawan et al. 2013)

Setiawan, I., I. Zulkarnain, S. Indarto, Sudarsono & A.F. Ismayanto (2010)- Genesa endapan emas di daerah Bombana: sebuah analisis awal berdasarkan pengamatan lapangan dan analisis petrografi. *Prosiding Pemaparan Hasil Penelitian Puslit Geoteknologi LIPI 2010*, p. 1-10.
(online at: <https://jrisetgeotam.lipi.go.id/index.php/proceedings/article/view/722/pdf>)
(*'Genesis of gold deposits in the Bombana area: a preliminary analysis based on field observations and petrographic analysis'. Gold mineralization in metamorphic rocks*)

Setyanta, B. & Subagio (2013)- Sinyal geomagnetik di Cekungan Sengkang implikasi terhadap pola struktur dan konfigurasi batuan alas cekungan. *Jurnal Sumber Daya Geologi (JSDG)* 23, 2, p. 69-79.
(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/91/85>)
(*'Geomagnetic signals in the Sengkang Basin and its implications for structural and basement configuration'. Intensity of magnetic anomalies at Sengkang Basin from -750- 400 nT. Sengkang Basin underlain by high magnetic ultrabasic rocks (especially E flank?). Geologic structures NE-SW fold, cut by NW-SE fault*)

Setyoko, J., S. Hadipandoyo & S. Oemar (2000)- Hydrocarbon resources assessment of the Late Miocene Tacipi Formation in the Bone Basin, South Sulawesi, Indonesia. *Proc. 36th Session Coord. Comm. Coastal and Offshore Programmes E and SE Asia (CCOP), Hanoi 1999*, p. 35-49.
(*Late Miocene Tacipi Fm reefal limestone gas producing in Kampung Baru Field, E Sengkang sub-basin of Bone Basin. Porosity generally 20-30% (moldic, vugular and fracture). Source rocks Eocene and Oligocene carbonaceous sediments. Unproven potential plays in Eocene Toraja Fm sst, Oligocene Toraja Fm carbonate and Pliocene Walanae Fm sst. Undiscovered resources in Tacipi play in Bone basin assessed as maximum 22.5 Gm³ and 5.3 million Tons of oil*)

Siagian, H.P. & Widijono (2009)- The possibility of hydrocarbon trap and its potential in the North Bone Basin, based on geological and geophysical data. *Jurnal Sumber Daya Geologi (JSDG)* 19, 1, p. 63-76.
(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/194/186>)
(*Bone basin believed to have formed since Early Tertiary, as fore-arc basin, underlain by pre-Tertiary metamorphics, volcanics and metasediments (Latimojong and Pompangeo Complexes). Hydrocarbon presence demonstrated by gas seeps in Pongko and Malangke villages. Coarse clastic and limestone deposits such as fluvio-deltaic Toraja and Lamasi Fms may be potential reservoirs; shales in Lamasi and Toraja Fms potential petroleum source rocks. Gulf Oil 1972 BBA 1X well in N part of Bone Bay TD at 10,521' in M Miocene*)

Siahaan, E.E., S. Ciptadi, D. Budihartanto & C.A.E. Pelmelay (1994)- Sistem panasbumi pada tektonik sesar Palu, di daerah Bora, Sulawesi Tengah. *Proc. 23rd Annual Conv. Indonesian Association Geologists (IAGI)*, p. 1001-1009.
(online at: <https://www.iagi.or.id/web/digital/54/36.pdf>)
(*'The geothermal system at the Palu fault, Bora area, C Sulawesi'. Granite in Palu area 15-16 Ma K/Ar ages*)

Siahaan, E.E., S. Soemarinda, A. Fauzi, T. Silitonga, T. Azimudin & I.B. Raharjo (2005)- Tectonism and volcanism study in the Minahasa compartment of the North Arm of Sulawesi related to Lahendong geothermal field, Indonesia. *Proc. World Geothermal Congress 2005, Antalya, Turkey*, p. 1-5.
(online at: <https://www.geothermal-energy.org/pdf/IGAstandard/WGC/2005/0654.pdf>)

(Minahasa segment of North Arm of Sulawesi is part of Sangihe active volcanic arc. Oldest rocks ('Pre Tondano volcanic series') composed of thick hyaloclastic rocks, basaltic andesite and pyroclastics with interbedded calcareous sediments with M Miocene- Pliocene planktonic foraminifera, suggesting volcanics deposited in open marine environment and became more terrestrial with time. Tondano Volcanics Plio-Pleistocene age)

Sidarto (2008)- Sesar barat laut- tenggara di daerah Mamuju dan sekitarnya dan hubungannya dengan pembentukan Cekungan Karama. *Jurnal Sumber Daya Geologi (JSDG)* 18, 2, p. 89-105.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/241/220>)

('NW-SE in the Mamuju area and surroundings and its relationship to the formation of the Karama Basin'. In SW Sulawesi four parallel NW-SE trending faults: Budong-budong, Talondo, Keang and Adang. Dextral faults in E Tertiary, but sinistral in Miocene-Pliocene. Karama Basin between Budong-budong and Talondo faults contains Eocene transgressive sedimentary rocks and probably step over basin of in E Tertiary)

Sidarto & S. Bachri (2013)- Struktur Geologi. In: Surono & U. Hartono (eds.) *Geologi Sulawesi*, LIPI Press, Jakarta, p. 277-302.

('Structural geology'. Chapter 12 in Geology of Sulawesi book. Brief reviews of major faults (Palu-Koro, Walanae, Matano, Balantak, etc.), Tertiary rifts (Makassar, Bone) and subduction zones)

Sidarto & U. Hartono (2009)- Identifikasi gunung api purba di daerah Sapaya, Sulawesi Selatan pada data indera jauh. *Jurnal Sumber Daya Geologi (JSDG)* 19, 6, p. 351-363.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/219/209>)

('Identification of ancient volcanoes in Sapaya, South Sulawesi, from remote sensing data'. S Arm of Sulawesi Island is Tertiary volcanic arc, represented by Camba Fm. Satellite imagery interpretation reveals two ancient volcanoes in Sapaya area and surroundings: (1) M Miocene- Pliocene Sapaya volcano eroded cone and (2) Pliocene Bantoloe volcano eroded cone. Sapaya Volcano may be controlled by Tethyan type subduction/collision between Australian micro continental and Eurasian continent plates)

Sidarto & Wahyono (2001)- Kaitan antara struktur geologi dan endapan batubara di cekungan Karama, Sulawesi. *Geological Research Development Centre (GRDC), Bandung, Special Publ. 26*, p. 15-28.

*('Link between structural geology and coal deposits in Karama basin, W Sulawesi'. Toraja Fm Late Eocene coal seams folded and thrust in Late Miocene- Early Pliocene. Coal rank locally increases along fault zones. Above coal Late Eocene limestone with *Discocyclus* and *Pellatispira*)*

Sidarto & Wahyono (2002)- Pemodelan geologi cekungan batubara di daerah Baraka, Enrekang, Sulawesi Selatan. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 12, 130, p. 2-18.

('Geologic model of the coal basin in the Baraka area, Enrekang, S Sulawesi'. Eocene coals of Toraja Fm rift section in Toraja Basin, N part of S Sulawesi. Overlie U Cretaceous Latimojong Fm and overlain by Late Eocene limestone. Three seams, Titok, Sangbuah and Batunoni-Lapin. Exposure of coal after Late Miocene-Pliocene folding event (see also Wahyono and Sidarto 2002))

Sidqi, M. & P. Utami (2018)- The geology and geothermal systems of the Minahasa District, North Sulawesi. *Proc. 6th Indonesia Int. Geothermal Convention & Exhibition (IIGCE), Jakarta 2018*, p. 1-7. *(online at: https://www.researchgate.net/publication/329362178_The_Geology_and_Geothermal_Systems_of_the_Minahasa_District_North_Sulawesi)*

(Minahasa district in N Arm of Sulawesi is parts of the Sangihe volcanic arc. Successive Pleistocene- Recent volcanic eruptions of Mts. Ambang, Soputan, Lokon, Mahawu, Tangkoko, Ruang, Karangetang and Mt. Awu led to multiple geothermal systems with different degrees of "maturity". Oldest volcanic activity in Lembeyan volcanic complex, E of Lake Tondano (Late Miocene?))

(Minahasa district in N Arm of Sulawesi is parts of the Sangihe volcanic arc. Successive Pleistocene- Recent volcanic eruptions of Mts. Ambang, Soputan, Lokon, Mahawu, Tangkoko, Ruang, Karangetang and Mt. Awu led to multiple geothermal systems with different degrees of "maturity". Oldest volcanic activity in Lembeyan volcanic complex, E of Lake Tondano (Late Miocene?))

Silver, E.A. (1981)- A new tectonic map of the Molucca Sea and East Sulawesi, Indonesia, with implications for hydrocarbon potential and metallogenesis. In: A.J. Barber & S. Wiryosujono (eds.) *The geology and tectonics of Eastern Indonesia*, Proc. CCOP-IOC SEATAR Working Group Meeting, Bandung 1979, Geological Research Development Centre (GRDC), Bandung, Special Publ. 2, p. 343-347.

(New fault zones discovered during Scripps 1976-1979 cruises and land expeditions: (1) Sula Thrust at N side Banggai- Sula Platform, (2) W continuation of Sorong FZ and (3) E extension of Batui Thrust which bounds upthrust E Sulawesi ophiolite (which also forms Gorontalo basin basement, and emplacement was complete in Pliocene or earlier). Also mapped recently active Tolo Thrust E of Sulawesi and Buton)

Silver, E.A., Y. Joyodiwiryo & R. McCaffrey (1978)- Gravity results and emplacement geometry of the Sulawesi ultramafic belt, Indonesia. *Geology (GSA)* 6, p. 527-531. *(also in Geological Research Development Centre (GRDC), Bandung, Special Publ. 2, p. 313-319)*
(SE arm Sulawesi gravity highs at schist ultramafic contacts indicate thick ultramafic rocks there, possibly dipping under schist. Gravity effect of ultramafics decreases E away from schist)

Silver, E.A., R. McCaffrey, Y. Joyodiwiryo & S. Stevens (1983)- Ophiolite emplacement by collision between the Sula Platform and the Sulawesi arc, Indonesia. *J. of Geophysical Research: Solid Earth* 88, B11, p. 9419-9435.

(online at: https://robmccaffrey.github.io/pubs/silver_ophiolite_jgr_1983.pdf)

(Large ophiolite belt from Miocene collision of Sulawesi island arc and continental Sula Platform. Batui thrust separates ophiolite from deformed sedimentary rocks along edge of Sula Platform and continues E from Sulawesi along S margin of Gorontalo basin. Sulawesi ophiolite traced offshore to oceanic crust basement of Gorontalo basin. Ophiolite melange underlies harzburgites on SE Arm beneath low-angle thrusts. Melange several 100m thick thrust packets of serpentine and red shale matrix and N to NE dipping foliation, consistent with significant N-ward component of lower plate movement, probably Sula platform margin. Ophiolite emplaced by oblique convergence of Sula platform along S edge of Gorontalo basin. Gorontalo basin probably forearc basin with ophiolite basement. Presence of dunite in Colo volcanic products in Tomini Bay indicate magma went through through oceanic material, possibly part of E Sulawesi Ophiolite)

Silver, E.A., R. McCaffrey & R.B. Smith (1983)- Collision, rotation, and the initiation of subduction in the evolution of Sulawesi, Indonesia. *J. of Geophysical Research: Solid Earth* 88, B11, p. 9407-9418.

(online at: https://robmccaffrey.github.io/pubs/silver_sulawesi_jgr_1983.pdf)

(Sulawesi shaped as result of collision with Sula platform, resulting in rotation of N volcanic arm and accretionary wedge of N Sulawesi trench. N Sulawesi trench changes laterally from no active deformation in E to a wide accretionary wedge in W. Early thrusting produced steep frontal slope (8°-16°), indicative of high basal shear stress, more advanced (W) zone of thrusting produces gentle slope (2°). Paleomagnetic data suggest post-Late Eocene counter-clockwise rotation of N Arm. Convergence between N Banda Basin and SW Sulawesi documented by Tolo thrust. S end of thrust projects toward Buton, but structural relations not clear)

Simandjuntak, T.O. (1980)- Wasuponda melange. *Proc. 8th Annual Conv. Indonesian Association Geologists (IAGI), Bandung*, p.

(First description of C Sulawesi Wasuponda melange. Contains eclogite)

Simandjuntak, T.O. (1981)- Some sedimentological aspects of Mesozoic rocks in eastern Sulawesi, Indonesia. *Proc. 9th Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta*, p.

Simandjuntak, T.O. (1986)- Sedimentology and tectonics of the collision complex of the East arm of Sulawesi, Indonesia. Ph.D. Thesis, Royal Holloway and Bedford New College, University of London, p. 1-374.

(online at: <https://repository.royalholloway.ac.uk/file/bf7a78df-c538-4bff-a28d-983a91cf0634/1/10090181.pdf>)

*(Stratigraphic-tectonic study of Sulawesi East Arm. Late M Miocene and younger Kolokolo melange of main thrust zone separates tectonized, obducted E Sulawesi Ophiolite belt from underlying imbricated Late Triassic-E Miocene sediment cover of Banggai-Sula continental block. Oil seeps generally associated with melange outcrops. Classic ophiolite stratigraphy in Early Cretaceous(?) East Sulawesi (Balantak) ophiolite: ultramafic rocks- gabbro- sheeted dikes- pillow basalts. ('Boba Fm' cherty ocean floor pelagic deposits above ophiolite: E Cretaceous (Valanginian- E Cenomanian) Boba beds radiolarian chert (with *Thanarla conica* (= *T. brouweri* Tan), *Zipondium*, *Archaeodictyomitra apiaria*, *Pseudodictyomitra cosmoconica*, *Acanthoricus*, *Cryptocephalic*, etc., p. 171; B. Murchey, USGS identifications), U Cretaceous pelagic calcilutite (with *Globotruncana*,*

Rotalipora) and Eocene- E Oligocene pelagics. Some pillow basalts may be E Tertiary seamounts. Post-orogenic 'molasse' Late Miocene- Pliocene in age and derived from N/NW)

Simandjuntak, T.O. (1986)- Struktur duplek (dwiunsur), sesar sungkup dan sesar jurus mendatar di lengan timur Sulawesi. Proc. 15th Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, p. ('Duplex structures, thrust faults and wrench faults in the East arm of Sulawesi')

Simandjuntak, T.O. (1986)- New data on the age of ophiolitic rocks in Eastern Sulawesi. Proc. 15th Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, p. 649-657. (see also Simandjuntak (1992) (online at: <https://www.iagi.or.id/web/digital/44/PIT-IAGI-1986-Vol-2-Paper-26.pdf>) (Radiometric analyses of gabbro, dolerite and pillow basalt from East Arm of Sulawesi suggest ophiolite and its seamount basalts are, respectively Cretaceous and Eocene in age (peridotites could not be dated due to low potassium content). Associated E Cretaceous (Valanginian- E Cenomanian range) radiolarian chert (deposited below CCD depth) and calcilutites with Late Cretaceous Globotruncana from upper ophiolite sequence)

Simandjuntak, T.O. (1990)- Sedimentology and tectonics of the collision complex in the East Arm of Sulawesi, Indonesia. Geologi Indonesia 13, 1, p. 1-35. (Summary of the Simandjuntak 1986 thesis. In E Arm of Sulawesi imbricated Mesozoic-Paleogene continental margin sediments of Banggai-Sula Platform juxtaposed with E Sulawesi Ophiolite Belt along Batui- Balantak Fault system. Three distinct sequences in E Arm: (1) Triassic- Paleogene continental margin; (2) Cretaceous pelagic chert and radiolaria-rich calcilutite (= sediment cover of ophiolite suite?) and (3) overlap assemblage of Neogene post- orogenic clastics ('Sulawesi Molasse'), with clasts of (1) and (2). Collision zone marked by Kolokolo Melange with M Miocene calcareous mudstone matrix, locally with oil seeps. At least 3 raised coral reef terraces on S coast of East Arm show ongoing uplift)

Simandjuntak, T.O. (1992)- New data on the age of the ophiolite in Eastern Sulawesi. Bull. Geological Research Development Centre (GRDC) 15, p. 38-44. (K/Ar dating of gabbro from E Sulawesi ophiolite gave ages of 93-48 Ma (Late Cretaceous- E Eocene); pillow basalts ~53-38 Ma (Eocene). Peridotites could not be dated due to very low K content. Oldest cherts with manganese nodules above pillow basalts of ophiolite complex in Boba beds from E Arm of Sulawesi contain E Cretaceous (Valanginian- E Cenomanian= > 95 Ma) radiolaria, overlain by U Cretaceous calcilutites with Globotruncana (K/Ar ages of E Sulawesi (Ophiolite radiometric ages therefore apparently almost all much too young?; JTvG)

Simandjuntak, T.O. (1992)- Sedimen Mesozoikum dan prospek hidrokarbon di Indonesia Timur (studi kasus penelitian geologi di lengan Timur Sulawesi). Jurnal Geologi dan Sumberdaya Mineral (JGSM) 2, 7, p. 10-20. ('Mesozoic sediments and hydrocarbon prospects in E Indonesia, special study of E arm of Sulawesi'. Oil and gas seeps, probably sourced from Jurassic marls, in many places between Banggai-Sula microcontinent and E Sulawesi ophiolite belt. Tectonism before, during and after continent collision may stimulate oil migration)

Simandjuntak, T.O. (1993)- Neogene plate tectonic convergence in eastern Sulawesi. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 3, 25, p. 2-10. (In M Miocene NW-ward moving microcontinental blocks incl. Banggai-Sula Platform, Tukang Besi- Buton Platform and Mekongga Platform, collided ('underplated') with E Sulawesi Ophiolite Belt, in 'Tethyan-type' convergence. Followed by deposition of Late Miocene- Pliocene post-orogenic 'molasse' of non-marine and shallow marine sediments. E Sulawesi Ophiolite overlain by U Cretaceous pelagic calcilutite with radiolaria (Matano= Boba Fm). C Sulawesi Metamorphic Belt formed in W-dipping Benioff zone in Cretaceous-Paleogene. Imbricated sedimentary cover of Banggai-Sula Plate with U Triassic (Tokala Lst Fm) - Jurassic (Nanaka quartz sst, Sinsidik Lst with belemnites) and U Cretaceous- Paleogene sediments)

Simandjuntak, T.O. (1993)- Struktur rangkap (duplex), sesar sungkup dan sesar jurus mendatar di Lengan Timur Sulawesi. Bull. Geological Research Development Centre (GRDC) 16, p. 27-44. ('Duplex structure overthrusting and displacement in the eastern arm of Sulawesi'. Batui Thrust is M Miocene suture between Banggai-Sula Platform and E Sulawesi Ophiolite Belt. Consists of several thrusts, all dipping

NW. NE portion subjected to dextral strike-slip with 150 km of displacement in Plio-Pleistocene (Balantak fault). Melanges related to tectonic diapirism developed along Batui Thrust zone. Several duplex structures developed in sediments of Banggai-Sula Plate)

Simandjuntak, T.O. & M. Mubroto (1991)- Neogene Tethyan type convergence in eastern Sulawesi. In: E.P. Utomo, H. Santoso & J. Sopaheluwakan (eds.) Proc. Silver Jubilee Symposium on the dynamics of subduction and its products, Yogyakarta-Karangasambung 1991, Research Development Centre Geotechnology, Indonesian Institut of Sciences (LIPI), Bandung, p. 274-277.

Simandjuntak, T.O., E. Rusmana, J.B. Supandjono & A. Koswara (1993)- Geology of the Bungku Quadrangle, Sulawesi. Quad. 2213, Map 1:250,000, Geological Research Development Centre (GRDC), Bandung, p. 1-13. *(E Central Sulawesi map sheet, mapped in 1980. Two terranes: (1) E Sulawesi ophiolite of Cretaceous ultramafics, overlain by Upper Cretaceous pelagic sediments (Matano Fm) and Late Miocene-Pliocene tuffaceous clastics and (2) 'Banggai-Sula terrane' of Triassic (-E Jurassic?) Tokala Fm limestones and clastics, Jurassic Nanaka Fm clastics with conglomerates with volcanics, red granite and metamorphic clasts, J-K pelagic limestones and U Eocene- Lower Miocene Salodik Fm limestones. Various episodes of folding; last tectonic event in Pleistocene)*

Simandjuntak, T.O., E. Rusmana, Suroño & J.B. Supandjono (1991)- Geology of the Malili Quadrangle, Sulawesi. Quad 2113, 1:250,000. Geological Research Development Centre (GRDC), Bandung, p. 1-35. *(C Sulawesi map between 2-3°S, N end Bone Bay. Comprises W and E Sulawesi provinces, separated by Palu-Koro fault. W Sulawesi with Late Cretaceous flysch, Eocene- Miocene clastics, Oligocene- M Miocene volcanic arcs and Neogene granitic rocks, unconformably overlain by Late Miocene- Pliocene turbidites, followed by Plio-Pleistocene- Recent andesitic volcanics. C Sulawesi Pompangeo metamorphic belt, E Sulawesi ophiolite overlain by Cretaceous pelagic Matano Fm with common Cretaceous radiolarian cherts near base. Late Miocene- Pliocene post-orogenic molasse)*

Simandjuntak, T.O., Suroño & Sukido (1994)- Geology of the Kolaka Sheet, Sulawesi (Quadrangles 2111, 2210, 2211), 1:250,000. Geological Research Development Centre (GRDC), Bandung, p. 1-18. *(SE Sulawesi map sheet between 4-5°S, mapped in 1983. Two juxtaposed terrains: (1) E Sulawesi ophiolite (E Cretaceous ultramafics overlain by Late Cretaceous pelagic limestone) and 'Pompangeo metamorphic complex' (incl. eclogites and glaucophane-bearing rocks) and (2) Buton- Tukang Besi continental terrane with ?Permo-Carboniferous? metamorphics and low-metamorphic Triassic Meluhu Fm clastics and Tokala Fm carbonates. Both overlain by M Miocene- Pliocene 'Sulawesi molasse'. Strong Paleogene deformation, M Miocene upthrust of E Sulawesi terrane onto Tukang Besi- Buton block and Plio-Pleistocene block faulting. (Panggabean & Suroño 2011: Matano Fm (pelagic rock overlying E Sulawesi ophiolite?) contains E Cretaceous radiolaria *Thanaria conica*, *Archaeodictyomitra apiaria*, *Pseudodictyomitra cosmoconica*), etc.)*

Simanjuntak, A.V.H., K.H. Palgunadi, P. Supendi, U. Muksin, E. Gunawan, S. Widiyantoro, N. Rawlinson et al. (2024)- The western extension of the Balantak Fault revealed by the 2021 earthquake cascade in the central arm of Sulawesi, Indonesia. *Geoscience Letters* 11, 35, p. 1-10. *(online at: <https://geoscienceletters.springeropen.com/articles/10.1186/s40562-024-00353-7>)* *(Two shallow earthquakes of magnitude 6.2 and 5.8 in central (=East) arm of Sulawesi in 2021 reveal previously unmapped faults, called C. Balantak and W Balantak)*

Simandjuntak, T.O., Suroño & J.B. Supandjono (1991)- Geologic map of the Poso Quadrangle, Sulawesi. Map 1:250,000. Geological Research Development Centre (GRDC), Bandung, p. *(C Sulawesi map between 1-2°S, S end Tomini Bay. Two terrains: W Sulawesi, E Sulawesi)*

Simons, W.J. F., D. van Loon, A. Walpersdorf, B.A.C. Ambrosius, J. Kahar, H.Z. Abidin, D.A. Sarsito, C. Vigny, S. Haji Abu & P. Morgan (2000)- Geodynamics of S.E. Asia: First results of the Sulawesi 1998 GPS campaign. In: K.P. Schwartz (ed.) Proc. Geodesy beyond 2000 Conference, Birmingham 1999, Springer, p. 271-277.

(Results of third GPS campaign of international GEODY5SEA (GEODYnamics of South and South East Asia) project, with a dense geodetic network in Sulawesi)

Socquet, A., J. Hollingsworth, E. Pathier & M. Bouchon (2019)- Evidence of supershear during the 2018 magnitude 7.5 Palu earthquake from space geodesy. *Nature Geoscience* 12, p. 192-199.

(Palu-Koro fault rapidly moving left-lateral strike-slip fault. Palu earthquake of September 2018 probably ruptured 30 km linear section of the rupture S of Palu city at supershear velocities)

Socquet, A., W. Simons, C. Vigny, R. McCaffrey, C. Subarya, D. Sarsito, B. Ambrosius & W. Spakman (2006)- Microblock rotations and fault coupling in SE Asia triple junction (Sulawesi, Indonesia) from GPS and earthquake slip vector data. *J. of Geophysical Research* 111, B08409, 3, p. 1-15.

(online at: <http://onlinelibrary.wiley.com/doi/10.1029/2005JB003963/epdf>)

(Current Sulawesi deformation described by small number of rapidly rotating blocks. SW Sulawesi (Makassar Block) rotates CCW at ~1.4°/Myr. NE Sulawesi (Bangai-Sula) 3 blocks: central N Sula Block moves NNW and rotates CW at ~2.5°/Myr, NE Manado Block rotates CW at ~3°/My; E Sulawesi pinched between N Sula and Makassar blocks. Along Makassar Block- Sunda Plate boundary, trench accommodates ~15 mm/yr of slip in Makassar Strait. N Sula-Manado blocks boundary is Gorontalo Fault, moving right laterally at ~11 mm/yr. 42 mm/yr relative motion between N Sula and Makassar blocks accommodated on Palu-Koro left-lateral fault zone. Data also indicate pull-apart structure in Palu area. Sulawesi example of collision accommodated by block rotation instead of mountain building)

Soehaimi, A & D. Muslim (2013)- Seismotectonics of the Palu-Kuro active fault and analysis of the disappearance of megalith cultures from central Sulawesi island. *Proc. 49th Annual Session Coord. Comm. Geoscience Programmes E and SE Asia (CCOP), Sendai*, p. 75-81.

(online at: www.ccop.or.th/download/as/52as2.pdf)

Soemarno, S. (1979)- Beberapa hasil penerapan cara terpadu pada batuan yang mengandung bijih khromit di daerah Lasitae (Barru), Sulawesi Selatan. *J. Riset Geologi dan Pertambangan (LIPI)* 2, 1, p. 32-44.

(online at: <http://pustaka.geotek.lipi.go.id/wp-content/uploads/2016/02/Riset-Vol.2-No.1-2-2-.pdf>)

('Some of the results of integrated study of rocks with chromite ore in the Lasitae (Barru) area, South Sulawesi'. Lasitae area mountains SE of Barru with ultramafic zones with two WSW-ENE belts of chromite ore deposits)

Soeria-Atmadja, R., J.P. Golightly & B.N. Wahyu (1974)- Mafic and ultramafic rock associations in the East Arc of Sulawesi. *Proceedings Institut Teknologi Bandung (ITB)* 8, 2, p. 67-85. *(also in Proc. Regional Conference. Geology of SE Asia, Kuala Lumpur 1972)*

(online at: <https://journals.itb.ac.id/index.php/jmfs/article/view/9683/3670>)

(E and SE arms of Sulawesi (incl. Wawoni island in S and W Buton) largely occupied by discontinuous belts of large ultramafic complexes, composed mainly of hartzburgite, lherzolite with some dunite and pyroxenite. Presumably of Late Mesozoic- Early Tertiary age. Associated with small masses of gabbroic rocks. Borders of ultramafic intrusions commonly serpentized. Contacts with surrounding rocks generally faults/ thrusts)

Soeria-Atmadja, R., B. Priadi, T.M. van Leeuwen & I. Kavalieris (1999)- Tectonic setting of porphyry Cu-Au, Mo and related mineralization associated with contrasted Neogene magmatism in the Western Sulawesi arc. *Island Arc* 8, 1, p. 47-55.

(Neogene W Sulawesi Arc three magmatic provinces: (1) South: K alkaline-shoshonitic, with leucite-bearing rocks, 13-2 Ma (2) Central: high-K calc-alkaline and (3) North low-K, normal calc-alkaline arc volcanics, mainly 22-13 Ma, also 9.5 Ma-present. Origin of magmatism in terms of subduction and collision processes contentious. Four widely spaced Cu-Au porphyry and one Mo porphyry district(s) along W Sulawesi Arc, with N Sulawesi province most mineralized. Porphyry Mo systems require involvement of continental crust in magma source, while Au-rich porphyry systems are derived from mantle source)

Soesilo, J. (1998)- Metamorfosa pada komplek Latimojong, Sulawesi Selatan dan makna tektoniknya. Masters Thesis, Institut Teknologi Bandung (ITB), p. 1-85. *(Unpublished)*

(Metamorphism in the Latimojong Complex, S Sulawesi and tectonic significance'. Metamorphic rocks of Latimojong Mts low- medium grade rocks derived from alternating siliciclastic, calcareous and volcanic rocks, intruded by basaltic-acidic, high K, calc alkaline and tholeiite rocks. W-dipping imbrication dominant structure and involves metamorphic rocks, serpentinites, chert and island arc metabasites of accretionary complex. At least three deformational phases, including metamorphism at glaucophane greenschist facies. Supports formation of primitive island arc prior to its collision with Sundaland margin)

Soesilo, J. & J. Sopaheluwakan (1998)- Petrologi dan geokimia meta-batuan beku Pegunungan Latimojong, Sulawesi Selatan. Proc. 27th Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 3 (Geodinamika, Magmat. Volkanologi), p. 94-107.

(online at: <https://www.iagi.or.id/web/digital/56/62.pdf>)

(Petrology and geochemistry of metamorphics of Latimojong Mts, S Sulawesi'. Geochemistry of 10 metamorphosed igneous rock samples in Latimojong metamorphic complex: metabasites (former island arc basalt), meta-gabbros, dolerites, andesites and granite, presumably formed in active subduction environment)

Soesilo, J., E. Suparka, C.I. Abdullah & V. Schenk (2010)- Pemetaan inklusi di dalam garnet tekanan tinggi pada kompleks melange Bantimala, Sulawesi Selatan. Majalah Geologi Indonesia (IAGI) 25, 3, p. 143-159.

(online at: <https://eprints.upnyk.ac.id/12891/>)

(Inclusion mapping in high pressure garnet in the Bantimala melange complex, South Sulawesi'. High pressure metamorphics of Bantimala Complex, S Sulawesi, consist of eclogite, eclogite-epidote and blueschist. Rocks rich in garnet with various inclusions of previously formed mineral groups. Two types of garnet: (1) massive brown-red almandine with inclusions of epidote, rutile, quartz, phenjite, glaucophane, etc., found in eclogite; (2) "ox-eye" rimmed garnet with inclusions of chlorite, epidote, rutile, calcite, actinolite, glaucophane, quartz, etc. Garnet formed during progradational metamorphism to eclogite facies, under P of 27-31 kb and T of up to 680° C. Assuming geothermal gradient of 6.5° C/km, eclogite was subducted to depth of 110 km)

Sohma, K. (1973)- *Florschuetzia*, a fossil sonneratioid pollen genus, from Sulawesi, Indonesia. Science Reports Tohoku University, Series 4 (Biology), 36, 4, p. 261-266.

Sompotan, A.F. (2012)- Struktur geologi Sulawesi. Perpustakaan Sains Kebumihan, Institut Teknologi Bandung (ITB). p. 1-54.

(online at: https://www.academia.edu/29803956/Buku_Geologi_Sulawesi_Armstrong_Sompotan)

(Geological structure of Sulawesi'. Mainly review of published data on Sulawesi geology)

Song, T., T. Hao, J. Zhang, L. Cao & M. Dong (2022)- Numerical modeling of North Sulawesi subduction zone: Implications for the east–west differential evolution. Tectonophysics 822, 229172, p. 1-11.

(Modeling of rapid evolution and obvious E-W differential evolution in N Sulawesi subduction zone, where Celebes Sea plate inserted itself under N arm of Sulawesi, which simultaneously rotated clockwise)

Sopaheluwakan, J. (1979)- The evolution of Franciscan type melange in South Sulawesi, with special reference to the Barru area. J. Riset Geologi dan Pertambangan (LIPI) 2, 1, p. 45-55.

(online at: <http://pustaka.geotek.lipi.go.id/wp-content/uploads/2016/02/Riset-Vol.2-No.1-2-2-.pdf>)

(Early study of Barru- Bantimala melange/ metamorphic complexes of SW Sulawesi, and similarities with SE Kalimantan and C Java. Metamorphics include glaucophane schists, eclogites, amphibolite, marble, etc., unconformably overlain by E Cretaceous? deep-sea sediments, followed by U Cretaceous flysch. Associated with fault-bounded, chromite-bearing ultramafics with shear zones (but no pillow lavas))

Sopaheluwakan, J. (1994)- Do Karangsambung (Central Java) and Bantimala (SW Sulawesi) form a single subduction process? a provocative view. Proc. 30th Anniversary Symposium, Research and Development Centre for Geotechnology (LIPI), Bandung, 2, p. 7-8.

(Cretaceous subduction complexes of Ciletuh (W Java), Karangsambung and Bayat (C Java), Meratus (S Kalimantan), and Bantimala and Barru (S Sulawesi) may belong to same orogenic belt. Bantimala and Barru complexes may form single and intact Mesozoic basement, linked to Meratus Range prior to Makassar Strait opening)

Sopaheluwakan, J. (1995)- The deep crustal processes of West Arm of Sulawesi and the evolution of Makassar Strait: evidences from Bantimala, Meratus Mountain and Palu Koro Fault Zone. In: Y. Kumoro et al. (eds.) Proc. Seminar Sehari Geoteknologi dalam industrialisasi, Hasil-hasil Penelitian Puslitbang Geoteknologi LIPI, p. 216-217. (*Abstract*).

(West Arm of Sulawesi was eastern margin of Sunda craton, now separated from mainland of Kailmantan by thinned continental crust of Makassar Straits. East Sunda crust exposed near Palu (Toboli complex schists and slates). Sunda continent rimmed by Late Mesozoic subduction/accretionary complex, exposed as tectonic windows in Bantimala and Barru areas, extending N to Palu and to SW in Karangsambung. Late Cretaceous accretion ended subduction. Long-standing subduction had enriched mantle wedge under continental margin; its buoyancy led to continental crustal stretching and opening of Makassar Straits in E Tertiary)

Sopaheluwakan, J., A. Kadarusman, B. Priyadi & H. Utoyo (1995)- The nature of basement rocks in the Palu Region, Central Sulawesi. The newly found eclogite and its regional implications. Proc. 6th Int. Congress Pacific Neogene Stratigraphy and IGCP-335, Neogene evolution of Pacific: biotic, climatic, oceanographic and tectonic development, Puspitek Serpong 1995, Bandung/Kyoto, p. 77-83.

Sopaheluwakan, J., K. Miyazaki, I. Zulkarnain & K. Wakita (1993)- Early Cretaceous Eastern Sunda subduction metamorphism and its tectonic implication: record of Karangsambung and Bantimala eclogites. Proc. 22nd Annual Conv. Indonesian Association Geologists (IAGI), Bandung, p.

Spencer, J.E. (2010)- Structural analysis of three extensional detachment faults with data from the 2000 Space-Shuttle Radar Topography Mission. GSA Today 20, 8, p. 4-10.

(Large grooved surfaces on Space Shuttle Radar Topography images interpreted as exhumed footwalls of recently active extensional detachment faults. Examples include N Tokorondo Mts NW of Lake Poso and Pompangeo Mts E of Lake Poso in C Sulawesi. Linear landforms interpreted by Hamilton, etc., as thrust imbrication with thrusts striking parallel to ridges here interpreted as stretching lineations of exhumed footwall of detachment fault. Length of lineaments suggests 60-70 km of extension above Pompangeo complex)

Spencer, J.E. (2011)- Gently dipping normal faults identified with Space Shuttle radar topography data in Central Sulawesi, Indonesia, and some implications for fault mechanics. Earth Planetary Science Letters 308, p. 267-276.

(Topography data from C Sulawesi show two corrugated, domal landforms, covering 100s to 1000s of km², bounded to N by abrupt transition to hilly to mountainous topography. Interpreted as metamorphic core complexes. N-ward transition interpreted as traces of extensional detachment faults, dipping 4°- 18°)

SRK Consulting (Australasia) Pty Ltd. (2021)- Independent Technical Assessment Report Toka Tindung Gold Mine, North Sulawesi, Indonesia. Project EDM004, p. 1-224.

(online at: https://minedocs.com/22/Toka_Tindung-TechnicalAssessmentReport-032021.pdf)

(Extensive review of geology and mineralisation contained in area of Toka Tindung Gold Mine, 35 km NE of Manado, N Sulawesi. Gold production since 2011. Gold hosted in Plio-Pleistocene andesitic and basaltic subaerial volcanic and volcanoclastic rocks, informally known as Maen volcanics. Economic gold-silver mineralisation discovered to date low-sulphidation epithermal style deposits, typically within small shoots that form at dilational sites along the host quartz vein structures)

Stelbrink, B., C. Albrecht, R. Hall & T. von Rintelen (2012)- The biogeography of Sulawesi revisited: is there evidence for a vicariant origin of taxa on Wallace's 'anomalous island'? Evolution 66, p. 2252-2271.

(online at: http://download.naturkundemuseum-berlin.de/bjoern.stelbrink/stelbrink_etal_2012.pdf)

(Divergence time estimates for split of Sulawesi lineages from sister groups postdate relevant tectonic vicariant events, suggesting island predominantly colonized by dispersal. Speciation on Sulawesi not before Miocene, consistent with geological evidence for more land on island from that time)

Stevens, C., R. McCaffrey, Y. Bock, J. Genrich, Endang, C. Subarya, S.S.O. Puntodewo, Fauzi & C. Vigny (1999)- Rapid rotations about a vertical axis in a collisional setting revealed by the Palu fault, Sulawesi, Indonesia. *Geophysical Research Letters* 26, 17, p. 2677-2680.

(online at: <http://onlinelibrary.wiley.com/doi/10.1029/1999GL008344/epdf>)

(GPS measurements indicate left-lateral Palu fault in C Sulawesi slips at ~38 mm/yr. Palu and nearby faults accomodate rapid CW rotation of nearly 4°/Ma of E Sulawesi relative to E Sunda. Rotation of E Sulawesi transfers E-W shortening between Pacific- Eurasian plates to N-S subduction of Celebes basin under Sulawesi)

Stolley, E. (1934)- *Über Mesozoische Belemniten-führenden Schichten von Celebes*. Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie 10, p. 172-175.

(‘On Mesozoic belemnite-bearing beds from Sulawesi’. Appendix in Brouwer (1934), describing material collected in 1929 from Central Sulawesi. Upper Jurassic (probably lower Oxfordian) belemnites, mainly Belemnopsis gerardi group (= Tithonian B. galoi- B. stolleyi of Challinor, 1990), from limestone with chert at Bahoempombini on Gulf of Tolo). No figures)

Subagio & B.S. Widijono (2012)- Interpretasi pola anomali gaya berat regional kaitannya terhadap potensi sumber daya geologi di lengan selatan Sulawesi. *Jurnal Sumber Daya Geologi (JSDG)* 22, 1, p. 49-64.

(online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/106/98>)

(‘Interpretation of the regional gravity anomaly patterns in relation to potential geological resources in the South arm of Sulawesi’. Geologic cross sections interpretation W-directed fold-thrusting)

Subandrio, A.S. (2006)- Diagenetic alteration in Late Miocene carbonate of Tacipi area, South Celebes. *Proc. 35th Annual Conv. Indonesian Association Geologists (IAGI), Pekanbaru 2006*, p. 1-10.

(Tacipi reefal carbonate platform in Sengkang Basin, S Sulawesi mainly homogenous boundstones at top and packstones with local grainstones, and wackestones at bottom. Four reef facies identified: patch reef, barrier reef, fore reef and lagoon. Extensive freshwater leaching created biomoldic and vug pores)

Subandrio, A.S. & E. Usman (2011)- Diagenetic features of paleo lagoonal reef of Tacipi Area, South Celebes. *Bulletin of the Marine Geology* 26, 2, p. 95-104.

(online at: <http://ejournal.mgi.esdm.go.id/index.php/bomg/article/view/37/38>)

Late M Miocene- E Pliocene Tacipi Lst exposed in Tacipi area, Sengkang Basin, in lagoonal facies. Limestones mainly homogenous boundstones on top and packstones with local grainstones, and wackestones at base. Extensive freshwater leaching of fossil fragments and calcareous cement created moldic and vug porosity)

Subroto, E.A., B. Priadi & B. Yulian (2004)- Study on gas samples collected from Tanjung Api and Tomori area, Sulawesi: abiogenic, biogenic, or thermogenic? *Buletin Geologi (ITB)* 36, 3, p. 117-124.

(Analysis of 3 gas samples from E Sulawesi. Two are from Donggi 1 well and are biogenic. Tanjung Api surface seep sample 53% hydrocarbon gas (98.2% methane/ CH₄, 1.5% ethane) and 16% hydrogen/H₂. Carbon isotopes d13C are unusually heavys, Origin is dubious: possibly abiogenic or post-mature or biodegraded (NB: more recent studies from ophiolites around the world show very similar serpentinization-derived gas seepage; see also Van Gorsel & Subroto, 2022)

Subandrio, J. (1997)- Petrologi dan geokimia batuan beku Formasi Kalamiseng, daerah Bone, Sulawesi Selatan. *Kumpulan Makalah Hasil Penelitian dan Pemetaan 1996/1997, Pusat Penelitian dan Pengembangann Geologi (GRDC), Bandung*, p. 364-374.

(‘Petrology and geochemistry of igneous rocks of the Kalamiseng Formation, Bone area, South Sulawesi’. Late Oligocene- E Miocene volcanics. In ‘Collection of Research Papers and Mapping Results of the Geological Research and Development Center, 1996/1997)

Sudarmono (1999)- Tectonic and stratigraphic evolution of the Bone Basin, Indonesia: insights to the Sulawesi collision complex. *Proc. 27th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta*, p. 531-534.

(Bone Basin is subduction complex/ suture between Sundaland and Gondwana-derived micro-continent that evolved into submerged intra-montane basin. Paleogene- E Miocene forearc stage with W-dipping subduction complex. M-L Miocene W-ward convergence of microcontinents toward subduction complex changed

deposition and basin configuration. M Miocene collision with accretionary complex, followed by collision with W Sulawesi. Collision led to E-ward rotation of SE Sulawesi, with rifting and submergence of S part of basin. Compression from collision caused major back-thrust systems of W-verging Kalosi and Majene fold belts in W Sulawesi. Colliding plates began to lock in Pliocene, and continued plate convergence was accommodated by strike-slip along Walanae, Palu Koro and other faults. Bone Basin submerged into intra-montane basin setting. Clastic sediments from surrounding mountains to E, N and W prograded S to depocenter. Strike-slip still active)

Sudijono (2005)- Biostratigraphy and the depositional environment of the Toraja Limestone at the Nanggala river section, Toraja, South Sulawesi. *Jurnal Sumber Daya Geologi (JSDG)* 15, 1 (148), p. 57-74.

(80m thick Toraja Fm limestone member at Nanggala River, 10km NE of Rantepao. Lower part Middle Eocene (Ta3) age, with Alveolina and Nummulites javanus. Upper ~10m Late Eocene (Tb) with Pellatispira madaraszi and abundant Discocyclina/ Asterocyclina. Overlying volcanic sst-claystone facies (Lamasi Volcanics?) with abundant Late Eocene (P15) planktonic foraminifera (Hantkenina, Gr. cerroazulensis, Pseudohastigerina micra). Toraja Fm underlain unconformably by Cretaceous Latimojong Fm metasediments)

Sudijono (2005)- On the age of the Makale Formation of the Makale-Totumbang Road section, Tana Toraja, South Sulawesi. *Jurnal Sumber Daya Geologi (JSDG)* 15, 2 (149), p. 3-23.

(Makale Fm ~500-1000m thick marl-limestone formation, well exposed between Makale and Totumbang, in NE part of South Arm. Affected by N-S trending, west-directed thrusting. Sampled part mainly zone Tf1, possibly also Te5 near base and Tf2 at top. Presence of Austrotrillina howchini, Cycloclypeus (Katacycloclypeus) annulatus, Flosculinella bontangensis, Miogypsina antillea, etc. Age late E Miocene- early M Miocene)

Sudradjat, A. (1982)- Geologi Lembah Palu Sulawesi Tengah dengan menggunakan teknik penginderaan jauh. Masters Thesis Institut Teknologi Bandung (ITB), p. *(Unpublished)*

('Geology of the Palu valley, Central Sulawesi, using remote sensing techniques'. Palu-Koro Valley 250 km long, is reflection of sinistral Palu-Koro strike slip fault, with active movement estimated at 2-3.5mm to 14-17 mm/ year, totaling 3.25 km. Palu-Koro fault separates two different terranes)

Sufriadin (2008)- Comparative petrography of Paleogene and Neogene coal deposits from Southern Arm Sulawesi. *Proc. 37th Annual Conv. Indonesian Association Geologists (IAGI), Bandung*, 1, p. 672-681.

(Petrography of 18 coal samples from SW Sulawesi. Toraja Fm Paleogene coals higher vitrinite and liptinite than Neogene Fm coal, which have more inertinite and higher mineral matter (clay, iron sulfides, minor carbonate). Vitrinite reflectance wide range in Paleogene (0.35- 0.86%). Neogene coals narrower range (0.44- 0.60%; lignite to HV Bituminous A coal). Maturity of some coals affected by igneous intrusions)

Sufriadin, K. Angayana & A. Sudarsono (2002)- Karakteristik mineralogi batubara daerah Tondongkurah, Kabupaten Pangkep, Sulawesi Selatan. *Proc. 31st Annual Conv. Indonesian Association Geologists (IAGI), Surabaya*, p. 185-192.

(online at: <https://www.iagi.or.id/web/digital/17/KARAKTERISTIK-MINERALOGI-BATUBARA-DAERAH-TONDONGKURAH,-KABUPATEN-PANGKET,-SULAWESI-SELATAN.pdf>)

('Characteristics of coal mineralogy in the Tondongkurah area, Pangkep District, S Sulawesi'. Presumably Eocene coal; JTvG?) (see also Gani & Soetjito, 1999))

Sufriadin, A. Idrus, S. Pramuwijoyo, I.W. Warmada & A. Imai (2011)- Study on mineralogy and chemistry of the saprolitic nickel ores from Soroaka, Sulawesi, Indonesia: implication for the lateritic ore processing. *J. Southeast Asian Applied Geology (UGM)* 3, 1, p. 23-33.

(online at: <https://journal.ugm.ac.id/jag/article/viewFile/7178/5618>)

(Investigation of mineralogy and chemistry of saprolitic nickel ores developed on ultramafic rock with different degrees of serpentinization in Soroako)

Sufriadin, A. Idrus, S. Pramuwijoyo, I.W. Warmada, A. Imai & Y. Yamauchi (2012)- Chromian spinel in peridotite of the Soroako ultramafic complex, Sulawesi, and its petrogenetic significance. *Proc. 41st Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 2012-M-03*, p. 1-8. *(online at:*

www.iagi.or.id/web/digital/9/2012_IAGI_Yogyakarta_Chromian-Spinel-in-Peridotite-of-the-Soroako.pdf)

(Cr-spinels in Soroako peridotites of E Sulawesi (ultramafic complex with affinity to alpine-type peridotite, bounded in W by W-dipping thrust fault that separates it from Mesozoic limestone and red shales) occur as inclusions in olivine and orthopyroxene. Likely derived from upper mantle of suprasubduction zone or fore-arc setting and formed by high partial melting with low oxygen fugacity)

Sufriadin, A. Idrus, S. Pramuwijoyo, I.W. Warmada, I. Nur, A. Imai, A.M. Imran & Kaharuddin (2012)- Thermal and infrared studies of garnierite from the Soroako nickeliferous laterite deposit, Sulawesi, Indonesia. *Jurnal Geologi Indonesia* 7, 2, p. 77-85.

(online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/401)

(Mineralogical study of garnierite, a green material with high nickel content, from Soroako nickel laterite deposit of C Sulawesi)

Sufriadin, A. Idrus, I.W. Warmada, I. Nur, S. Ueno & A. Imai (2012)- Characteristics and the occurrence of “garnierite” from the Soroako nickeliferous laterite deposits, Sulawesi, Indonesia. *Majalah Geologi Indonesia*, 27, 1, p. 1-11.

(Green Ni-Mg hydrous silicate ores called ‘garnierites from Soroako nickeliferous laterite deposits in three modes of occurrence: slickenside fault coatings, fracture fill veins and matrix in conglomeratic peridotite)

Sufriadin, A. Jaya H.S. & A.M. Imran (2007)- Characteristic and the occurrence of coal deposits in Neogene Mandar Formation of West Sulawesi Province. Proc. Joint Convention 32nd HAGI, 36th IAGI and 29th IATMI, Bali 2007, p. 387-394.

(Very thin layers (up to 15cm thick) and lenses of Late Miocene coals in Mandar Fm in Polaman Regency, westernmost Sulawesi. Mainly vitrinite (93.4-98.6 %), followed by inertinite (1.2- 3.0 %). Vitrinite reflectance R_{max} 0.56-0.60%, indicating high volatile bituminous coal rank)

Sufriadin, S. S. Widodo & Y. Mendaun (2018)- Analisis petrografi dan kualitas batubara Sinjai, Sulawesi. *J. Penelitian Enjiniring (JPE)* 20, 2, p. 21-25.

(online at: <http://cot.unhas.ac.id/journals/index.php/jpe/article/download/16/39>)

(Coal deposits in Sinjai Regency in SE part of S Sulawesi with thin seams (<2m). Associated with well-bedded tuffs. Vitrinite dominant, followed by inertinite. Mineral matter dominated by clay and minor pyrite. Ash content 8.8 to 40%, low sulfur. R_v-max 0.40% indicating sub-bituminous coal rank)

Sufriadin, S. Ueno, A. Imai, A. Idrus, S. Pramumijoyo & I.W. Warmada (2010)- Characteristics and the occurrence of garnierite from the Soroako nickeliferous laterite deposits, Sulawesi. Proc. 39th Annual Conv. Indonesian Association Geologists (IAGI), Lombok, p.

(See also Sufriadin et al. 2012)

Sufriadin, S. Widodo, M. Thamrin, A. Maulana, A. Ito & T. Otake (2020)- The nature of ultramafic rocks from Sulawesi, Indonesia and their suitability for CO₂ sequestration, Proc. 3rd Int. Conf. Transdisciplinary Research on Environmental Problems in SE Asia, Gorontalo 2018, IOP Conference Series: Earth and Environmental Science 589, 012024, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/589/1/012024/pdf>)

(Serpentinization of Sulawesi ultramafic rocks led to transformation of olivine and lesser pyroxene into lizardite and chrysotile. This reduced grain size and decreased density. Some Sulawesi ultramafic rocks e good candidate as the host for mineral carbonation)

Sufriadin, S. Widodo, M. Thamrin, A. Ito & T. Otake (2021)- The Latowu ultramafic rock-hosted iron mineralization in the Southeastern Arm Sulawesi, Indonesia: characteristics, origin, and implication for beneficiation. *Int. J. Advanced Science Engineering Information Technology (IJASEIT)* 11, 3, p. 987-993.

(online at: https://ijaseit.insightsociety.org/index.php/ijaseit/article/view/10273/pdf_1784)

(Iron mineralization in serpentinized ultramafic rocks of Latowu block in NW part of SE Sulawesi. Magnetite formed from alteration of Cr-spinel during serpentinization of ultramafic rocks)

Sugiarno, U., F. Ardian P., Marsaban, R. Eksa J. & B. Milian M. (2022)- Geochemical and tectonic settings in South Kabaena Island, Central Buton Regency, Southeast Sulawesi Province. Proc. 51st Annual Conv. Indonesian Association Geologists (IAGI), Makassar, 104, p. 1-6.

(online at: <https://www.iagi.or.id/web/digital/71/PITIAGI-22-S-Abs-084.pdf>)

(Study of ultramafic rocks in S Kabaena island, part of East Sulawesi Ophiolite)

Suhendra, R., A. Agangi, R. Takahashi, M.A. Elburg, M.Z. Tuakia, H. Wicaksono, H. Sato & I. Setiawan (2025)- Late Eocene to Pliocene magmatic evolution and its association with gold mineralization in central western Sulawesi, Indonesia. J. Asian Earth Sciences 281, 106506, p.

(Comprehensive review of Late Eocene subduction-related magmatism and Late Miocene–Pliocene K-rich extension-related magmatism in central western Sulawesi, forming gabbro and biotite-rich granitoids)

Suherlina, L., J. Newson, Y. Kamah & M. Brehme (2022)- The dynamic evolution of the Lahendong geothermal system in North-Sulawesi, Indonesia. Geothermics 105, 102510, p. 1-19.

(online at: <https://www.sciencedirect.com/science/article/pii/S0375650522001572>)

(Geothermal system of Pertamina Lahendong project, Tomohon, N Sulawesi. Produced electricity for >20 years. Two primary reservoirs. Several fault trends in area, mainly NE-SW striking strike-slip faults and NW-SE trending thrust faults, also E-W striking normal faults and N-S trends. Long-term changes in reservoir. Etc.)

Sukadana, I.G., A. Harijoko & L.D. Setijadji (2015)- Tataan tektonika batuan gunung api di Komplek Adang, Kabupaten Mamuju, Provinsi Sulawesi Barat. Eksplorium 36, 1, p. 31-44.

(online at: <http://jurnal.batan.go.id/index.php/eksplorium/article/view/2769/pdf>)

(‘Tectonic setting of the Adang Volcanic Complex in Mamuju Region, West Sulawesi Province’. Adang volcanic complex in W Sulawesi subdivided into seven complexes. K-Ar ages ~5.4 (sanidine) to 2.4 Ma (biotite). Basic-intermediate alkaline volcanics with high radioactivity. Volcanic center and several lava domes, composed of phonolite to dacite rock, with ultrapotassic affinity, formed in active continental margin and influenced by SW Sulawesi micro-continental crust (see also Shaban et al. 2016, suggesting rift volcanism))

Sukadana, I.G. & F.D. Indrastomo (2016)- Radioactive mineral occurrences on submarine alkaline volcanic rocks in West Tapalang, Mamuju, West Sulawesi, Indonesia. Proc. 14th Regional Conference Geology and Mineral Resources of SE Asia (GEOSEA XIV) and 45th Annual Conv. Indonesian Association Geologists (IAGI) (GIC 2016), Bandung, p. 260-262.

(online at: https://www.researchgate.net/publication/322675940_Radioactive_Mineral_Occurrences_on_Submarine_Alkaline_Volcanic_Rocks_in_West_Tapalang_Mamuju_West_Sulawesi_Indonesia)

(High concentrations of radiometric U and Th in Mamuju area, W Sulawesi, in ultrapotassic, leucite-bearing (Pliocene?) basaltic- intermediate Adang Volcanics. Three volcanic domes, probably submarine volcanism; submarine flanks of volcano dominated by erosive-depositional and mass-wasting features)

Sukadana, I.G., Sulaeman, H. Syaeful, F.D. Indrastomo, T.B. Adimedha, R.C. Ciputra, F. Pratiwi et al. (2025)- High Field Strength Element (HFSE) and Rare Earth Element (REE) enrichment in laterite deposit of High Background Natural Radiation Area (HBNRA) of Mamuju, West Sulawesi, Indonesia. Resources (MDPI) 14, 5, 84, p. 1-23.

(online at: <https://www.mdpi.com/2079-9276/14/5/84>)

(Significant enrichment of high field strength elements (HFSEs) and Rare Earth elements (REEs) in lateritic deposits near Mamuju, W Sulawesi, derived from Late Miocene Adang Fm ultrapotassic volcanic rocks)

Sukadana, I.G., H. Syaeful, F.D. Indrastomo, K.S. Widana & E. Rakhma (2016)- Identification of mineralization type and specific radioactive minerals in Mamuju, West Sulawesi. J. East China University of Technology 39, Supplement (Proc. Workshop Socio-economic outlook of radioactive and associated minerals production in Asia and the Pacific, Yogyakarta 2016), p. 36-45.

(online at: https://www.researchgate.net/publication/322675607_Identification_of_Mineralization_Type_and_Specific_Radioactive_Minerals_in_Mamuju_West_Sulawesi)

(Radioactive minerals in Tapalang, Ampalas, Adang and Malunda alkaline volcanic rocks complex in W Sulawesi, mainly primary favidite and thorianite, and secondary gummite, autonite, etc.))

Sukadana, I.G., W. Warmada, A. Harijoko, F.D. Indrastomo & H. Syaeful (2021)- The application of geostatistical analysis on radiometric mapping data to recognized the Uranium and Thorium anomaly in West Sulawesi, Indonesia. Proc. 2nd Int. Conference Earth Science and Energy, Kuala Lumpur 2020, IOP Conference Series: Earth and Environmental Science 819, 012030, p. 1-12.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/819/1/012030/pdf>)

(High radioactive anomalies in Mamuju area, W Sulawesi, associated with (E Pliocene) leucite-bearing high-K Adang Volcanics)

Sukamto, R. (1975)- Geological map of Indonesia, VIII, Ujung Pandang (Makassar) sheet, 1:1, 000, 000. Geological Research Development Centre (GRDC), Bandung.

(Reprinted in 1989/1990. 1:1 million map covering most of Sulawesi and Banggai-Sula (not incl. North Arm))

Sukamto, R. (1975)- Perkembangan tektonik di Sulawesi dan daerah sekitarnya; suatu sintesis perkembangan berdasarkan tektonik lempeng. Geologi Indonesia (IAGI) 2, 1, p. 1-13.

('Tectonic development of Sulawesi and surrounding regions; a synthesis of the evolution of plate tectonics')

Sukamto, R. (1978)- The structure of Sulawesi in the light of plate tectonics. In: S. Wiryosujono & A. Sudradjat (eds.) Proc. Regional Conference Geology and Mineral Resources of SE Asia (GEOSEA), Jakarta 1975, 2, Indonesian Association Geologists (IAGI), p. 121-142.

(online at: <https://www.iagi.or.id/web/digital/32/PIT-IAGI-1975-Paper-13.pdf>)

(One of first reviews of Sulawesi geology in terms of plate tectonics. Glaucofane schists associated with ultrabasic rocks found along W part of E Sulawesi province post-Cretaceous in age, but before intra-Miocene orogenic phase. Glaucofane schist in SW Sulawesi older than mid-Cretaceous. M Miocene intense folding, followed by overthrusting in E Arm and C part of W Sulawesi. E Sulawesi ophiolite emplacement pre-Triassic (?). In S Sulawesi E Tertiary W-dipping subduction zone which became inactive in M Miocene, then flipped to W side of Sulawesi, in Makassar Straits)

Sukamto, R. (1981)- Geological map of the Danau Tempe Sheet South Sulawesi, 1:250,000. Geological Research Development Centre (GRDC), Bandung.

(Probably same as Pangkajene- Watampone Quad map (Danau Tempe in N of this map sheet))

Sukamto, R. (1982)- The geology of the Pangkajene and western part of Watampone Quadrangles, South Sulawesi, scale 1:250,000. Geological Research Development Centre (GRDC), Bandung, p. 1-27.

(SW Sulawesi map between 4-5°S. With Bantimala basement complex of ultrabasics, metamorphics with NE-dipping foliation and 111 Ma K/Ar age and melange. Overlain by >2000m of Late Cretaceous Balangbaru Fm flysch. Paleocene volcanics, 3000m of Eocene- M Miocene Tonasa carbonates, E-M Miocene and Late Miocene- E Pliocene volcanoclastics. No sedimentation or volcanic activity after Late Pliocene)

Sukamto, R. (1986)- Tektonik Sulawesi Selatan dengan acuan khusus ciri-ciri himpunan batuan daerah Bantimala. Ph.D. Thesis, Institut Teknologi Bandung (ITB), p. 1-364. *(Unpublished)*

('Tectonics of S Sulawesi, with special emphasis on rock associations in the Bantimala area'. Bantimala Melange includes tectonically mixed and imbricated Triassic- E Cretaceous rocks, including Kayubiti ultramafics, Bontorio metamorphics, Paremba sandstone (thought to have E Jurassic ammonites, but may be Cretaceous?; Grant-Mackie in Sukamto & Westermann 1992), Dengendeng basalt, schist breccia and Paring chert (Late Jurassic-E Cretaceous). Unconformably overlain by Late Cretaceous Balangbaru Fm forearc flysch, Alla Fm Paleocene arc volcanics, Eocene Malawa Fm terrestrial clastics, Late Eocene-E Miocene Tonasa Fm carbonates and M-Late Miocene arc volcanics)

Sukamto, R. (1991)- Geological mapping of melange complex in Bantimala area, South Sulawesi. In: E.P. Utomo et al. (eds.) Proc. The Silver Jubilee LIPI- Symposium on the Dynamics of subduction and its products,

Yogyakarta-Karangasambung 1991, Research and Development Center for Geotechnology, Indonesian Institut of Sciences (LIPI), Bandung, p. 61-62.

Sukamto, R. & N. Ratman (2013)- Batuan Pratersier. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 13-36.

('Pretertiary rocks'. Chapter 2 in Geology of Sulawesi book. Triassic or older rocks in Sulawesi mainly metamorphics. In S Sulawesi E-M Jurassic Paremba Sst, and Late Jurassic- E Cretaceous 'Paring Chert'. Mid-Cretaceous Bantimala melange overlain by Upper Cretaceous volcanics and Balangbaru Fm flysch, etc.)

Sukamto, R. & N. Ratman (2013)- Batuan Paleogen. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 37-63.

('Paleogene rocks'. Chapter 3 in Geology of Sulawesi book. M-L Eocene-Oligocene volcanics and clastics and Late Eocene- Oligocene limestones, widespread in W and N Sulawesi)

Sukamto, R. & N. Ratman (2013)- Batuan Neogen. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 65-92.

('Neogene rocks'. Chapter 4 in Geology of Sulawesi book. Miocene- Pliocene volcanics, clastics and limestones, widespread in W and N Sulawesi)

Sukamto, R. & N. Ratman (2013)- Batuan Kuartar. In: Surono & U. Hartono (eds.) Geologi Sulawesi, LIPI Press, Jakarta, p. 93-112.

(' Quaternary rocks'. Chapter 5 in Geology of Sulawesi book)

Sukamto, R. & T.O. Simandjuntak (1983)- Tectonic relationship between the geologic provinces of Western Sulawesi, Eastern Sulawesi, and Banggai-Sula in the light of sedimentological aspects. Bull. Geological Research Development Centre (GRDC) 7, p. 1-12. *(also in Proc. 4th Regional Conference Geology and Mineral Resources of SE Asia, GEOSEA IV, Manila 1981)*

(Three tectonic domains in Sulawesi: (1) W Sulawesi Late Cretaceous- Eocene flysch-type forearc sediments derived from volcanic arcs; (2) E Sulawesi oceanic environment of ophiolites overlain by Jurassic and Cretaceous pelagic sediments; (3) Banggai-Sula microcontinent with basement of Carboniferous metamorphics and Permo-Triassic plutonic rocks, overlain by Triassic-Cretaceous continent-derived shelfal sediments)

Sukamto, R. & S. Supriatna (1982)- The geology of the Ujung Pandang, Benteng and Sinjai Quadrangles, Sulawesi, scale 1:250,000. Geological Research Development Centre (GRDC), Bandung, p. 1-20.

(SW Sulawesi map. Oldest rocks U Cretaceous flysch over older metamorphics. Thick, folded Eocene marine clastics with Pellatispira and Nummulites in NE corner of map (Salokalupang Fm). Eocene- M Miocene Tonasa Fm carbonate platform 1750m thick or more. Early Miocene and Plio-Pleistocene volcanic activity)

Sukapti, W.S. (2001)- Palynological study of the Burecing member, Walanae formation, South Sulawesi. Jurnal Teknologi Mineral (ITB) 8, 1, p. 29-36.

Sukapti, W.S. & R. Saragih (2018)- Analisis dan identifikasi polen Formasi Tinombo- Ampana- Sulawesi Tengah. Pros. Seminar Nasional ke 60, Kimia dalam industri dan lingkungan, Yogyakarta 2018, p.

('Analysis and identification of pollen in the Tinombo formation, Ampana, Central Sulawesi')

Sukido, D. Satria & S, Koesoemadinata (1997)- Geological map of the Enrekang Sheet. Scale 1: 100.000. Geological Research and Development Centre, Bandung.

Sukarna, D. (1998)- Tertiary geology of the West Arm Sulawesi and Southeastern Kalimantan. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 8, 78, p. 2-8.

(Stratigraphic successions in SE Kalimantan and SW Sulawesi suggest these were united in Late Cretaceous- E Tertiary, located in fore-arc/ accretionary complex of W-dipping Cretaceous subduction system. M Eocene-early M Miocene extension led to separation of W arm of Sulawesi. In W arm Sulawesi M Eocene clastics

deposition changed to carbonate platform in Late Eocene- M Miocene, followed by inversion movements in late M Miocene due to collision of Banggai-Sula microcontinent)

Sukarna, D., Sudarsono, S. Indarto, H. Utoyo, J. Sopaheluwakan, B. Priadi & S. Pramumijoyo (2000)- Peridotit bergarnet dan batuan malihan berderajat menengah daerah Winatu-Wana, Kulawi, Sulawesi Tengah. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 10, 111, p. 2-16.

('Garnet peridotites and intermediate metamorphic rocks in the Winatu-Wana area, Kulawi, C Sulawesi'. Palu area of NW Sulawesi with garnet-bearing peridotite (xenoliths in Palu granite), Toboli Complex epidote-amphibolite greenschist metamorphics (118.4 Ma) and U Cretaceous Latimojong Fm metasediments (parts of Sundaland margin basement) and acid-intermediate Plio-Pleistocene Palu granitoid. Palu Valley part of paleo-subduction complex from C Java to Bantimala-Barru))

Suliantara & T. Susantoro (2015)- Hydrocarbon potential of Tolo Bay Morowali Regency: qualitative analysis. *Scientific Contributions Oil and Gas (SCOG)*, Lemigas, Jakarta, 38, 1, p. 13-24.

(online at: <http://journal.lemigas.esdm.go.id/index.php/SCOG/article/view/536>)

(Tolo Bay E of East Sulawesi, with water depth of up to 3500m. Part of Banggai Basin and within Late Cretaceous- M Miocene collision zone between Banggai-Sula Microcontinent and E Sulawesi. Drift phase sediment at front of Banggai-Sula Microcontinent is potential source and reservoir rock. Hydrocarbon exploration very risky)

Sumadirdja, H., T. Suptandar, S. Harjoprawiro & D. Sudana (1973)- Reconnaissance geological map of the Palu Quadrangle, Sulawesi, 1:250,000. Geological Research Development Centre (GRDC), Bandung.

(NW Sulawesi map between 0-1°S, 'neck' between Makassar Straits and Tomini Bay, incl. onshore adjacent to Suramana Block. Oldest rocks are metamorphics, overlain by Eocene Tinombo Fm and Celebes Molasse. Probably different ages granitic intrusions)

Sumartono, Sabtano J.S. & Y.R. Ramli (2001)- Review on systematic geochemical mapping in Sulawesi-Indonesia. *Proc. CCOP 37th Annual Session Bangkok 2000*, 2, Technical Reports, p. 43-59.

(Results of systematic geochemical mapping of SW and SE arms of Sulawesi. Three provinces distinguished: (1) West: magmatic arc granitoid intrusives associated with epithermal gold, porphyry copper-gold, volcanogenic massive sulphide, manganese and iron mineralisations (2) Central: metamorphic rocks and melange with rare metallic mineral occurrences and (3) East: ophiolite nappe with nickel, chrome and iron mineralisations)

Suminto (1987)- Sedimentologi endapan molasa di daerah Taweli, Kabupaten Donggala. In: *Kolokium hasil pemetaan dan penelitian Puslitbang Geologi 1992/1993*, Geological Research Development Centre (GRDC), Bandung, Special Publ. 15, p. 1-16.

*('Sedimentology of molasse deposits in the area of Tawaeli, Donggala District'. In: *Colloquium results of mapping and research GRDC 1992/1993*)*

Suminto (1994)- Sedimentologi Formasi Tinombo di daerah Kecamatan Tinombo, Kabupaten Donggala, Sulawesi Tengah. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 4, 38, p. 2-8.

('Sedimentology of the Tinombo Formation in the Kecamatan Tinombo, Donggala area, C Sulawesi'. On Tinombo Fm Late Eocene- E Oligocene marine clastics and limestones (with Nummulites), incl. 'flysch-facies', in Tomini Bay side of NW 'neck' of Sulawesi. ~3900m thick measured section NW of Tinombo, in steeply NW dipping sediments, with two diorite intrusion ~30 and 100m thick. Deepening-upward succession (formation also contains Pellatispira according to Harahap et al. 2003; JTvG))

Suminto (1995)- Lingkungan pengendapan fasies sedimen klastika Formasi Walanae di daerah Lappariaja, Bone, Sulawesi Selatan. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 5, 10, 44, p. 10-19.

('Outline of clastic sediment facies of the Walanae Formation in the Lappariaja area, Bone, S Sulawesi'. Late Miocene- Pliocene Walanae Fm in E side of SW arm of Sulawesi. In Sungei Bengo section ~600m thick shallow marine clastics above limestone deposits and with terrestrial facies at top)

Sumosusastro, P.A., H.D. Tjia, A.R. Fortuin & J. Van der Plicht (1989)- Quaternary reef record of differential uplift at Luwuk, Sulawesi east arm, Indonesia. In: J.E. van Hinte et al. (eds.) Proc. Snellius II Symposium, Jakarta 1987, Netherlands J. of Sea Research 24, 2-3, p. 277-285.

(Luwuk area near E tip of Sulawesi E arm dominated by raised coral reef terraces, elevations of >400m. Lower group of 6- 10 terraces up to 30-100m. Middle group up to 250m, 18°- 22° seaward sloping surface bordered by coast-parallel faults. Upper group of terraces >400m above sea level. U/Th ages of four reef terraces at 410m, 62m, 19m and 6.6m range from 350 ka- 67 ka. Uplift rate of highest terrace 184 cm/ka)

Sunartadirdja, M.A. (1959)- Beitrage zur Geomorphologie von Sudwest Sulawesi. Doct. Thesis Johann Wolfgang Goethe Universitat, Frankfurt, p. 1-98. *(Unpublished)*
(‘Contributions to the geomorphology of SW Sulawesi’)

Sunartadirdja, M.A. & H. Lehmann (1960)- Der tropische Karst von Maros und Nord-Bone in SW-Celebes (Sulawesi). Zeitschrift fur Geomorphologie, Supplement 2, p. 49-65.

(‘The tropical karst of Maros and North Bone in SW Sulawesi’. Two types of karst on SW Sulawesi: steep-walled and rounded. Suggested explanations include differences in limestone type (Nummulites limestone versus coral limestone), age, and tectonic history, but thickness of limestone above valley floor is controlling factor)

Sunarya, Y., K. Judawinata & D.Z. Herman (1980)- Penelitian stratigrafi dan geokimia bijih tipe Kuruoka di daerah Sangkaropi, Kecamatan Sescan, Tana Toraja, Sulawesi. Proc. 15th Annual Meeting Indonesian Association Geologists (IAGI), Yogyakarta, p.

(‘Study of the stratigraphy and geochemistry of ore of Kuruoka type in the area of Sangkaropi, District Sescan, Tana Toraja, Sulawesi’)

Sunarya, Y., T. Yoshida, K. Yudawinata, R. Rinawan, Hartono & B. Sutopo (2011)- The Sangkaropi massive sulphide deposit district, South Sulawesi: its implications for genesis and exploration for Kuroko-type deposits. In: N.I. Basuki (ed.) Proc. Conf. Sulawesi Minerals Resources 2011, Manado, MGEI/IAGI, p. 230-242.

Sunarya, Y., T. Yoshida, K. Yudawinata, R. Rinawan, Hartono & B. Sutopo (2012)- The Sangkaropi massive sulphide deposit district, South Sulawesi: its implications for genesis and exploration for Kuroko-type deposits. Majalah Geologi Indonesia (IAGI) 27, 2, p. 109-119.

(online at: bgl.esdm.go.id/publication/index.php/dir/article_download/769)

(Same paper as Sunarya et al. 2011. Sangkaropi massive sulphide deposits in near Rantepao in C part of SW Sulawesi. Deposits closely associated with Miocene submarine volcanism of W Sulawesi arc (‘Green Tuff Fm/ Old Andesite Fm, and composed of ‘Kuroko-type’ stratiform and stockwork ore bodies, mostly covered with thin layer of barite. Sulphide minerals include sphalerite, galena, chalcopyrite, pyrite, tetrahedrite, bornite, etc. Temperatures of fluid inclusions in sphalerite and quartz 160- 346°C)

Supardi, N. & D.H. Barianto (2017)- Fasies dan porositas batuan karbonat Formasi Tonasa pada daerah Barru dan Jeponto, Sulawesi Selatan. Proceedings Seminar Nasional Kebumihan ke-10, Yogyakarta, p. 468-476.

(‘Facies and porosity of carbonate rocks of the Tonasa Formation in the Barru and Jeponto areas, South Sulawesi’)

Supardi, N., A.M. Imran & M. Farida (2014)- Lingkungan pengendapan batuan karbonat Formasi Tonasa pada daerah Karama Kecamatan Bangkala Kabupaten Jeneponto, Provinsi Sulawesi Selatan. J. Penelitian Geosains (Hasanuddin University) 10, 2, p. 58-67.

(online at: <http://repository.unhas.ac.id/bitstream/handle/123456789/15298/>)

(‘Depositional environment of Tonasa carbonate rock formations in the Karama area, District of Bangkala, Jeneponto, South Sulawesi Province’. Outcrop of M Eocene Tonasa Fm marl dominated section with limestone interbeds at S-most tip of S Sulawesi deemed to be deposited in middle shelf environment)

Supardi, N. & S.A. Rahmawati (2022)- Biostratigrafi batugamping berdasarkan kandungan foraminifera besar di daerah Donggala, Sulawesi Tengah. Jurnal Geocelbes 6, 1, p. 47-55.

(online at: <https://journal.unhas.ac.id/index.php/geocelbes/article/view/19949/8109>)

(‘Biostratigraphy of limestone based on large foraminifera content in the Donggala region, Central Sulawesi’. Donggala Formation limestone in ‘neck’ of Sulawesi, supposedly part of Sulawesi molasse (?) and supposedly contain E-M Miocene Miogypsina group forams (N.B. photos of supposed Miogypsina group forams in thin section all seem to be misidentified, and look more like non-age-diagnostic Amphistegina; JTvG))

Suparka (1977)- Hubungan antara khromit dan bantuan ultramafik: dengan daerah Balambano-Karebe, Sulawesi Selatan; sebagai suatu tinjauan. J. RISET Geologi dan Pertambangan (LIPI) 1, 1, p. 17-33.
(online at: <http://pustaka.geotek.lipi.go.id/wp-content/uploads/2016/02/Riset-Vol.1-No.1-22-.pdf>)
(‘The relationship between chromite and ultramafic rocks: with Balambano-Karebbe area, S Sulawesi; a review’)

Supendi, P., M. Ramdhan, Priyobudi, D. Sianipar, A. Wibowo, M.T. Gunawan et al. (2021)- Foreshock–mainshock–aftershock sequence analysis of the 14 January 2021 (Mw 6.2) Mamuju-Majene (West Sulawesi, Indonesia) earthquake. Earth Planets and Space 73, 106, p. 1-10.
(online at: <https://earth-planets-space.springeropen.com/articles/10.1186/s40623-021-01436-x>)
2021 earthquake in W Sulawesi, likely caused by movement on faults within Majene fold-thrust belt)

Supendi, P., N. Rawlinson, J. Han, S. Widiyantoro, S. Pilia, A.D. Nugraha & D. Karnawati (2025)- Evidence of magma reservoirs beneath volcanoes in Northern Sulawesi and the Molucca Sea from regional earthquake tomography. Geophysical Research Letters 52, 3, e2024GL110794, p. 1-9.
(online at: <https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2024GL110794>)
(New earthquake tomography model reveals clear evidence of high velocity subducting slabs beneath Molucca Sea Collision Zone and N Sulawesi, along with low velocity zones above Sangihe and Halmahera slabs, that likely represent magma reservoirs. Diffuse low-velocity anomaly in mantle beneath Colo volcano consistent with decompression melting induced by extension)

Suratman (2000)- Geologi dan endapan Ni-laterit Soroako Sulawesi Selatan. Proc. 29th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 2, p. 37-44.
(‘Geology and Ni-laterite deposits at Soroako, S Sulawesi’. Review of nickel laterites with saprolite ore in weathering zone of East Sulawesi ophiolite, in E and W Soroakao blocks)

Suratman (2000)- Geology and nickel-laterite weathering deposit in the southeast arm of Sulawesi. Berita Sedimentologi 14, p. 12-15.
(online at: <https://journal.iagi.or.id/index.php/FOSI/article/view/256/226>)
(Nickel laterite in SE Sulawesi derived from chemical weathering of ultrabasic rocks. Main occurrences in SE Sulawesi in two ~NW-trending belts of ultrabasic rocks: (1) southern belt from Sua-sua through Pomalaa and Torobulu to Wawoni island; (2) northern belt from Malili and Kolonodale to Lasolo on E coast)

Surjono, S.S. & P.N. Pamurty (2011)- Dynamic sedimentation of Mapi Formation in Majene area, West Sulawesi. Proc. Joint. 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-169, p. 1-10.
(Description of depositional environments in 3 traverses of M Miocene- Pliocene Mapi Fm (N16-N20) in SW Sulawesi controlled by tectonics of Sulawesi and volcanism. Overall shallowing-upward succession. Volcanism generated by subduction in both S and N arms of Sulawesi)

Surjono, S.S., A.A. Santika & M.R. Asy’ari (2018)- Provenance of Mesozoic Meluhu sandstone and its implication to petroleum system in Meluhu area, southeast arm of Sulawesi. Proc. 2nd ISPG Research Forum, Indonesian Society of Petroleum Geologists (ISPG), RF18ISPG-076-GL, p. 1-20. *(online at: https://www.researchgate.net/publication/370496620_Provenance_of_Mesozoic_Meluhu_sandstone_and_its_implication_to_petroleum_system_in_meluhu_Area_Southeast_arm_of_Sulawesi)*
(Petrographic analysis of M Triassic- E Jurassic Meluhu Fm, 80 km NW of Kendari, in E part of SE arm of Sulawesi, shows 49% monocrystalline quartz, 9% polycrystalline quartz, 10% feldspars, 16% sedimentary lithics and 4% metamorphic rock fragments. Derived mainly from metamorphic rocks (‘collision orogen’))

Surmont, J., C. Laj, C. Kissel, C. Rangin, H. Bellon & B. Priadi (1994)- New paleomagnetic constraints on the Cenozoic tectonic evolution of the North Arm of Sulawesi, Indonesia. *Earth Planetary Science Letters* 121, p. 629-638.

(Paleomagnetism of Sulawesi N arm between 120- 122°E suggests post-Miocene CW rotation of ~20-25° of W part, probably during N-ward drift of N Arm along Palu-Matano sinistral transcurrent fault. Oligocene- E Miocene CW rotation of same amplitude documented by Sasajima et al. (1979). Between 122.5- 124°E CW and CCW rotations from ±6° to 85°, likely corresponding to microblock rotation and consistent with complex fault system of Gorontalo/ Kotamobagu shear zones)

Surono (1989)- Molasa di lengan Timur Sulawesi. *Bull. Geological Research Development Centre (GRDC), Bandung* 13, p. 39-45.

(‘The molasse in the East Arm of Sulawesi’. Widespread molasse deposits in E Sulawesi of M Miocene-Pliocene age, rich in ophiolite fragments. Also as 1981 IAGI Conference paper)

Surono (1989)- Hubungan stratigrafi antara Kepulauan Banggai-Sula dan lengan Timur Sulawesi. *Bull. Geological Research Development Centre (GRDC)* 13, p. 46-60.

(‘Stratigraphic relationship between the Banggai-Sula Islands and the East Arm of Sulawesi’. Different types of basement and overlying rocks, but both overlapped by similar Late Miocene-Pliocene Celebes Molasse)

Surono (1994)- A sedimentologic investigation of the Southeast Arm of Sulawesi, with special reference to the Kendari area. Ph.D. Thesis, University of Wollongong, Australia, p. 1-211 + Appendices, figures, tables.

(online at: <https://ro.uow.edu.au/theses/1393/>)

(Collision complex in SE Arm of Sulawesi consists of SE Sulawesi continental terrane, overthrust by ophiolite E Sulawesi Ophiolite Belt in Oligocene- M Miocene and overlain by synorogenic E Miocene Sulawesi Molasse. SE Sulawesi continental terrane consists of metamorphic basement unconformably overlain by clastics-dominated Late Triassic Meluhu Fm (basal part fluvial, grading upward into deltaic and marine facies) and carbonate-dominated Eocene- E Oligocene Tampakura Fm (incl. oolites). Paleolatitude of basin at time of Triassic Meluhu Fm deposition ~20°S. Basal Sulawesi Molasse unconformably over Paleogene, with Matarape conglomerate with ophiolite clasts, overlain by E Miocene limestone with Te5 larger forams (Miogypsinoides, Spiroclypeus, Lepidocyclus) (Sample 6A; identified by Chaproniere 1993) and NN3 nannofossils)

Surono (1994)- Stratigraphy of the Southeast Sulawesi continental terrane, eastern Indonesia. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 31, 4, p. 4-11. *(also reprinted in Surono 2008)*

(SE Arm of Sulawesi continental terrane composed of Mesozoic metamorphic rocks, intruded by granites. Unconformably overlain by Late Triassic Meluhu Fm fluvial clastics (Carnian- Norian?; with Falcisporites), and U Jurassic- Lw Cretaceous marine deposits of Tetambahu Fm (with Tithonian- Hauterivian radiolaria incl. Archaeodictyomitra and Thanarla). Unconformably overlain by Paleogene Tampakura Fm oolitic- dolomitic carbonates with Nummulites (?). SE Sulawesi and Banggai-Sula block stratigraphy similar to central PNG. Paleomagnetic analysis suggest SE Arm part of continental terrane, deposited 20°S of present location in Late Triassic, at N Australian (PNG) continental margin. Emplacement of poorly-dated E Sulawesi Ophiolite complex over SE Sulawesi continental block margin in latest Oligocene (= collision of SE Sulawesi- Buton?). Post-collisional Sulawesi Molasse unconformable over molasse and older formations, with Pandua Lst interbeds with E Miocene larger foraminifera)

Surono (1994)- A petrographic study on an oolitic limestone succession of the Eocene-Oligocene Tampakura Formation, South-East Sulawesi, Indonesia. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 5, 50, p. 2-11. *(also reprinted in Surono 2008, p. 103-118)*

(?Eocene Tampakura Fm limestone unconformable between underlying Late Triassic Meluhu Fm and overlying Miocene-Pliocene Sulawesi Molasse. Oolites dominant, minor lime mudstone locally rich in globigerinid planktonic foraminifera, some dolomite)

Surono (1995)- Sedimentology of the Tolitoli Conglomerate Member of the Langkowala Formation, Southeast Sulawesi, Indonesia. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 5, 46, p. 1-7.

(also reprinted in Surono 2008, p. 161-173. E-M Miocene Tolitoli conglomerates of SE Sulawesi unconformable on Triassic clastics and Paleogene limestone. Deposited in braided river/ alluvial fan environment, with general paleocurrent direction to West. Conglomerate clasts mainly derived from Late Triassic Meluhu Fm sandstones, with minor contribution from Tampakura Fm. No fossils, but age derived from position unconformably over Oligocene and under Late Miocene-Pliocene Boepinang Fm)

Surono (1996)- A regional stratigraphic review of the South East Arm of Sulawesi, Indonesia. Proc. 25th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 2, p. 169-189.

Surono (1997)- A preliminary study on the origin of dolomite in the Tampakura Formation, Southeast Sulawesi, Eastern Indonesia. Bull. Geological Research Development Centre (GRDC) 21, p. 151-161.
(Dolomite in Eocene- E Oligocene(?) oolitic Tampakura Fm in SE Sulawesi formed in intertidal- supratidal zones)

Surono (1997)- A petrographic study on sandstones from the Meluhu Formation, Southeast Sulawesi, Eastern Indonesia. Bull. Geological Society Malaysia 40, p. 215-231.
(online at: www.gsm.org.my/products/702001-100878-PDF.pdf)
(Late Triassic Meluhu Fm sandstone 39-95% quartz (av. 68%). Polycrystalline quartz av. 12.7%. Undulose extinction common in monocrystalline quartz. Source area mainly metamorphic rocks, probably with thin cover of sedimentary and volcanic rocks. Thick cyclic channel deposits S of Tinobu with coarse clasts, probably deposited close to source area of high relief, forming alluvial fans along basin margin)

Surono (1997)- A provenance study of sandstones from the Meluhu Formation, Southeast Sulawesi, Eastern Indonesia. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 7, 73, p. 2-16.
(Same as Surono (1997) above. Also reprinted in Surono (2008). Late Triassic Meluhu Fm sandstones dominated by quartz (mainly monocrystalline, also common polycrystalline) and lithics (sedimentary and metamorphic; very minor volcanics). Most likely source low-grade metasediments at SW margin of block)

Surono (1997)- Geology and origin of the Southeast Sulawesi continental terrane, Indonesia. Proc. 26th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta 1977, p. 961-974.
(online at: <https://www.iagi.or.id/web/digital/64/71.pdf>)
(On SE Sulawesi Continental Terrane(s) in SE Arm of Sulawesi, overridden by E Sulawesi Ophiolite. Oldest unit pre-Carboniferous low-grade metamorphics, intruded by Permo-Triassic aplite and associated volcanics. Unconformably overlain by Late Triassic Meluhu Fm Triassic clastics (with Halobia, Daonella, Falcisporites), unconformably overlain by Eocene Tamborasi and 400m of Tampakura Fm Eocene-Early Oligocene carbonates. Similarities in stratigraphy suggest same origin as Banggai-Sula terrane; also similar to Kubor Anticline, PNG. Before collision with E Sulawesi Ophiolite Belt in latest Oligocene (E Miocene age of basal Sulawesi molasse in SE Sulawesi), joined with Banggai-Sula Terrane. Three pre-collision tectonic events: Permian-Late Triassic pre-rift (pre-breakup), Jurassic breakup and Late Jurassic-Oligocene rift-drift)

Surono (1998)- A sedimentological study of the oolitic limestone succession of the Paleogene Tampakura Formation in Southeastern Sulawesi, Indonesia. In: J.L. Rau (ed.) Proc. 33rd Session Co-ord. Comm. Coastal Offshore Geoscience Programmes E and SE Asia (CCOP), Shanghai 1996, 2, p. 10-41. *(reprinted in Surono 2008, p. 133-160)*
(Late Eocene- E Oligocene Tampakura Fm consists of oolite, lime mudstone, wackestone, packstone and framestone, and dolomite. Widely distributed in N part of SE Sulawesi. Underlain by U Triassic Meluhu Fm clastics and unconformably overlain by E Miocene Sulawesi Molasse. Tampakura Fm deposited in tidal environment. Basin configuration was rimmed shelf)

Surono (1998)- Geology and origin of the Southeast Sulawesi continental terrane, Indonesia. Media Teknik (UGM) 20, 3, p. 33-42.
(Same paper as Surono 1997, above)

Surono (1999)- An organic petrology study on coal and carbonaceous rocks from the Triassic Meluhu Formation, Southeast arm of Sulawesi, Eastern Indonesia. *Majalah Geologi Indonesia (IAGI)* 15, 1-2, p. (also reprinted in Surono 2008)

(Two coal seams, 0.7 and 0.9m thick, in basal part of Triassic Meluhu Fm of SE Sulawesi. Vitrinite is dominant maceral. Average vitrinite reflectance R_v 0.69%)

Surono (2008)- Geology of the Southeast arm of Sulawesi. Geological Survey, Bandung, Special Publ. 35, p. 1-213.

(Reprint collection of 12 previously published papers on SE Sulawesi)

Surono (2011)- Tektono-stratigrafi bagian Timur Sulawesi. Proc. Joint. 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-054, p. 1-5.

(‘Tectonostratigraphy of East Sulawesi’. Brief review; no figures)

Surono Martosuwito (2012)- Tectonostratigraphy of the eastern part of Sulawesi, Indonesia, in relation to the terrane origins. *Jurnal Sumber Daya Geologi (JSDG)* 22, 4, p. 199-207.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/119/113>)

(E Sulawesi mainly formed by two terranes, both unconformably covered by post-collisional Sulawesi molasse: (1) ophiolite complex and E Cretaceous Matano Fm pelagic sediment cover (with Valanginian radiolaria) and (2) Banggai Sula and SE Sulawesi continental terranes (metamorphic basement, Late Triassic- Paleogene sediment cover), both overlain by E Miocene- Pliocene Sulawesi Molasse. Ophiolite and pelagic cover thrust over continental terranes in Oligocene (~33-26 Ma). Ophiolite K-Ar ages 93.4- 26 Ma (too young?; JTvG), formed in mid-ocean ridge within Pacific Plate. Continental terranes originated from N margin of Australian Continent)

Surono (2013)- Geologi lengan Tenggara Sulawesi. Geological Survey (Badan Geologi), Bandung, Special Publ., p. 1-169.

(online at: <https://geologi.esdm.go.id/storage/publikasi/JE7ZurXikq6pjMxA4fsi0BDAnQiSqZLNpqUIW4HK.pdf>)

(‘Geology of the SE Arm of Sulawesi’. Extensive review of tectonics, stratigraphy, etc., of SE Sulawesi)

Surono (2013)- Kepingan Benua. In: Surono & U. Hartono (eds.) *Geologi Sulawesi*, LIPI Press, Jakarta, p. 153-211.

(‘Continental fragments’. Chapter 8 in Geology of Sulawesi book. Brief review of continental blocks of Sulawesi: Banggai-Sula, Siombok, Tambayoli, Bungku, Mattarombeo, SE Sulawesi, Buton and Tukangbesi)

Surono (2013)- Batuan sedimen Neogen dan Kuartar. In: Surono & U. Hartono (eds.) *Geologi Sulawesi*, LIPI Press, Jakarta, p. 225-257.

(‘Neogene and Quaternary sedimentary rocks’. Chapter 10 in Geologi Sulawesi book. E Sulawesi Molasse members suggest E Miocene- Pliocene age range)

Surono & S. Bachri (2002)- Stratigraphy, sedimentation and palaeogeographic significance of the Triassic Meluhu Formation, Southeast arm of Sulawesi, Eastern Indonesia. *J. Asian Earth Sciences* 20, p. 177-192.

(SE Sulawesi M-L Triassic Meluhu Fm fluvio-deltaic clastics unconformable on metamorphic basement and unconformably overlain by Paleogene carbonates. Source area rugged and composed of metamorphic rocks, overlain by sandstone and volcanic rocks. Meluhu Fm deposited in humid tropical region. Paleomagnetic study shows ~25° clockwise rotation and paleolatitude of 20° S. Meluhu Fm early rift stage sediment on NW Australian continent. Continental fragment, including Meluhu Graben, separated from Australia to become allochthonous terrane before colliding with Sulawesi)

Surono, Mac Endharto, A. Azis & D.M. Ali (1992)- Sedimentology of the Meluhu Formation, Southeast Arm of Sulawesi, Indonesia. Proc. 21st Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 2, p. 833-852.

(online at: [https://www.iagi.or.id/web/digital/50/21th-Vol-II-\(7-10-Des-1992\)-463-482.pdf](https://www.iagi.or.id/web/digital/50/21th-Vol-II-(7-10-Des-1992)-463-482.pdf))

(Late Triassic- Jurassic Meluhu Fm widespread in SE Sulawesi. Fluvial sandstones underlain by metamorphic basement, overlain by marine Jurassic Tuetue Mb and Laonti Fm limestone with ammonites and belemnites. Three members: (1) Lower part Toronipa Mb sand-rich fluvial deposits (max. 800m thick); (2) middle part Watuteluboto Mb tide-influenced deltaic deposits (max. thickness 200m); (3) upper part Tuetue Mb estuarine-shallow marine clastics with thin (Jurassic?) limestone beds near top (110m, thickening to NW).. Paleocurrents generally to ESE. Provenance from volcanic, metamorphic and sedimentary rocks. Lithics mainly sedimentary and metamorphic rocks, also minor volcanics)

Surono & U. Hartono (eds.) (2013)- Geologi Sulawesi. LIPI Press, Jakarta, p. 1-348.

('The geology of Sulawesi'. Comprehensive overview of Indonesian of geology and stratigraphy of Sulawesi by Geological Survey and ITB personnel. 13 chapters)

Surono, T.O. Simandjuntak & E. Rusmana (1997)- Collision mechanism between the oceanic and continental terranes in the Southeast private arm of Sulawesi, Eastern Indonesia. Bull. Geological Research Development Centre (GRDC) 21, p. 109-125. *(also in reprint in Surono 2008, p. 193-213)*

(Banggai-Sula terrane originated from PNG and collided with W Sulawesi volcanic arc in Oligocene. Collision caused anticlockwise rotation of S arm and clockwise rotation of N arm. SE Sulawesi-Buton also allochthonous continental terrane now juxtaposed with E Sulawesi Ophiolite Belt. In SE Sulawesi highly deformed Eocene- E Oligocene carbonates unconformably overlain by gently deformed E Miocene Celebes molasse, suggesting major deformation near Late Oligocene)

Surono, T.O. Simandjuntak, R.L. Situmorang & Sukido (1994)- Geology of the Batui Quadrangle, Sulawesi. Quad 2114, 1:250,000. Geological Research Development Centre (GRDC), Bandung, p. 1-38.

(E Sulawesi geological map between 1 and 2°S, NW side of Tolo Bay, mapped in 1981. Two terranes: (1) Banggai-Sula Platform with Carboniferous metamorphics and Permo-Triassic granites and (2) E Sulawesi ophiolite belt, composed of E Cretaceous ultrabasics overlain by U Cretaceous Matano Fm deep marine pelagic cherts and calcilitites. Terranes collided in M Miocene, creating Late Miocene- Pliocene molasse. Quaternary uplift. Oil seeps in several places along Batui thrust, the collision zone between ES ophiolite and BS Platform. Miocene Kolokolo melange near Batui Thrust))

Surono & D. Sukarna (1995)- The Eastern Sulawesi Ophiolite Belt, Eastern Indonesia. A review of its origin with special reference to the Kendari area. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 5, 46, p. 8-16.

(Also in Ophiolit di Sulawesi, Halmahera, dan Kalimantan, Geological Research Development Centre (GRDC), Bandung, Special Publ. 28 (2001), p. 1-10 and reprinted in Surono 2008). Mafic-ultramafic rocks widespread in SE arm of Sulawesi. Peridotite dunite, etc. with gabbro and basalt characterize mid-oceanic ridge type ophiolite complex. Ophiolite probably was thin widespread layer covering continental terrane. Late Cretaceous- Late Oligocene age (does not fit with reported E Cretaceous radiolaria in overlying sediments?; JTvG). Paleomagnetic results suggest formation at 17-24°S in Late Cretaceous and rotated CW about 60° (Mubroto). Ophiolite debris abundant in M Miocene and younger Sulawesi Molasse. SE arm ophiolite probably thrust over SE Sulawesi continental terrane in M-Late Oligocene, while in E arm it occurred in E Miocene)

Surono & D. Sukarna (1996)- Sedimentology of the Sulawesi molasse in relation to Neogene tectonics, Kendari area, Eastern Indonesia. Proc. 6th Int. Congress Pacific Neogene Stratigraphy, IGCP355, Serpong 1995, p. 57-72.

(Reprinted in Surono 2008, p. 175-192)

(Miocene- Pliocene Sulawesi Molasse post-collisional deposits near Matarape village in SE Arm of Sulawesi. Basal Matarape Fm conglomerates unconformably over Paleogene Tampakura Fm limestone and ophiolites, dominated by peridotite and pyroxenite clasts. Conglomerates conformably overlain by E Miocene limestone, with E Miocene forams (Spiroclypeus) and nannofossils (NN3). Ophiolite-derived fragments dominant in lower molasse, decreasing in size upsection, and more detritus from SE Sulawesi continental terrane, suggesting ophiolite formed thin cover over SE Sulawesi terrane)

Surono & H.A. Tang (2009)- Batuan pembawa emas primer dari endapan emas sekunder di Kabupaten Bombana, Sulawesi Tenggara berdasarkan interpretasi indera jauh. Proc. 38th Annual Conv. Indonesian Association Geologists (IAGI), Semarang 2009, p. 1-11.

(online at: https://www.iagi.or.id/web/digital/26/2009_IAGI_Semarang_Batuan-Pembawa-Emas.pdf)

(*'Primary gold source rock from secondary gold deposits in Bombana Regency, SE Sulawesi based on remote sensing interpretation' SE Sulawesi secondary gold deposits in streams and in Miocene Langkowala Fm sandstones (= "Celebes Molasse"?: JTvG). Rivers draining from Mendoke and Rumbia Mts, formed by metamorphic and meta sediments, but possible igneous intrusion identified with remote sensing in W end of Mendoke Mountains. Similar to Surono & Tang (2009), below*)

Surono & H.A. Tang (2009)- Kemungkinan keterdapatannya endapan emas primer di Kabupaten Bombana, Sulawesi Tenggara. J. Teknologi Mineral dan Batubara 5, 4, p. 163-170.

(online at: <https://jurnal.tekmira.esdm.go.id/index.php/minerba/article/view/885/726>)

(*'Possible occurrences of primary gold deposits in Bombana District, SE Sulawesi'. In 2009 63,000 traditional gold miners were worked in Bombana, SE Sulawesi area, exploiting modern stream deposits. Secondary gold also found within Miocene clastics of the Langkowala Fm. Primary gold source not clear (see also Idrus et al. 2011: interpreted as 'orogenic gold')*)

Sutadiwiria, Y. (2019)- Peranan biomarker dan paleofasies pada rekonstruksi tektonik batuan Paleogen- Neogen di Selat Makassar bagian Timur dan Sulawesi Barat. Ph.D. Thesis, Universitas Padjadjaran, p. 1-310.

(online at: https://repository.karyailmiah.trisakti.ac.id/documents/repository/disertasi_yarra-sutadiwiria-peranan-biomarker-dan-paleofasies-pada-rekonstruksi-tektonik-batuan-paleogen-neogen-di-selat-makassar-bagian-timur-dan-sulawesi-barat.pdf)

(*'The role of biomarkers and paleofacies in the tectonic reconstruction of Paleogene-Neogene rocks in the Eastern Makassar Strait and West Sulawesi'*)

Sutadiwiria, Y., M. Burhannudinur, M.A. Jambak, C.P. Riyandhani & Yeftamikha (2022)- Geochemical characterization of coal, carbonaceous shale, and marine shale as source rock in West Sulawesi, Indonesia. Indonesian J. on Geoscience (IJOG) 9, 3, p. 303-314.

(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/774/374>)

(*Geochemical analyses of Eocene potential source rock from outcrops in Mamuju area, Kaluku 1 well in E Makassar Straits and KYS well in W Sulawesi. Two source facies, fluvio-deltaic and marine*)

Sutadiwiria, Y., M.T. Fathaddin, I.S. Ronoatmojo, D. Syavitri, Cahyaningratri P R, B. Belladesta, Yeftamikha & A. Livsey (2024)- Updated geochemical characterization of hydrocarbon potential of surface sample in Lariang-Karama Sub-Basin, West Sulawesi, Indonesia. Scientific Contributions Oil and Gas (SCOG, Lemigas) 47, 2, p. 101-115.

(online at: <https://journal.lemigas.esdm.go.id/index.php/SCOG/article/view/1624/pdf>)

(*Review of Lariang-Karama Sub-Basin, W Sulawesi, organic geochemistry of Paleogene-Neogene source rocks. Marine shale source rocks in W Sulawesi and lacustrine shale source in E Makassar Strait*)

Sutadiwiria, Y., A.H. Hamdani, Y.A. Sendjaja, I. Haryanto & Yeftamikha (2018)- Biomarker composition of some oil seeps from West Sulawesi, Indonesia. Indonesian J. on Geoscience (IJOG) 5, 3, p. 211-220.

(online at: <http://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/397/268>)

(*Nine oil seep samples from Lariang and Karama Basins, SW Sulawesi. Some biodegradation. Biomarkers suggest mixed terrestrial plant and marine origin. High oleanane content interpreted as evidence for transport of angiosperm plant material into marine environment. Organic matter facies mixed allochthonous macerals from terrestrial higher plants, transported into basin from distal swamps and soils*)

Sutadiwiria, Y., M.A. Jambak & Yeftamikha (2020)- Perbandingan kematangan antara sumur LYS dan KYS di daratan Sulawesi Barat berdasarkan analisis geokimia. J. Geoscience Engineering Energy (JOGEE) 1, 2, p. 47-55.

(online at: <https://www.e-journal.trisakti.ac.id/index.php/jogee/article/download/7684/5585>)

(‘Maturity comparison between wells LYS and KYS in W Sulawesi based on geochemical analysis’. Two wells drilled in 2011 in Budong Block, onshore West Sulawesi are LYS (Lariang 1) and KYS (Karama KD-1). LYS-1 well is shallow well that only penetrates to E Miocene, while KYS well TD in Eocene. Eocene sediments matured at ~10Ma, Miocene sediments hermallly immature)

Sutadiwiria, Y., D. Syavitri & Y. Yeftamikha (2021)- Contribution of terrestrial material in West Sulawesi based on geochemical and biostratigraphy analysis. Proc. 5th Annual Applied Science and Engineering Conference (AASEC), Bandung 2020, IOP Conference Series: Materials Science Engineering 1098, 062014, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1757-899X/1098/6/062014/pdf>)

(Geochemical analysis of cutting samples of LYS and KYS exploration wells were drilled in N and S of Budong Block, W Sulawesi. LYS (= Lariang 1) Late Miocene-Pleistocene section in deeper marine environment, while KYS (= Karama 1)with M Eocene- E Pliocene section, also in marine environment (inner neritic-bathyal). Relatively low amount of terrestrial organic material, but higher in Neogene than in Paleogene)

Sutadiwiria, Y., Yeftamikha, A.H. Hamdani, Y. Andriana, I. Haryanto & E. Sunardi (2017)- Origin of oil seeps in West Sulawesi onshore, Indonesia: geochemical constraints and paleogeographic reconstruction of the source facies. J. Geological Sciences Applied Geology (UNPAD) 2, 1, p. 10-15.

(online at: <http://jurnal.unpad.ac.id/gstag/article/view/13420/7373>)

(Numerous oil- gas seeps onshore W and S Sulawesi, but no commercial discoveries so far in area. Biomarkers indicate coals and/or coaly shales as source, with some marine input in Karama region to S. Best candidate for source of oil seeps is Eocene coals or coaly shales of Toraja or Kalumpang Fm. Maturities at generation equivalent with Ro 0.8-1.0 %)

Sutjipto, M. (1999)- The geology and development of the Limpoga epithermal sediment-hosted deposit, Ratatotok District, North Sulawesi. Proc. 28th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, 2, p. 235-252.

(online at: <https://www.iagi.or.id/web/digital/65/17.pdf>)

(Newmont paper in Limpoga sediment-hosted epithermal gold deposit, 70km S of Manado, N Sulawesi, 3km E of Mesel Mine. Hosted by clean Miocene? lagoonal limestone, overlain by volcanogenic sediments and intruded by andesite. (see also Turner et al. (1994) and Azzaman et al. (2021): Carlin-type gold deposit))

Suyono & Kusnama (2010)- Stratigraphy and tectonics of the Sengkang Basin, South Sulawesi. Jurnal Geologi Indonesia 5, 1, p. 1-11.

(online at: www.bgl.esdm.go.id/dmdocuments/jgi20100101.pdf)

(Neogene stratigraphy and tectonic evolution of Sengkang Basin, onshore SW Sulawesi. Formed by NNW-SSE trending Walanae Fault system, followed by formation of Pliocene-Pleistocene foreland basin with W-prograding syn-orogenic Walanae Fm deposits. Fault system separated E and W parts of S Sulawesi and influenced Late Miocene- Quaternary deposition. Lower part of unit with small Late Miocene Tacipi Mb carbonate reefs in E Sengkang Basin. Lamasi Ophiolite in W Sulawesi and analogous E Sulawesi ophiolite separated by deep Bone Bay, suggesting orogenic collapse may have occurred here)

Swamidharma, Y.C.A. (2011)- Nickel laterite contents and grades in Sulawesi. In: N.I. Basuki (ed.) Proc. Conference Sulawesi Minerals Resources 2011, Manado, Indonesian Soc. Economic Geologists (MGEI)/IAGI, p. 289-298.

Swift, L.R. & M. Alwan (1990)- The discovery of gold-silver mineralization at Binebase, Sangihe Island, Indonesia. Proc. Pacific Rim Congress (PACRIM 90), 2, Gold Coast, Australia, 1990, Australasian Institute of Mining and Metallurgy (AusIMM), Parkville, p. 533-539.

(Binebase Au-Ag mineralisation on SE Sangihe Island hosted in Neogene andesitic volcanics)

Syafri, I. (2000)- Etude petrologique et geochimique des peridotites a grenat, eclogites et roches associees des parties Ouest et Centrale de l’île de Sulawesi, Indonesie. Ph.D. Thesis Universite de Paris 6, p. 1-455.

(Unpublished) ('Petrological and geochemical study of the garnet peridotites, eclogites and associated rocks in west and central parts of Sulawesi island'. Study of high-grade metamorphic rocks in Bantimala tectonic complex (E Cretaceous eclogites derived from Tethys ocean crust basalts in W-dipping subduction zone), Palu fault zone (granulites derived from arc volcanics; garnet peridotites exhumed from ~70km depth) and Wassupang melange (eclogites from oceanic gabbro subducted under W Sulawesi in Late Eocene- Early Oligocene)

Syafri, I. (2002)- The eclogites and associated rocks from Wassupang melange in the eastern part of the Central Sulawesi metamorphic belt, Indonesia: P-T history and geodynamic implications. Proc. 31st Annual Conv. Indonesian Association Geologists (IAGI), Surabaya, p. 1-19.

(Wassupang melange in East Arm of Sulawesi is tectonic melange with exotic blocks of eclogites and high-pressure (HP) metamorphic rocks in sheared matrix)

Syafri, I. (2004)- Komposisi kimia eklogit dan batuan bergarnet- berglaukofan dari kompleks Bantimala Sulawesi Selatan, Indonesia serta kemungkinan jenis- jenis batuan asalnya. Bull. Scientific Contribution (UNPAD) 2, 2, p. 50-60.

('The chemical composition of eclogite and garnet-glaucophane rocks of the Bantimala complex, S Sulawesi, Indonesia and their possible origin')

Syafri, I. (2014)- Ekoglit terubah dan batuan asosiasinya sebagai indikator subduksi purba selama Eosen Atas hingga Oligosen Bawah di sabuk metamorfik Sulawesi Tengah Bagian Timur- Indonesia. Bull. Scientific Contribution (UNPAD) 12, 3, p. 131-146.

(online at: <http://jurnal.unpad.ac.id/bsc/article/view/8374/3890>)

('Eclogite and associated rocks as an indicator of Late Eocene- E Oligocene subduction in E part of C Sulawesi metamorphic belt, East Indonesia'. Eclogites in several areas in Sulawesi: Bantimala, Palu valley, Bongka River and in Wasuponda melange complex. Wasuponda eclogites different from Bantimala or Palu and formed at different times. P-T conditions of ~21 kbar and 500°C of both Wasuponda and Bantimala eclogites indicate formation at 61-80 km depth. Eclogite from Wasuponda Melange underwent retrograde metamorphism to amphibolite/greenschist and originated from gabbroic oceanic crust. Bantimala eclogite formed during Cretaceous subduction, collision and microcontinent accretion; Wasuponda eclogite in NE dipping melange, formed during Eocene-Oligocene (intra-oceanic?) subduction and obduction)

Syafri, I., J.R. Kienast & J. Girardeau (1995)- New data on high-pressure rocks from Barru Complex, South-West Sulawesi, Indonesia: P-T history and geodynamic implications. Proc. 8th Regional Conference Geology Mineral Energy resources of SE Asia (GEOSEA), Manila 1995, p.

Syafri, I., J.R. Kienast & R. Soeria-Atmadja (2005)- High-pressure granulite from Palu Valley, Central Sulawesi, Indonesia; P-T history and geodynamic implications. Majalah Geologi Indonesia (IAGI) 20, 2, Special Edition, p. 68-79.

(P-T conditions calculated from HP granulite at Palu suggest formed at ~65 km in upper mantle, while normally these form at 35-40 km depth. It may be derived from foreign (Australian?) material carried into subduction zone mantle wedge below continental crust of Sulawesi)

Syafrizal, K. Anggayana & D. Guntoro (2011)- Karakterisasi mineralogi endapan nikel laterit di daerah Tinanggea, Kabupaten Konawe Selatan, Sulawesi Tenggara. J. Teknologi Mineral (JTM) 18, 4, p. 211-220.

(online at: <https://digilib.itb.ac.id/assets/files/2022/MjAxMSBTWUFGUkUwMS1QQVBFUi5wZGZY.pdf>)

('Characterization of mineralogy of a lateritic nickel deposit in the Tinanggea area, South Konawe Regency, SE Sulawesi'. Lateritic nickel from advanced weathering of Ni-silicate bearing ultramafic rock)

Syafrizal, T.A. Rivai, K. Yonezu, D. Kusumanto, K. Watanabe & A.N.H. Hede (2017)- Characteristics of a low-sulfidation epithermal deposit in the River Reef Zone and the Watuputih Hill, the Poboya gold prospect, Central Sulawesi, Indonesia: host rocks and hydrothermal alteration. Minerals (MDPI) 7, 124, p. 1-16.

(online at: www.mdpi.com/2075-163X/7/7/124/pdf-vor)

(Poboya gold mineralization hosted in granite, biotite gneiss and biotite schist of Palu Metamorphic Complex)

Syafrizal, Bhima & T.A. Rivai (2020)- Vein textures at the Hill Reef Zone, the Poboya prospect, Central Sulawesi, Indonesia. Proc. 2nd Int. Conference Earth Science Mineral and Energy, Yogyakarta 2019, AIP Conference Proceedings 2245, 070029, p. 1-9.

(online at: https://www.researchgate.net/publication/342791756_Vein_textures_at_the_Hill_Reef_Zone_the_Poboya_prospect_Central_Sulawesi_Indonesia)

(Three gold-bearing vein zones within metamorphic rocks at Poboya prospect, Palu area, C Sulawesi. Gold mineralization at Hill Reef 1 and 2 Zones classified as low-sulfidation epithermal deposit (see also Wadji et al. 2012 and Rivai et al. 2015, 2017, 2019))

Szentpeteri, K., G. Albert & Z. Ungvari (2015)- Plate tectonic and stress-field modelling of the North Arm of Sulawesi (NAoS), Indonesia, to better understand the distribution of mineral deposit styles. Proc. SEG 2015 Conference World class ore deposits: discovery to recovery, Hobart, Australia. (Abstract + Poster) (online at: www.researchgate.net/publication/282566392_Plate_tectonic_and_stress-field_modelling_of_the_Nor Etc.)

(N Arm of Sulawesi with 4 active gold mines. Three oceanic plates subducting under N Arm. Molucca and Celebes plates dip opposite to each other, Sangihe plate at right angles to other two. Variations in subducting plates marked by breaks in morphology and earthquake intensity, corresponding to arc-transform structures in upper plate. N Arm and Tomini and Gorontalo Bays in extensional regime (incl. uplifts of metamorphic core complexes), possibly tied to slab detachment and/or rollback of Sulawesi Trench. Young (5-1 Ma) Au-Cu mineralized districts in N Arm related to extensional features and intersections with transtensional arc normal faults (which may extend as tear faults on lower, opening window to mantle))

Taliding, T.U., S Widodo & A Ilyas (2023)- Proximate and microscopy analysis of coal in Tamalea Village, Bonehau District, Mamuju Regency, West Sulawesi Province, Indonesia. Proc. 4th Int. Conf. Global Issues for Infrastructure, Environment and Socio-Economic Development (GIESED), Makassar 2021, IOP Conference Series: Earth and Environmental Science 1134, 012028, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1134/1/012028>)

(Coal deposits in (Eocene?) Toraja Fm in Tamalea Village, Bonehau District, W Sulawesi, rel. high in ash (5.6% to 65%, incl. common pyrite). Moisture content (3.6- 8.4%))

Tan Sin Hok (1935)- Over ouderdomsbepalingen op grond van radiolarien van Oost-Celebes. De Ingenieur in Nederlandsch-Indie (IV) 2, 4, p. IV.31- IV.33.

(online at: <https://www.stichtingblauwelijn.nl/assets/files/1935-04.pdf>)

('On age determinations based on radiolarians of E Sulawesi'. The validity of Late Jurassic- Early Cretaceous age determinations of 12 E Sulawesi radiolarian-bearing samples by Hojnós in Von Loczy (1934) questioned here by Tan SH (who proposed no alternative ages, who was probably wrong here and Hojnós' conclusions were directionally correct; all species recorded range within Late Jurassic- E Cretaceous (e.g. O'Dogherty 2009). Tan's criticism perpetuated his own erroneous assumption of Neogene age of E Cretaceous radiolarian-rich marls from Roti in his 1927 thesis, which led him to the wrong conclusion that radiolaria are long-ranging and not useful for biostratigraphic zonations; JTvG))

Thamsi, A.B., M.H. Wakila, L. Ahmad & M. Aswadi (2025)- Geochemistry of iron ore in Kadong-Kadong, South Sulawesi, Indonesia. Iraqi Geological J. 58, 1D, p. 1-17.

(online at: <https://igj-iraq.org/igj/index.php/igj/article/view/2705/2199>)

(Chemistry of iron ore deposits in Kadong-Kadong Area, Luwu Regency, S Sulawesi. Conclusion: "chemical composition of the research areas shows that rock types are andesite and basaltic andesite" (little detail on sample locality and age/formation, and results hardly surprising?; JTvG))

'T Hoen, C.W.A.P. & K.G.J. Ziegler (1917)- Verslag over de resultaten van geologisch-mijnbouwkundige verkenningen en opsporingen in Zuidwest Celebes. Jaarboek Mijnwezen Nederlandsch-Indie 44 (1915), Verhandelingen 2, p. 235-363.

('Results of geological-mining reconnaissance and investigations in SW Celebes'. First extensive SW Sulawesi survey, from 12-1912 until 3-1915, with focus on Eocene coal occurrences below Late Eocene Nummulites

limestone. Brief discussion of gas seeps; no oil seeps encountered. Pretertiary composed of steeply dipping schists, overlain by less steep (10-40°) (Cretaceous) graywackes. With 1:200,000 scale geologic map and 1:20,000 maps of coal fields Tondong Koerah, Podo, Batoekoe and Malawa)

Tien, C.Y. (2018)- Age and geochemical constraints on Cenozoic magmatic evolution in Southern Sulawesi. M.Sc. Thesis, National Taiwan University, p. 1-155. *(Unpublished) (in Chinese)*.

Tien, C.Y., M.F. Chu, S.L. Chung, A. Maulana, M. Mawaleda, H.Y. Lee & X. Zhang (2018)- Age and geochemical constraints on Cenozoic magmatic evolution in Southern Sulawesi. American Geophysical Union, Fall Meeting 2018, Abstract T31D-0344.

(Zircon U-Pb age and geochemical data of Cenozoic igneous rocks from S Sulawesi indicate 3 episodes of magmatism: (1) Eocene (53-36 Ma) calc-alkaline, (2) Late Miocene (11-5 Ma) ultrapotassic-potassic, and (3) Pleistocene (3-1 Ma) sodic alkaline. Magma sources of Eocene rocks from mantle wedge, Late Miocene rocks from heterogeneous lithospheric mantle, and Pleistocene rocks from both lithospheric and asthenospheric mantle. Eocene magmatism might occur in subduction-zone setting, late Miocene and Pleistocene magmatism probably produced by Neogene rollback of Banda slab in collision-zone setting)

Tiranda, H. (2022)- Morpho-bathymetric features of the Southwest Celebes Sea. *Berita Sedimentologi* 48, 1, p. 31-44.

(online at: <https://journal.iagi.or.id/index.php/FOSI/article/view/389/372>)

(SW Celebes Sea controlled by active tectonics of North Sulawesi Trench and Palu-Koro Fault zone. Also major route of Indonesian Throughflow. Four types of morpho-bathymetric features: structural, erosional, gravitational and depositional. N Sulawesi fold-thrust belt associated with formation of N Sulawesi Trench and Palu-Koro Fault zone. In northern, deeper area of Celebes Sea mainly erosional and depositional features)

Tiranda, H. & R. Hall (2021)- Structural and stratigraphic development of offshore NW Sulawesi, Indonesia. 58p. *(Preprint)*

(online at: <https://eartharxiv.org/repository/view/2074/>)

(Study of offshore NW Sulawesi based on interpretation of offshore seismic and multibeam bathymetry: Deepwater Tarakan Basin in NW, Muara Sub-basin in W and N Sulawesi Fold-Thrust Belt in E. No continuation of left-lateral strike-slip Palu-Koro Fault to Borneo. Basins developed after extension in M Eocene associated with oceanic spreading in Celebes Sea. Several episodes of subsidence, particularly in E Miocene in Muara Sub-basin. Rapid prograding shelves from E Borneo linked to regional uplift on land since M Miocene)

Titu-Eki, A. & R. Hall (2020)- The significance of the Banda Sea: tectonic deformation review in Eastern Sulawesi. *Indonesian J. on Geoscience (IJOG)* 7, 3, p. 291-303.

(online at: <https://ijog.geologi.esdm.go.id/index.php/IJOG/article/view/619/320>)

(Study of structural features from topography of East Sulawesi and bathymetry data of Banda Sea: "area was majorly deformed during Neogene, specifically relating to the opening of the Banda Sea due to the subduction rollback of Banda")

Tjakradinata, S. & A. Sumanegara (1981)- Bijih sulfida dalam batuan gunungapi daerah Bilolo-Sangkaropi, Sulawesi Selatan. *Proc. 10th Annual Conv. Indonesian Association Geologists (IAGI)*, p. 289-308.

(online at: <https://www.iagi.or.id/web/digital/34/PIT-IAGI-1981-Vol-1-Paper-26.pdf>)

(‘Sulfide ores in volcanic rocks of the Bilolo-Sangkaropi area, South Sulawesi’)

Tjia, H.D. (1973)- Palu-Koro fault zone, Sulawesi. *Berita Direktorat Geologi, Bandung, Geosurvey Newsletter* 5, p. 1-3.

(Suggests 750km of sinistral displacement along NNW trending Palu-Koro fault zone of C Sulawesi (subsequent authors' estimates closer to 200-250km; JTvG))

Tjia, H.D. & P. Sumosusastro (1986)- Radiocarbon age of a 410-metre reef flat at Luwuk, Sulawesi. *Warta Geologi (Newsletter Geological Society Malaysia)* 12, 3, p. 127-129.

(online at: <https://gsmpubl.files.wordpress.com/2014/09/ngsm1986003.pdf>)

(Quaternary raised reef terraces at Luwuk Peninsula, E Sulawesi. Highest terrace at 410m asl, with radiocarbon age of Luwuk-6 sample of 35,000 ± 400 yr B.P. (at which time sea level was ~50m below present-day). More detail see Sumosusastro et al. 1989)

Tjia, H.D. & T.H. Zakaria (1974)- Palu-Koro strike slip fault zone, Central Sulawesi. *Sains Malaysiana* (University Kebangsaan Malaysia), 3, p. 67-88.

Tonggiroh, A. & I. Nur (2019)- Geochemical correlation of gold placer and indication of Au-Cu-Pb-Zn-Ag mineralization at Parigi Moutong, Central Sulawesi, Indonesia. *Journal of Physics: Conference Series* 1341, 052003, p. 1-15.

(online at: <https://iopscience.iop.org/article/10.1088/1742-6596/1341/5/052003>)

(Parigi Moutong area in SW part of North Arm of Sulawesi area of small-scale gold mining. Sources of placer deposits from 4 types of hydrothermal deposits: Au-Cu, Au-Zn, Cu-PB and epithermal Au-Ag)

Tournier, N., S. Fabbri, A. Damanik, F. Anselmetti, T. Wiguna, S.Y. Cahyarini & H. Vogel (2025)- The large-magnitude earthquake potential of an active strike-slip fault system in Lake Poso, Central Sulawesi, Indonesia. *Sedimentologica* (Geneva University) 3, 1, p. 1-16.

(online at: <https://oap.unige.ch/journals/sdk/article/view/1604/2249>)

(High-resolution geophysical and bathymetric surveys at Lake Poso in C Sulawesi in 2022 show large subaquatic slides and lake-bottom offsets, indicating high-intensity earthquakes, tied to active local fault system. Data suggest recurrence of large-magnitude earthquakes every 1600 ± 1450 years over last 11,000 years)

Trail, D.S., T.U. John, M.C. Bird, R.C. Obial, B.A. Pertzelt, D.B. Abiog & S. Parwoto (1974)- The general geological survey of Block 2, Sulawesi Utara, Indonesia. PT Tropic Endeavour Indonesia, Report, p. 1-68.

(Unpublished, but apparently widely circulated report on a September 1971-August 1973 minerals survey, which forms basis of much of knowledge of N Sulawesi Cenozoic arc-volcanic dominated geology)

Triani, R. Umam & Sismanto (2021)- 3D Modeling of subsurface Lawanopo Fault in Southeast Sulawesi, Indonesia using Grablox and its consequence to geohazard. *Indonesian J. Geography* 53, 1, p. 67-77.

(online at: <https://jurnal.ugm.ac.id/ijg/article/download/50878/pdf>)

(Lawanop Fault in SE Sulawesi is sinistral strike-slip fault, thought to be active since Plio-Pleistocene, or M Miocene. 3D model of subsurface fault using gravity data, allowing separation of high density Cretaceous ultramafics (13km thick) and moderate gravity metasediments (25km thick) and low gravity Triassic sediments)

Tsujimori, T., V.B. Sisson, J.G. Liou, G.E. Harlow & S.S. Sorensen (2006)- Very-low-temperature record of the subduction process: a review of worldwide lawsonite eclogites. *Lithos* 92, p. 609-624.

(Formation and preservation of lawsonite eclogites requires cold subduction to mantle depths and rapid exhumation. Glaucophane-bearing lawsonite eclogites together with serpentinite and garnet-quartz micaschists in accretionary complex of Albian-age (106 Ma) in Barru complex, W Sulawesi. Mineralogy suggests peak conditions of P~2.1 GPa and T=520°C)

Tuakia, M.Z., R. Takahashi & A. Imai (2018)- Geological and geochemical characteristics of gold mineralization in the Salu Bulu Prospect, Sulawesi, Indonesia. *Resource Geology* 69, 2, p. 176-192.

(online at: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/rge.12193>)

(Salu Bulu gold prospect in Awak Mas project in Latimojong Mts, central W Sulawesi. Gold mineralization hosted by the meta-sediments intercalated with meta-volcanics of Cretaceous Latimojong Metamorphic Complex. Ores ~3m thick. Gold mineralization in epithermal condition, after metamorphism of host rocks. T and P of ore formation from 190-210°C and 1.2-1.9 MPa)

Tuckey, S.H., N.M. Silvio & S.D. Potter (1998)- Geological modeling and resource estimation of the Toka Tindung epithermal gold deposit, North Sulawesi, Indonesia. In: S. Shedden (ed.) *Seminar papers Gold & nickel ore reserve estimation practice seminar*, Australasian Institute of Mining and Metallurgy (AusIMM), Carlton, 10, p. 76-92.

Turner, S.J., P.A. Flindell, D. Hendri, I. Hardjana, P.F. Lauricella et al. (1994)- Sediment-hosted gold mineralisation in the Ratatotok District, North Sulawesi, Indonesia. *J. Geochemical Exploration* 50, p. 317-336. (*Gold mined in Ratatotok district in Minahasa Regency since at least 1850s. Newmont exploration delineated sediment-hosted replacement-style deposit at Mesel, in Late Miocene limestone in island arc environment. Later uplift resulted in karst development in limestone and erosion of adjacent volcanic arc with deposition of thick epiclastic unit, followed by shallow level andesite intrusion into sequence. Mineralisation synchronous with late-stage reactivation of strike-slip faults. Elsewhere in district mineralisation in permeable zones along limestone-andesite contacts, quartz-calcite veins and stockworks*)

Turner, S.J., S.A. Garwin & A.H. Hofstra (2002)- Mesel SRHDG deposit and low-sulfidation gold veins in the Ratatotok District, North Sulawesi, Indonesia. Geological Society of America, 2002 Annual Meeting, 1p. (*Abstract only*)
(*N Arm of Sulawesi classic oceanic island arc with porphyry Cu and volcanic-hosted epithermal Au-Ag deposits. Ratatotok/ Mesel deposits hosted in Miocene carbonates deposited in NE-trending graben. Carbonate sequence deposited on and later covered by andesitic volcanics and volcanoclastics. Carbonates gently folded along E-W axes. Porphyritic andesite intrusions dated at 4.3 to 3.4 Ma*)

Ulfers, A., K. Hesse, C. Zeeden, J.M. Russell, H. Vogel, S. Bijaksana & T. Wonik (2021)- Cyclostratigraphy and paleoenvironmental inference from downhole logging of sediments in tropical Lake Towuti, Indonesia. *J. Paleolimnology* 65, p. 377-392.
(*online at: <https://link.springer.com/article/10.1007/s10933-020-00171-9>*)
(*Lake Towuti Drilling Project in C Sulawesi by Leibniz Institute in 2015, recovered >1000m of core, the longest continuous lacustrine sediment succession from Indo Pacific Warm Pool. Age model spans from late MIS 23 to late MIS 6 (~900- 130 ka).Eccentricity cycles main drivers of variations in hydroclimate in area*)

Umar, E.P., A. Harijoko, A. Setianto & W.Suryanto (2023)- Structural map of Sulawesi derives from gravity data and its implications for geothermal systems. Proc. The 4th Geoscience and Environmental Management Symposium, ICST UGM 2023, E3S Web of Conferences 468, 04004, p. 1-8.
(*online at: https://www.e3s-conferences.org/articles/e3sconf/pdf/2023/105/e3sconf_icstugm2023_04004.pdf*)
(*Satellite gravity used for fault etc. identification in Sulawesi*)

Umbgrove, J.H.F. (1930)- Een tocht naar Tandjong Api, Oost Celebes. *Onze Aarde* 3, 7, p. 282-286.
(*'A trip to Tanjung Api, East Sulawesi'. At N coast of E arm of Sulawesi serpentinitic rocks (Iherzolite) from which self-igniting gases flow. In short-lived popular science monthly magazine*)

Umbgrove, J.H.F. (1939)- De atollen en barriere-riffen der Togian eilanden. *Leidsche Geologische Mededelingen* 11, 1, p. 139-187.
(*online at: www.repository.naturalis.nl/document/549574*)
(*'The atolls and barrier reefs of the Togian Islands'. Study of modern atolls and reefs in Tomini Gulf, N Sulawesi, with reconnaissance geology observations on Togian Islands. Oldest rocks are sediments, intruded by young volcanics (but no recent activity). Togian peak and nearby areas composed of andesite/ trachyte volcanic rocks. Raised reef terraces younger than T_f/ Miocene*)

Umbgrove, J.H.F. (1942)- A revision of fossil corals from Celebes described by Dollfus. *Geologie en Mijnbouw (N.S.)* 5, p. 14-16.
(*online at: https://drive.google.com/file/d/1gJHuDZR314U_cYFZxqglAkhjY4LtefVP/view*)
(*Brief note on identifications by Dollfus (1915) of fossil corals from Sulawesi, collected by Abendanon. Disagrees with most identifications of samples from Saadang and Donggala. No figures*)

Usman, E. & Panuju (2013)- Study of gas potency based on gravity anomaly modeling and seismic profile analysis at Banggai-Sula Basin. *Bulletin of the Marine Geology* 28, 2, p. 51-60.
(*online at: <http://ejournal.mgi.esdm.go.id/index.php/bomg/article/download/55/56>*)

Utama, H.W., W. Gheovani, N. Supardi & W. Mukhtar (2016)- Determination of facies depositional environment based on outcrop of carbonate rock and micro-forams of Tonasa Formation at Karama, South Sulawesi. Proc. 40th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA16-285-SG, p. 1-6. (*18m section in calcareous claystone in Tonasa Lst at Karama with M Eocene planktonic foraminifera (Globigerina senni, Globigerapsis kugleri, etc.), and open marine small benthics*)

Utoyo, H., B. Priadi, A. Kadarusman & Sudarsono (1997)- K-Ar age of granitoids from Palu-Koro fault zone, Central Sulawesi. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 7, 71, p. 17-20. (*Granitic rocks in Palu-Koro fault zone with K/Ar ages between 8.4- 1.0 Ma. Categories: biotite-poor granite (2-5 Ma), mylonitized granite (5-7 Ma), biotite granite (6-8 Ma). Toboli gneissic granite 96 Ma (M Cretaceous)*)

Utoyo, H. (1998)- K/Ar dan Ar/Ar batuan granitik daerah Kulawi, Sulawesi Tengah. Proc. 27th Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 1, p. 72- 76. (*online at: <https://www.iagi.or.id/web/digital/56/8.pdf>*) (*'Radiometric ages of granitic rocks in the Kulawi area, C Sulawesi'. Kulawi area in Palu-Koro fault zone area. Ar/Ar dates of biotite from granitic rocks dated between 3.1- 3.5 Ma, hornblende 6.4 Ma. K/Ar ages from biotite generally higher: 3.8- 10.1 Ma, hornblende 5.5 Ma*)

Utoyo, H. (2008)- Bijih besi di daerah Bonocani Kabupaten Bone, Sulawesi Selatan. Jurnal Sumber Daya Geologi (JSDG) 18, 5, p. 309-317. (*online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/251/231>*) (*'Iron ore in Bontocani area, Bone district, South Sulawesi'. Iron ore in boulders; magnetite and hematite mineralization associated with granitoid intrusions*)

Utoyo, H. & Subiyanto (2001)- Ofiolit Pegunungan Batui, Luwuk, Sulawesi Tengah. Geological Research Development Centre (GRDC), Bandung (GRDC), Special Publ. 28, p. 27-46. (*'Ophiolite of the Batui Mountains, Luwuk, Central Sulawesi'. Batui Mts ophiolite incomplete upper part of ophiolite sequence, with gabbro-basalt in N, dominantly serpentinite in S. Eocene and Miocene K/Ar ages (too young?-JTvG). No evidence of mineralization*)

Van Bemmelen, R.W. (1949)- Celebes. In: The geology of Indonesia, Government Printing Office, Nijhoff, The Hague, 1, p. 389-441.

Van den Bergh, G.D., U.M. Lumban Batu, P.L. de Boer & F. Aziz (1995)- Lithostratigraphy of the West Sengkang Basin. In: The geology and stratigraphy of the vertebrate-bearing deposits in the Sengkang Basin: the terrestrial faunal evolution of South Sulawesi during the Late Pliocene and Quaternary. Geological Research Development Centre (GRDC), Bandung, Special Publ. 18, p. 14-27.

Van den Bergh, G.D., U.M. Lumban Batu, P.L. de Boer & F. Aziz (1995)- Lithostratigraphy of the East Sengkang Basin. In: The geology and stratigraphy of the vertebrate-bearing deposits in the Sengkang Basin: the terrestrial faunal evolution of South Sulawesi during the Late Pliocene and Quaternary. Geological Research Development Centre (GRDC), Bandung, Special Publ. 18, p. 28-31.

Van der Vlerk, I.M. & J.J. Dozy (1934)- The Tertiary rocks of the Celebes-expedition- 1929. In: H.A. Brouwer, Geologisch onderzoekingen op het eiland Celebes, Verhandelingen Kon. Nederlands Geologisch Mijnbouwkundig Genootschap (KNGMG), Geologische Serie 10, p. 183-218. (*online at: <https://www.delpher.nl/nl/boeken/view?identifier=MMKB24:064908000:00001>*) (*Appendix in Brouwer, 1934. Documentation of Eocene limestones with Pellatispira and Miocene limestones in different parts of Sulawesi. Several conglomeratic limestones from NE part of SE arm (Bahumpombini/ Bungku area) contain E Miocene larger foraminifera (Te5; Miogypsina, Spiroclypeus and Lepidocyclina (Eulepidina)), but also reworked clasts of U Cretaceous pelagic limestone with Globobotruncana (here called Discorbina; JTvG), radiolarian chert and serpentine (suggesting E Miocene or older uplift/exhumation of E Sulawesi ophiolite terrane?; JTvG)*)

Van Gorsel, J.T. (2022)- Geological investigations of Sulawesi (Celebes) before 1930. *Berita Sedimentologi* 48, 1, p. 79-114

(online at: <https://journal.iagi.or.id/index.php/FOSI/article/view/391/373>)

(Review of the early discoveries of the geology of Sulawesi, from the first naturalist expeditions in the 1820s until 1930, after which geological and mining investigations of Sulawesi essentially stopped for four-decades)

Van Gorsel, J.T. & E.A. Subroto (2022)- Abiogenic gas seepage from serpentinite at Tanjung Api, Tomini Bay, East Sulawesi. *Berita Sedimentologi* 48, 1, p. 67-78.

(online at: <https://journal.iagi.or.id/index.php/FOSI/article/view/390/374>)

(Burning gas seeps at Tanjung Api at S coast of Tomini Bay is abiogenic (abiotic) gas, composed of isotopically anomalous methane and hydrogen, which formed from serpentinitization of ultramafic rocks of the East Sulawesi Ophiolite Complex)

Van Leeuwen, T. (1981)- The geology of southwest Sulawesi with special reference to the Biru area. In: A.J. Barber & S. Wiryosayono (eds.) *The geology and tectonics of Eastern Indonesia*. Geological Research Development Centre (GRDC), Bandung, Special Publ. 2, p. 277-304.

(online at: https://www.researchgate.net/publication/270645816_The_geology_of_Southwest_Sulawesi_with_special_reference_to_the_Biru_area)

(SW Sulawesi Biru area E of Makassar almost complete U Cretaceous- U Miocene record. Basement is Bantimala Complex metamorphics (K/Ar age 111 Ma), ultrabasic rocks and tectonic melange with NE-dipping radiolarian cherts, clastics and igneous rocks. Metamorphics unconformably overlain by latest Jurassic-E Cretaceous sands, shale and radiolarian cherts. Sands near base with metamorphic and ultramafic clasts. Flysch-type U Cretaceous folded and uplifted before deposition of thick Langi Fm andesitic volcanics (Paleocene K/Ar age near base; upper part with Late Eocene coals and limestones with Pellatispira). Conformably overlain by ~400m U Eocene- M Miocene Tonasa Limestone (Tb- Lower Tf, but mid-Oligocene unconformity). Unconformably overlain by >1000m thick M and U Miocene Sopo-Walanae-Lemo Fm volcanics (~17- ~5 Ma?). Mid-M Miocene folding and uplift event, associated with 40° CCW rotation of area. Also unconformity at base of U Miocene Lemo andesitic volcanics and Plio-Pleistocene folding-uplift event)

Van Leeuwen, T., C.M. Allen, M. Elburg, H.J. Massonne, J.M. Palin & J. Hennig (2016)- The Palu Metamorphic Complex, NW Sulawesi, Indonesia: origin and evolution of a young metamorphic terrane with links to Gondwana and Sundaland. *J. Asian Earth Sciences* 115, p. 133-152.

(manuscript online at: <https://eprints.qut.edu.au/221189/1/95551.pdf>)

(Young metamorphic core complexes of Palu (PMC) and Karossa, mainly in 'neck' of NW Sulawesi. N part mainly amphibolite (oceanic parentage?), S part mainly biotite schists (meta-sediments) with some gneiss (meta-granite). Local peridotite. Rocks resided at depths of 60-120 km during part of their histories. S part overlain by U Cretaceous Latimojong Fm clastics and volcanics (but parts of PMC also metamorphosed Latimojong Fm). Zircon ages of metamorphics suggest metamorphism event at 3-4 Ma of older protoliths (210-230 Ma/ Late Triassic and ~80-120 Ma/M Cretaceous). Rapid cooling exhumation in latest Miocene- M Pliocene (Ar/Ar cooling ages 6.0- 3.6 Ma). Composite terrane with (1) gneiss unit of Gondwana origin (but presence of Late Triassic meta-granitoids and recycled Proterozoic zircons suggest W Sulawesi Block origin in New Guinea region, not NW Australian margin, as suggested in recent reconstructions?), (2) schist unit composed of low-metamorphic turbidites deposited in Late Cretaceous- E Tertiary along SE Sundaland margin, and (3) slivers of amphibolite with oceanic crust characteristics)

Van Leeuwen, T., C.M. Allen, A. Kadarusman, M. Elburg, J.M. Palin, Muhardjo & Suwijanto (2007)- Petrologic, isotopic, and radiometric age constraints on the origin and tectonic history of the Malino metamorphic complex, NW Sulawesi, Indonesia. *J. Asian Earth Sciences* 29, p. 751-777.

(online at: https://www.academia.edu/3247304/Petrologic_isotopic_and_radiometric_age_constraints_on_the_origin_and_tectonic_history_of_the_Malino_Metamorphic_Complex_NW_Sulawesi_Indonesia)

(Malino Metamorphic Complex (MMC) at W end of Sulawesi N arm mica schists and gneisses from proximal turbidite and granitoid protoliths, with intercalations of greenschist, amphibolite, marble and quartzite)

Devonian- Early Carboniferous age, Archean-Proterozoic inherited zircons, and isotopic signatures indicate terrane derived from New Guinea-Australian margin. Similarities with Birds Head basement suggests common origin. Greenschists around MMC from adjacent autochthonous Paleogene. Barrovian progression from greenschist through epidote-amphibolite to amphibolite. P-T estimations suggest 27-30 km burial. Cooling ages 23-11 Ma, and 7 Ma age for unconformably overlying volcanic rocks, indicate Miocene exhumation. Two tectonic scenarios: (1) continental fragment docked with Sulawesi in Mesozoic and exhumed as metamorphic core complex in Miocene; (2) subducted beneath N arm in Late Oligocene, then rapidly returned to surface)

Van Leeuwen, T.M. & Muhardjo (2005)- Stratigraphy and tectonic setting of the Cretaceous and Paleogene volcanic-sedimentary successions in Northwest Sulawesi, Indonesia: implications for the Cenozoic evolution of Western and Northern Sulawesi. *J. Asian Earth Sciences* 25, p. 481-511.

(online at: www.academia.edu/37367798/stratigraphy_and_tectonic_setting_of_the_Cretaceous_and_P_Etc.) (W Sulawesi is rifted continental margin of E Sundaland. Metamorphic basement, partly of Australian origin, overlain by Late Cretaceous Latimojong Fm fore-arc turbidites. M Eocene- earliest Miocene transgressive cycle: syn-rift siliciclastics, nummulitic limestone and associated shelf sediments to deeper marine mudstones and turbidites (Budungbudung and Tinombo Fms). At same time N Sulawesi oceanic island arc, with bimodal Papayato volcanism on oceanic crust. Cretaceous- Paleogene volcanic and sedimentary suites contrasting tectonic setting of two provinces. Relationship between two domains not clear: probably formed continuous belt through Cenozoic, definitely connected by E Miocene. Paleogene deformation in N part of NW Sulawesi and unconformable relationship with overlying formations may be result of collision of N arm with Australian-derived continental fragment in E Miocene, or M Miocene formation of extensional metamorphic core complex. Second major tectonic event Pliocene-ongoing, affects entire region)

Van Leeuwen, T.M. & P.E. Pieters (2011)- Mineral deposits of Sulawesi. In: N.I. Basuki (ed.) Proc. Conf. Sulawesi Minerals Resources 2011, Manado, MGEI/IAGI, p. 1-109.

(online at: https://www.researchgate.net/publication/269113891_Mineral_deposits_of_Sulawesi) (Major review of Sulawesi mineral deposits. Same as Van Leeuwen & Pieters (2013))

Van Leeuwen, T.M. & A. Maulana (2025)- Geology of the Sulawesi region. Hasanudin University, UNHAS Press, Makassar, p. 1-1284.

(online at: https://www.researchgate.net/publication/394979763_GEOLOGY_OF_THE_SULAWESI_REGION_book_pdf) (Recent, extensive review of the geology of all parts of Sulawesi, documenting virtually all works ever published since the early colonial era)

Van Leeuwen, T.M. & P.E. Pieters (2012)- Mineral deposits of Sulawesi. Geological Agency, Ministry of Energy and Mineral Resources, Bandung, p. 1-127.

(Extensive overview of mineral deposits of N, W and E Sulawesi Provinces, set in historic and geologic contexts. Sulawesi has complex geology with wide variety of mineralization styles, including porphyry Cu-Au, porphyry Mo, epithermal, metamorphic and sedimentary Au, lateritic nickel and Fe, etc. Gold mining started in 1896, nickel in 1938. By world standards Sulawesi is underexplored)

Van Leeuwen, T.M., E.S. Susanto, S. Maryanto, S. Hadiwisastra, Sudijono, Muhardjo & Prihardjo (2010)- Tectonostratigraphic evolution of Cenozoic marginal basin and continental margin successions in the Bone Mountains, Southwest Sulawesi, Indonesia. *J. Asian Earth Sciences* 38, 6, p. 233-254.

(Bone Mts in SW Sulawesi composed of Oligocene- Lower Miocene transtensional marginal basin Bone Gp (MORB-like volcanics and interbedded hemipelagic mudstones), juxtaposed against Eocene- Miocene continental margin Salokalupang Gp. Latter: (1) M- U Eocene volcanoclastics with limestone intercalations in upper part, reflecting arc volcanism and carbonate development along Sundaland margin; (2) Oligocene calcarenites, deposited on passive margin, and (3) Lower- M Miocene clastics- volcanics, formed in extensional regime without subduction. At ~14-13 Ma start of widespread extension in SW Sulawesi, with potassic volcanism (Camba Fm), reaching peak 1 Ma year later with juxtaposition of Bone Gp against Salokalupang Gp along Walanae strike-slip fault. Potassic volcanism continued to end Pliocene, locally to Quaternary)

Van Leeuwen, T.M., R. Taylor, A. Coote & F.J. Longstaffe (1994)- Porphyry molybdenum mineralization in a continental collision setting at Malala, Northwest Sulawesi, Indonesia. *J. Geochemical Exploration* 50, p. 279-315.

(online at: www.researchgate.net/publication/229413281_Porphyry_molybdenum_mineralization_in_a Etc)
(Malala deposit in NW Sulawesi only known porphyry Molybdenum in Indonesia, associated with mainly granitic intrusives (Malala porphyries) as late differentiates in roof zone of Dondo batholith. Intrusives part of 600 km belt of granites and granodiorites, emplaced in continental margin ('W Sulawesi') in Late Miocene-Pliocene, during and following collisions between several microcontinents and Sulawesi western magmatic arc/eastern subduction complex. Granitoids from partial melting of lower crust (possibly underthrust Precambrian- Paleozoic continental crust) due to lithospheric thickening in continental collision regime)

Van Schelle, C.J. (1889)- Verslag over het voorkomen van goudvoerende aderen bij Sumelatta (Residentie Menado). *Jaarboek Mijnwezen Nederlandsch Oost-Indie* 18 (1889), Technisch Administratief Gedeelte, Verhandelingen, p. 5-38.

(*'Report on the occurrence of gold-bearing veins near Sumelatta (Residency Menado)'. Early investigation of gold near Sumalata along the N coast of N Sulawesi in 1886, at the request of potential mining concessionaire Parmentier. Gold mined by natives since 1813, directed by Rajah of Limbotto, who claimed 20% of all gold mined. Many small shafts down to 14m depth. At that time, native shallow gold mine workings were already mostly abandoned (in 1896 entrepreneurs Bauermann and Parmentier applied for a gold mining concesssion, and appointed now-retired Ir. Van Schelle as board member of his Mijnbouw Maatschappij Soemalatta; JTvG)*)

Van Schelle, C.J. (1889)- Verslag van een onderzoek naar de waarde van bekende goudvindplaatsen in de afdeling Gorontalo (Res. Menado). *Jaarboek Mijnwezen Nederlandsch Oost-Indie* 18 (1889), Technisch Administratief Gedeelte, Verhandelingen, p. 39-55.

(*'Report of investigation of the value of known gold occurrences in the district Gorontalo, Residency Manado'. Brief review of native mining sites at Patente, Banganite, Lantia, Popaja, Lanoeo, etc.)*)

Van Schelle, C.J. (1889)- Opmerkingen over de geologie van een gedeelte der afdeling Gorontalo, Res. Menado. *Jaarboek Mijnwezen Nederlandsch Oost-Indie* 18 (1889), Wetenschappelijk Gedeelte 2, p. 115-158.

(*'Remarks on the geology of a part of the district Gorontalo, Residency Manado'. Results of 1886 survey in N Sulawesi. Knowledge of N Sulawesi at this time still very rudimentary. Presence of granite, diorite, andesite and Late Tertiary clastic sediments and limestones*)

Van Straelen, V. (1924)- *Portunus brouweri*. Portunien nouveau du Tertiaire de l'Île Celebes. *Jaarboek Mijnwezen Nederlandsch Oost-Indie* (1923), Verhandelingen p. 169-170.

(*'Portunus brouweri, a new portunid from the Tertiary of Sulawesi'. New species of crab fossil from probably Miocene-age lithographic limestones with fish fossils at Patunuang Asu, S Sulawesi (see also Brouwer 1924)*)

Van Vuuren, L. (1920)- Het gouvernement Celebes: proeve eener monographie. Encyclopedisch-Bureau, Weltevreden, 535p. + Atlas with 25 maps.

(*Early geographic description of Sulawesi. Includes geology chapter, influenced by Wegener's continental drift theory*)

Van Waterschoot van der Gracht, W.A.J.M. van (1915)- Voorloopige mededeeling in zake de geologie van Centraal-Celebes. *Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap* 32, p. 188-204.

(online at: <https://resolver.kb.nl/resolve?urn=MMUBA13:001661001:pdf>)

(*'Preliminary communication on the geology of Central Sulawesi'. Summary of 1913 fieldwork in Toraja lands, mainly to investigate stratigraphy. Widespread, thick, folded red Globigerina marls with thin limestone intercalations of E-M Eocene age, not Cretaceous as previously suggested. Overlain by several km thick volcanic series, probably Late Eocene- Miocene age. Mid-Tertiary granite intrusions. "Sulawesi more likely part of Tethys geosyncline than of Asian mainland'. (Heavily criticized by Abendanon 1915 for proposing sweeping regional conclusions based on only 11 days of fieldwork in small part of C Sulawesi)*)

- Van Waterschoot van der Gracht, W.A.J.M. (1915)- Bijdrage tot de geologie van Centraal-Celebes. Jaarboek Mijneuzen Nederlandsch Oost-Indie 43 (1914), Verhandelingen 2, p. 16-73.
(*'Contribution to the geology of Central Sulawesi'. Report on 2-week journey into C Sulawesi Toraja lands from Palopo at N end of Bone Bay. One of first to demonstrate that widespread red claystones are of E-M Eocene age (with interbeds of limestone with Nummulites, Assilina; identified by L. Rutten). Different from earlier interpretations of De Sarasin (1912) and J. Ahlburg (1910, 1911 (but interpretations disputed by E. Abendanon, whose Celebes books had not been published yet))*)
- Vigny, C., H. Perfettini, A. Walpersdorf, A. Lemoine, W. Simons, D. van Loon, B. Ambrosius, C. Stevens, R. McCaffrey et al. (2002)- Migration of seismicity and earthquake interactions monitored by GPS in SE Asia triple junction: Sulawesi, Indonesia. *J. of Geophysical Research* 107, B10, 2231, p. 7/1-7/11.
(online at: <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2001JB000377>)
(*GPS- detected coseismic and transient post-seismic deformation related to January 1996 earthquake on N Sulawesi (Minahassa) trench*)
- Villeneuve, M., J.J. Cornee, W. Gunawan, J. Girardeau, C. Monnier, J.P. Rehault, J. Malod, S. Burhanuddin et al. (1995)- Role of the Miocene extensional tectonic event in the blueschist exhumation and the molassic basin origin in the Sulawesi island (Indonesia). *EUG 8, Terra Nova, Supplement*, p. 119. (*Abstract only*)
- Villeneuve, M., J.J. Cornee, W. Gunawan, M.C. Janin, J. Butterlin, P. Saint-Marc & H. Samodra (2000)- Continental block collision in the eastern arm of Sulawesi (Indonesia); structure and geodynamic interpretation. *Comptes Rendus Academie Sciences, Paris, IIA, Earth Planetary Science* 330, 5, p. 371-378.
(online at: https://www.academia.edu/26730800/Continental_block_collision_in_the_eastern_arm_of_Sulawesi_Indonesia_Structure_and_geodynamic_interpretation)
(*E arm of Sulawesi result of collision between two continental blocks: Tokala in W and Banggai-Sula in E. Tokala block results from Oligocene obduction of ophiolitic Asiatic basin (W Sulawesi) onto passive margin of Gondwanan-origin Banda block (later called Kolonodale Block) near end-Oligocene or beginning of Miocene. Tokala Block then collided by Banggai-Sula block in E-M Pliocene or later*)
- Villeneuve, M., J.J. Cornee, W. Gunawan, R. Martini, G. Tronchetti, M.C. Janin, P. Saint-Marc & L. Zaninetti (2001)- La succession lithostratigraphique du bloc de Banda dans la region de Kolonodale (Sulawesi central, Indonesie). *Bull. Societe Geologique France* 172, 1, p. 59-68.
(online at: <https://archive-ouverte.unige.ch/unige:9820>)
(*'Lithostratigraphy of the Banda Block in the Kolonodale area, C Sulawesi'. E and SE Sulawesi composed of two major continental blocks: (1) 'Banda block' (in later papers called Kolonodale Block; JTvG) including also Buru, Seram and Sinta Ridge, collided with Asian volcanic arc of W Sulawesi in Oligocene, then was dismembered during Late Neogene Banda Sea opening, and (2) Banggai-Sula block which drifted from Irian Jaya and collided with Banda block in Mid-Late Pliocene. Fragment of Banda block is in E Sulawesi, corresponding to the ophiolitic zone, where, in Kolonodale area, it is possible to reconstruct sedimentary succession under ophiolite, despite intensive deformations. Good overview of Late Triassic carbonates*)
- Villeneuve, M., W. Gunawan, O. Bellier, H. Bellon, J.J. Cornee, R. Martini & J.P. Rehault (2013)- Multiple collisions in Sulawesi Island and relationships with the geodynamical evolution of eastern Indonesia. In: 2nd Southeast Asian Gateway evolution Meeting (SAGE 2013), Berlin, p. 177. (*Abstract only*)
(*Three small NE Gondwanan blocks from E or SE collided with W and N Arms of Sulawesi, at W-dipping subduction zone(s): (1) Late Oligocene- E Miocene 'Kolonodale Block', tectonically capped by large ophiolite; (2) M Miocene 'Lucipara Block' collision with Kolonodale Block; (3) M Pliocene 'Banggai-Sula Block'. Kolonodale Block strikingly similar to Timor and Lucipara, while Banggai-Sula blocks similar to Birds Head*)
- Villeneuve, M., W. Gunawan, J.J. Cornee & O. Vidal (2002)- Geology of the Central Sulawesi belt (eastern Indonesia): constraints for geodynamic models. *Int. J. Earth Sciences (Geologische Rundschau)* 91, 3, p. 524-537.
(online at: www.researchgate.net/publication/225636349_Geology_of_the_central_Sulawesi_belt_eastern_Indonesia_Constraints_for_geodynamic_models_etc.)

(Sulawesi four major tectonic events: (1) Mid-Cretaceous in W arm; (2) Oligocene Eastward ophiolite obduction and collision of 'Kolonodale Block' of Gondwana origin, producing metamorphic belt in C Sulawesi; (3) Middle Miocene collision of Banda Block and Tukang-Besi Platform and (4) Middle Pliocene collision between Kolonodale and Banggai-Sula blocks)

Von Koenigswald, R. (1933)- Over het zogenaamde voorkomen van *Spirifer verneuili* Murch. op Celebes. De Mijningenieur 1933, 1, p. 14-16.

('On the alleged occurrence of Spirifer verneuili Murchison on Sulawesi'. Paleozoic brachiopod first reported from Sulawesi by Brouwer is almost certainly from Chinese pharmacy, not from Sulawesi. Brachiopods like Spirifer Cyrtua and Orthis are rel. common in Chinese pharmacies across Java and outer areas and were presumably all imported from China for Chinese medicinal purposes)

Von Loczy, L. (1933)-: A keletcelebeszi Eszakboengkoee es Bongkavidek foldrajzi es foldtani viszonyai. Foldtani Kozlony (Bull. Hungarian Geological Society) 62, p. 130-164. (In Hungarian, with German summary)

(online at: https://epa.oszk.hu/01600/01635/00385/pdf/EPA01635_foldtani_kozlony_1932_62_01-12_130-164.pdf)

('Geology of the North Boengkoee and the Bongka areas of East Sulawesi'. Short version of Von Loczy (1934; below, about results of 1928 BPM expedition)

Von Loczy, L. (1934)- Geologie van Noord Boengkoee en het Bongka-gebied tusschen de Golf van Tomini en de Golf van Tolo in Oost-Celebes. Verhandelingen Geologisch-Mijnbouwkundig Genootschap Nederland Kolonien, Geologische Serie 10, p. 219-322.

('Geology of the North Boengkoee and the Bongka areas between the Gulf of Tomini and the Gulf of Tolo in East Sulawesi'. Report on BPM fieldwork in 1928 in Bongka River region, Sulawesi E arm. 70% of area covered by ophiolites (peridotite, serpentinite gabbro), thrust over Triassic- U Cretaceous sediments (local contact-metamorphism), incl. 300-500m dense yellow U Triassic (Norian) limestone rich in Misolia. Deep marine Late Jurassic belemnite limestone and white and red radiolarian-bearing Jurassic- Cretaceous limestones. Highly folded Late Eocene limestones with Discocyclina- Pellatispira. Celebes molasse 1200m thick, with Miocene Lepidocyclina limestone near base. Separate chapters on radiolaria (Hojnos; U Jurassic- Lw Cretaceous) and foraminifera (Van der Vlerk), Mesozoic macrofossils (Kutassy). Some of Von Loczy's conclusions debated by Hetzel (1935), Oostingh (1935), Tan Sin Hok (1935))

Von Staff, H. (1911)- Zum Problem der Entstehung der Umrissform von Celebes. Zeitschrift Deutschen Geologischen Gesellschaft, Berlin, Monatsberichte 63, 13, p. 180-186.

(online at: https://www.zobodat.at/pdf/Z-dtsch-Geol-Ges_63_0180-0186.pdf)

('On the problem of the origin of the outline shape of Sulawesi'. Followed by Reply by Ahlburg, 1911, p. 399-405. (The unusual K shape of Sulawesi was also discussed by Abendanon 1912 and Sarasin 1912))

Von Steiger, H. (1915)- Petrografische beschrijving van eenige gesteenten uit de onderafdeeling Pangkadjene en het landschap Tanette van het gouvernement Celebes en onderhoorigheden. Jaarboek Mijnwezen Nederlandsch Oost-Indie 42 (1913), Verhandelingen, p. 171-227.

('Petrographic description of rocks from sub-district Pajangkane and Tanette region, SW Sulawesi'. Mainly igneous rocks, also glaucophane schist. With 1:150,000 scale geological map of departments Makassar and Bone by 'T Hoen)

Voosen, P. (2019)- Indonesian earthquake broke a geologic speed limit. Science Magazine 363, 6427, p. 570.

(online at: <https://www.science.org/doi/pdf/10.1126/science.363.6427.570>)

(Devastating magnitude-7.5 earthquake that struck Palu, Sulawesi, in September 2018 triggered tsunami and killed more than 2000 people. The 'supershear event' ripped through Earth's crust at very high speed along strike-slip fault, traveling ~150 km in only 35 seconds)

Vuillemin, A., A. Friese, R. Wirth, J.A. Schuessler, A.M. Schleicher, H. Kemnitz, A. Lucke et al. (2020)- Vivianite formation in ferruginous sediments from Lake Towuti, Indonesia. Biogeosciences 17, p. 1955-1973.

(<https://bg.copernicus.org/articles/17/1955/2020/bg-17-1955-2020.pdf>)
(Presence of large crystals (> 5 mm) and nodules (> 5 cm) of vivianite (ferrous iron phosphate) in otherwise siderite-rich sediment cores from Lake Towuti, E Sulawesi)

Wahyono & Sidarto (2002)- Karakteristik kimia dan fisika serta pematangan batubari di daerah Baraka, Enrekang, Sulawesi Selatan. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 12, 132, p. 20-37.
(*'Chemical and physical characteristics and maturation of coal in the Baraka area, Enrekang, S Sulawesi'. Eocene Baraka coals NE of Enrekang high sulfur and ash, brown coal to medium volatile bituminous. Two groups: (1) Titok crushed and sheared with R_{vmax} 0.19-1.48% and Batunoni-Lapin with R_{vmax} 0.32-0.64%*)

Wahyudiono, J., A.K. Gibran, B. Salimuddin & Baharuddin (2019)- Distribution of the Cretaceous rocks in Balantak, Salodik and Pagimana areas and their implication to tectonic evolution of the East Sulawesi. *Proc. Joint Convention HAGI-IAGI-IAFMI-IATMI (JCY 2019)*, Yogyakarta 2019, ID-479-JCY2019, p. 1-7.
(*online at: www.researchgate.net/publication/342657094_Distribution_of_the_Cretaceous_Rocks_in_Balantak_Salodik_and_Pagimana_Areas_and_Their_Implication_to_Tectonic_Evolution_of_the_East_Sulawesi*)
(*Highly deformed Upper Cretaceous Luok/Matano Fm in Luwuk-Banggai basin in East Arm of Sulawesi 100-600m thick, with Belemnopsis fossils. (ost of paper is literature review, limited new data (figures too much reduced to be legible; JTvG)*)

Wahyudiono, J., Triwurjani, D. Yurnaldi, S. Adhitama, Suryatman, Abdullah, M.D.K. Dhony & S. Mawardi (2024)- Matano Fault and major damage during ancient iron industry era along the Matano Lake, Sulawesi. *Proc. 53rd Annual Conv. Indonesian Association Geologists (IAGI)*, Balikpapan 2024, p. 1-9.
(*online at: <https://www.iagi.or.id/web/digital/79/180---Matano-Fault-and-major-damage-during-ancient-iron-industry-era-along-the-Matano-Lake,-Sulawesi---Joko-Wahyudiono.pdf>*)
(*On historical relationship between seismic activity along Matano Fault and ancient iron industry around Lake Matano in S Sulawesi during Luwu Kingdom, a prominent iron producer from 8th early 20th century*)

Wajdi, M.F., B. Santoso, D. Kusumanto & S. Digidowirogo (2011)- Metamorphic hosted low sulphidation epithermal gold system at Poboya, Central Sulawesi: a general descriptive review. In: N.I. Basuki (ed.) *Proc. Conference Sulawesi Minerals Resources, Manado 2011, MGEI/IAGI*, p. 201-210.
(*See also Wajdi et al. 2012*)

Wajdi, M.F., B. Santoso, D. Kusumanto & S. Digidowirogo (2012)- Metamorphic hosted low sulphidation epithermal gold system at Poboya, Central Sulawesi: a general descriptive review. *Majalah Geologi Indonesia (IAGI)* 27, 2, p. 131-141.
(*online at: www.bgl.esdm.go.id/publication/index.php/dir/article_detail/771*)
(*'Low sulfidation epithermal gold systems in metamorphic rocks in Poboya, C Sulawesi: general descriptive review'. Same as Wajdi et al. 2011. On Poboya epithermal gold prospect 12 km NE of Palu, C Sulawesi, on E margin of pull-apart basin related to Palu Koro sinistral strike slip fault system*)

Wake, B.A., A.S. Iswahyudi & M. Dadi Kuswandi (1997)- Epithermal gold-silver mineralization in a fossil hot spring system, Toka Tindung, North Sulawesi. *Seminar Nasional Sumber Daya Geologi, Fakultas Teknologi Mineral, UPN 'Veteran' Yogyakarta*, p.

Wake, B., N. Silvio, A. Lattore, A.S. Iswahyudi & A. Purwanto (1996)- Geology of the Toka Tindung epithermal gold deposit, North Sulawesi, Indonesia. *Proc. Conf. Porphyry related copper and gold deposits of the Asia Pacific Region, Cairns 1996, Australian Mineral Foundation, Adelaide*, p. 9.1-9.8.
(*On Toka Tindung low sulphidation epithermal gold deposit on N tip of Sulawesi, 35km NE of Manado. Two vein systems in Pliocene andesitic volcanoclastics*)

Wakita, K. (2002)- Mystery man and mysterious unconformity in South Sulawesi, Indonesia. *Chishitsu News* 573, p. 48-68. (*in Japanese*)
(*online at: www.gsj.jp/Pub/News/pdf/2002/05/02_05_05.pdf*)

Wakita, K., Munasri, J. Sopaheluwakan, I. Zulkarnain & K. Miyazaki (1994)- Early Cretaceous tectonic events implied in the time-lag between the age of radiolarian chert and its metamorphic basement in Bantimala area, South Sulawesi, Indonesia. *The Island Arc* 3, 2, p. 90-102.

(online at: www.academia.edu/8323112/Early_Cretaceous_tectonic_events_implied_in_the_time_lag_between_the_age_of_radiolarian_chert_and_its_metamorphic_basement_in_the_Bantimala_area_South_Sulawesi_Indonesia)
(*Bantimala Complex of S Sulawesi mainly melange, chert, basalt, ultramafic rocks and high-P metamorphics. Radiolarian assemblage from unconformably overlying chert Mid-Cretaceous (late Albian-early Cenomanian= around 100 Ma), while K-Ar ages from schist range from 132-114 Ma. This suggests brief tectonic event followed by quick waning tectonism during Albian-Cenomanian transgression*)

Wakita, K., J. Sopaheluwakan, K. Miyazaki, I. Zulkarnain & Munasri (1996)- Tectonic evolution of the Bantimala Complex, South Sulawesi, Indonesia. In: R. Hall & D. Blundell (eds.) *Tectonic evolution of Southeast Asia*, Geological Society, London, Special Publ. 106, p. 353-364.

(*Bantimala Complex NE-dipping tectonically stacked slices, composed mainly of high-P metamorphics and radiolarian chert, but also E-M Jurassic sandstones and overlain by mid-Cretaceous radiolarites and Late Cretaceous turbiditic series. Ages of metamorphics suggest oceanic plate subduction in Late Jurassic- earliest Cretaceous. Subduction ceased in Albian. High-P schists exhumed due to collision of Gondwana-derived microcontinents*)

Walpersdorf, A., C. Rangin & C. Vigny (1998)- GPS compared to long-term geologic motion of the North arm of Sulawesi. *Earth Planetary Science Letters* 159, p. 47-55. (also in *GEODYSSSEA 1998 report*, p. 239-250)

(online at: http://www.geologie.ens.fr/~vigny/articles/Walpersdorf_etal_EPSL_1998.pdf)
(*Paleomagnetic data from N arm of Sulawesi indicate ~20-25° rotation since 5 Ma, suggesting 200-250 km of left-lateral displacement along Palu-Koro fault. Similar Palu fault displacement derived from magnetic anomalies of Celebes seafloor, which implies 200- 250 km of oceanic crust subducted at N Sulawesi trench. Another marker for rotation derived from opening of Gulf of Tomini and NW migration of calc-alkaline subduction-related volcanism. GPS observation of 4 cm/year of left-lateral strike-slip across Palu fault fit well with N arm motion of 4-5 cm/year. Current motion rates from GPS similar to long-term rates*)

Walpersdorf, A., C. Vigny, P. Manurun, C. Subarya & S. Sutisna (1998)- Determining the Sula block kinematics in the triple junction area in Indonesia by GPS. *Geophysical J. International* 135, 2, p. 351-361

(online at: <https://academic.oup.com/gji/article/135/2/351/776566>)
(*GEODYSSSEA SE Asian GPS investigations concentrate on Sulawesi. Current deformation high, with distinct deformation domains in study. Triple junction area best viewed as headland of Australian Plate deflected by collision with Philippine Plate. N part dominated by Sula domain, which shows CW rotation. To S connected to Australian Plate by ensemble of microblocks undergoing CCW rotation*)

Walpersdorf, A., C. Vigny, P. Manurun, C. Subarya & S. Sutisna (1998)- GPS observation of the Triple Junction, Indonesia. In: P. Wilson & G.W. Michel (eds.) *The geodynamics of S and SE Asia (GEODYSSSEA) Project*, GeoForschungsZentrum, Potsdam, Scientific Technical Report STR 98/14, p. 226-238.

(*Point of convergence of Eurasian, Philippine and Australian plates situated near E Sulawesi (Sula Domain). Velocities relative to Eurasia of Australian Plate 7.5 cm/year to ENE, and Philippine Plate at 9.0 cm/yr to WNW. Rigid CW rotation of N Sulawesi micro-block, around rotation pole near Manado, with most of Sula-Sunda movement accommodated along Palu-Koro and Matano faults (adjacent Sula Block on NE side ~5 cm/yr displacement to NW). Etc.*)

Walpersdorf, A., C. Vigny, C. Subarya & P. Manurung (1998)- Monitoring of the Palu-Koro Fault (Sulawesi) by GPS. *Geophysical Research Letters* 25, 13, p. 2313-2316.

(online at: <http://onlinelibrary.wiley.com/doi/10.1029/98GL01799/epdf>)
(*5 years of GPS monitoring by GEODYSSSEA project shows ~3.4 cm/yr ongoing left-lateral strike slip on Palu-Koro Fault*)

Wang, S., C. Xu, W. Xu, Z. Yin, Y. Wen & G. Jiang (2018)- The 2017 Mw 6.6 Poso earthquake: implications for extrusion tectonics in Central Sulawesi. *Seismological Research Letters* 90, 2A, p. 649-658.

(Proposed kinematic model attributes extension in C Sulawesi to gravitational collapse, in which mass lateral extrusion along large-scale Palu-Koro strike-slip fault played important role)

Wanner, J. (1910)- Beitrage zur Geologie des Ostarms der Insel Celebes. Neues Jahrbuch Mineralogie Geologie Palaontologie, Beilage Band 29, p. 739-778.

(‘Contributions to the geology of the East Arm of Sulawesi Island’. Results of 2-month geological reconnaissance in 1905, mainly in SE side of E Arm, along Peleng Straits, near Toeli, Nambo, etc. In around Central Mountains describes (1) ultrabasic rocks, (2) rel. widespread Eocene limestones with Alveolina, Discocyclina and Nummulites, reminiscent of Alveolina Limestone of Misool; (3) E Miocene shallow water carbonates with Lepidocyclina and Miogyopsina; (4) Celebes molasse conglomerates 1200m thick or more (sandy marls and limestone near base with Pliocene planktonic and larger foraminifera, incl. Globorotalia tumida, no lepidocyclinids; JTvG), (5) Quaternary raised coral reef terraces up to 400m above s.l. Near Toeli also probably Jurassic-age ‘Toeli Limestone’, reminiscent of Buru Limestone. Along N coast (Tomini Bay) common gabbro and peridotite, with oil seep in Babason creek, a tributary of Lobu River. Gabbro appear to be intrusives in U Oligocene- E Miocene limestone with Spiroclypeus, Lepidocyclina)

Wanner, J. (1914)- Eine Reise durch Ost-Celebes. Petermanns Geographische Mitteilungen 60, 1, p. 78-81 and p. 133-136.

(online at: https://zs.thulb.uni-jena.de/receive/jportal_jpvolume_00166384)

(‘A voyage through East Sulawesi’. Summary of Wanner’s 1905 traverse of East Sulawesi for Koninklijke/Royal Dutch Petroleum Co. from Kintom. Mainly travel report with little geology (more information in Wanner, 1910). In Babason creek near Dolong oil seep from fractures in gabbro, suggesting these overlie Tertiary (and/or Mesozoic?) sediments. With 1 map)

Wanner, J. (1919)- Die Geologie von Mittel-Celebes nach den neueren Forschungen E.C. Abendanons und anderer. Geologische Rundschau 10, 1, p. 45-62.

(online at: https://www.zobodat.at/pdf/Geologische-Rundschau_10_0045-0062.pdf)

(‘The geology of Central Sulawesi after new investigations of E.C. Abendanon and others’. Review of Central Sulawesi investigations. No figures)

Wanner, J. (1923)- Die Geologie von Celebes, speciell vom okonomischen Gesichtspunkte. Vierte Koloniale Vacantiecurus voor Geografen, Comite voor Indische Lezingen en Leergangen, Amsterdam, p. 3-10.

(‘The geology of Sulawesi, especially from an economic point of view’. Brief summary of lecture on Sulawesi geology and indications of oil, coal and metals. No figures)

Wanner, J. & E. Jaworski (1931)- Liasammoniten von Jamdena und Celebes. Neues Jahrbuch Mineralogie Geologie Palaontologie, Beilage Band 66, B, p. 199-210.

(‘Liasic ammonites from Yamdena and Sulawesi’. Sulawesi ammonites from poorly known central part of East arm, collected by BPM geologist Weber. First records of E Jurassic ammonites from E Sulawesi (Arnioceras cf. seilaeve from dark grey sandy limestone as float in upper Balingara River, 20km SE of river mouth). Yamdena (Tanimbar Islands) ammonites from Tasik Selwasa and Botenjahu mud volcano deposits include Echioceras wichmanni, Asterocheras sparsicostatum n.sp. and Arnioceras cf. arnouldi. Fauna and lithology very similar to ‘grey cephalopod nodule marl’ of Roti and Timor, described by Krumbeck (1922))

Watkinson, I.M. (2011)- Ductile flow in the metamorphic rocks of Central Sulawesi. In: R. Hall, M.A. Cottam & M.E.J. Wilson (eds.) The SE Asian gateway: history and tectonics of Australia-Asia collision, Geological Society, London, Special Publ. 355, p. 157-176.

(online at: http://searg.rhul.ac.uk/pubs/watkinson_2011%20Sulawesi%20ductile%20flow.pdf)

(Gneisses, amphibolites and schists exposed along Palu-Koro Fault of W-C Sulawesi are part of regionally metamorphosed Mesozoic-Precambrian basement. In Palu and Neck regions of Sulawesi, ductile shear fabrics record low-angle W-ward extension. Further south in Palu valley, extension directed towards SW. Cross-cutting granitic dykes show foliation in neck region of Sulawesi occurred before ~44-33.7 Ma. In Palu valley it occurred before 5-3.5 Ma, precluding origin as result of Palu-Koro Fault activity. Ductile flow during either

Eocene-Miocene mid-crustal extension above metamorphic core complex, Cretaceous subduction-related deformation in overriding plate, or intracontinental deformation within Gondwana)

Watkinson, I.M. & R. Hall (2011)- The Palu-Koro and Matano faults, Sulawesi, Indonesia: evolution of an active strike-slip fault system. Geophysical Research Abstracts 13, EGU2011-8270, EGU General Assembly 2011. (Abstract only. Palu-Koro and Matano faults of Sulawesi important active strike-slip faults. Palu-Koro fault slip rate 32-45 mm/yr and left-lateral displacement about 200 km. Shorter Matano fault SE continuation and now in process of coalescing with Palu-Koro fault. Faults probably did not initiate before ~5 Ma)

Wermüller, J.O. (1926)- Petrographische Untersuchung von Eruptivgesteinen des Pik von Maros in Süd-West-Celebes. Schweizerische Mineralogische Petrographische Mitteilungen. 6, 2, p. 205-254.
(online at: <https://www.e-periodica.ch/digbib/view?pid=smp-001:1926:6#232>)
(*'Petrographic investigation of volcanic rocks of the peak of Maros in SW Sulawesi'. Descriptions of rocks from volcanic Maros Peak (phonolite; 1375m high) and associated igneous rocks (incl. marosite, named after Maros Peak; also shonkinite, trachyte, etc.). Rocks collected between 1895-1902 by P. and F. Sarasin cousins and in 1904 by Basel Prof. C. Schmidt. With photomicrographs of thin sections*)

White, L.T., R. Hall & R.A. Armstrong (2014)- The age of undeformed dacite intrusions within the Kolaka Fault zone, SE Sulawesi, Indonesia. J. Asian Earth Sciences 94, p. 105-112.
(manuscript online at: <https://ro.uow.edu.au/ndownloader/files/50503518>)
(*Dacite intrusions in strand of Kolaka Fault that crosses SE Arm of Sulawesi and N Bone Bay. Kolaka Dacite undeformed, with zircon ages between ~4.4 and 7 Ma. Rare inherited zircons, with ages between 8- 1854 Ma, show SE arm of Sulawesi is underlain by Proterozoic or younger material*)

White, L.T., R. Hall & R.A. Armstrong, A.J. Barber, M.K. BouDagher-Fadel, A. Baxter, K. Wakita, C. Manning & J. Soesilo (2017)- The geological history of the Latimojong region of western Sulawesi. J. Asian Earth Sciences 138, p. 72-91.
(manuscript online at: <https://core.ac.uk/download/pdf/84839832.pdf>)
(*Latimojong Metamorphic Complex in C-W Sulawesi is accretionary complex of metamorphic rocks tectonically mixed with cherts and ophiolitic rocks, overlain(?) by unmetamorphosed U Cretaceous Latimojong Fm distal turbidites (not observed in this study). Aptian-Albian radiolaria in chert float sample, presumably from Latimojong Metamorphic Complex. Foraminifera ages from Toraja Group (56-23 Ma), Makale Fm (20.5-11.5 Ma) and Enrekang Volcanic Series (8.0-3.6 Ma). Magmatic zircons record ~38, ~25 and 8.0-3.6 Ma phases of volcanism. Late Miocene- E Pliocene high-K Enrekang Volcanics (~3.9-7.5 Ma) and Palopo Granite (6.6-4.9 Ma) may be tied to crustal extension/ slab rollback. Miocene-Proterozoic inherited zircons in Pliocene igneous rocks support Proterozoic-Phanerozoic (193, 38-34 Ma) basement or sediments derived from these. Little evidence for Oligocene-Pliocene thrusting in Latimojong region)*

Whitten, A.J., M. Mustafa & G.S. Henderson (1988)- The ecology of Sulawesi. Gadjah Mada University Press, Yogyakarta, p. 1-777. (Reprinted 2002, Periplus Edition, 727p.)

Wibowo, B.A., L. Bai, S. Rohadi, D.P. Sahara, Z. Chen, K. Karyono, Y. Setiawan, P.H. Widyadharma et al. (2025)- Slab morphology and associated seismic and volcanic activities beneath Sulawesi Island, Indonesia. J. Volcanology Geothermal Research 465, 108352, p.
(*Seismic tomography under Sulawesi shows high velocity anomalies for subducting slabs and low velocity anomalies beneath active volcanoes. Revealing: S-ward subduction of Celebes slab, N-ward subduction of Banggai-Sula slab, SW subduction of Sangihe slab, and double subduction of Sangihe and Halmahera arcs*)

Wibowo, S., M.F. Rosana & A.D. Haryanto (2017)- Implication of fracture density on unserpentinized ultramafic rocks toward characteristics of sapolite zone in Sorowako, South Sulawesi. Bull. Scientific Contribution (UNPAD) 15, 2, p. 101-110.
(online at: <http://jurnal.unpad.ac.id/bsc/article/view/13375/pdf>)

(Nickel grades reach maximum in saprolite zones. Fracture density in ultramafic bedrocks played important roles during laterisation. In Sorowako ultramafic complex of East Sulawesi Ophiolite Complex high-medium fractured types of bedrock tied to thick saprolite zone)

Wichmann, A. (1893)- *Über Glaukophan-Epidot-Glimmerschiefer von Celebes. Neues Jahrbuch Mineralogie Geologie Palaontologie* 1893, 2, p. 176-178.

(online at: https://www.zobodat.at/pdf/Neues-Jb-Min-Geol-Palae_1893_2_0169-0178.pdf)

(‘On glaucophane-epidote-mica schists from Sulawesi’. Brief paper, first description of common glaucophane schist from SW Sulawesi, in float of Pajangkene River)

Wichmann, A. (1893)- *Petrographische Studien über den Indischen Archipel. I. Leucitgesteine von der Insel Celebes. Natuurkundig Tijdschrift voor Nederlandsch-Indie* 53, 2, p. 315-331.

(online at: [http://62.41.28.253/cgi-bin/...](http://62.41.28.253/cgi-bin/))

(‘Leucite-bearing rocks from Sulawesi island’. First description of Neogene leucite-bearing volcanic rocks, which are widespread across SW Sulawesi (Parang-Lowe near Makassar, Pajangkene, Tempe, Walanae, etc.). Previously known only from N Java and Bawean island)

Wichmann, A. (1895)- *Petrographische Studien über den Indischen Archipel. II. Zur Geologie der Insel Saleijer. Natuurkundig Tijdschrift voor Nederlandsch-Indie* 54, p. 236-268.

(online at: www21.us.archive.org/details/mobot31753002489778)

(‘Petrographic studies on the Indies Archipelago, II. On the geology of Salayar Island’, Mainly petrographic descriptions of rocks from Salayar, S of SW arm of Sulawesi, collected by M. Weber in 1889. In East mainly young volcanic rocks (mica trachyte, andesites and tuffs, basalt). In West quartz sandstone without andesitic detritus, white marl (with Late Miocene-Pliocene planktonic forams; reminiscent of E Java Kendeng zone and Timor) and Neogene coral limestone)

Wichmann, A. (1896)- *Bemerkungen zur Geologie des Posso-Gebietes. Petermanns Geographische Mitteilungen* 42, p. 160-165.

(online at: https://zs.thulb.uni-jena.de/receive/jportal_jpvolume_00196527)

(‘Remarks on the geology of the Poso area’. Report on the journey of Dutch missionary A.C. Kruijt in 1893 and 1895, one of the first Europeans to reach Lake Poso (P and F. Sarasin also traveled past Lake Poso, in 1894?). Rel. common serpentized peridotitic rocks. In NE of Poso area, at Tanjung Api along Tomini Bay, serpentized ultramafic rocks (with burning gas seep))

Wichmann, A. (1900)- *Zur Geologie der Minahasa. Dr. A. Petermanns Geographische Mitteilungen* 1900, 1, 2p.

(online at: <https://era-prod11.ethz.ch/zut/content/zoom/29147152>)

(‘On the geology of the Minahasa’, North Sulawesi. Brief 2-page critical review of work by Bucking (1899))

Wichmann, A. & H. Wichmann (1896)- *Der Posso-See in Celebes. Dr. A. Petermanns Geographische Mitteilungen, Gotha, 42, 160-165.*

(online at: https://gotha.digital/item/jportal_jparticle_00507401)

(Brief, early description of geography and geology of Poso Lake area in C Sulawesi, by University of Utrecht Professor A. Wichmann, surveyed with missionary A.C. Kruyt)

Widiasmoro, B. Priadi & R. Soeria-Atmadja (1997)- *Granitoid Neogene tipe tumbukan di zona sesar Palu-Koro, Sulawesi Tengah. Proc. 26th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 371-389.*

(online at: <https://www.iagi.or.id/web/digital/64/29.pdf>)

(‘Neogene collision-type granitoids in the Palu-Koro fault zone, Central Sulawesi’. Late Miocene potassic calc-alkaline granitoids, syn-collisional, tied to M Miocene Banggai-Sula block collision)

Widiatama, A.J., A. Fahrudin & L.D. Santy (2021)- *Characteristics of polymetallic enrichment on oceanic red bed in Matano Formation, Baturubei, Central Sulawesi, Indonesia. Int. Seminar on Mineral and Coal Technology, Bandung 2021, IOP Conference Series: Earth and Environmental Science* 882, 012045, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/882/1/012045/pdf>)
(*Matano Fm on East Arm of Sulawesi (here not overlying E Sulawesi ophiolite as in 'Type Matano' Fm, but part of Banggai-Sula block cover?; JTvG) has little-studied Late Early- Late Cretaceous oceanic red beds (CORB) in two facies: radiolarites and red clay facies. Radiolarites dominated by siliceous pelagic bioclastics and deposited under oxic environment. Red clays dominated by hemipelagic material with small amount of pelagic silica shells, deposited under reducing environment in basin plain environment in passive margin tectonic setting below carbonate compensation depth, and enriched in Mn, V, Ni, Zn and La*)

Widijono, B.S. & B. Setyanta (2000)- Model kerak dan implikasi geodinamika lajur sesar Palu-Koro sajian analisis data gayaberasat, kegempaan dan kinematika. Geological Research Development Centre (GRDC), Geophysical Series 1, p. 21-34.
(*Crustal model of area of Palu-Kuro fault zone from gravity-magnetic data*)

Widodo, S., Sufriadin, A. Imai & K. Anggayana (2016)- Characterization of some coal deposits quality by use of proximate and sulfur analysis in the Southern Arm Sulawesi, Indonesia. Int. Journal of Engineering and Science Applications (UNHAS) 3, 2, p. 137-143.
(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/1085/233>)
(*SW Sulawesi coal deposits at Paluda, Padanglampe, Lamuru and Tondongkura. Lower moisture of Paluda coal might be affected by igneous intrusion. Coal samples generally high ash (29%) and sulfur (3.74%). No vertical distribution trend for ash and sulfur*)

Widodo, S., Sufriadin, A. Saputno, A. Imai & K. Anggayana (2017)- Geochemical characterization and its implication for beneficiation of coal from Tondongkura Village, Pangkep Regency, South Sulawesi Province. Int. Journal of Engineering and Science Applications (UNHAS) 4, 1, p. 83-95.
(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/1286/290>)
(*Coal from Tondongkura, Pangkep Regency, recently used as fuel, but has high ash and sulfur content. Seam 1 medium ash- middle sulfur coal. Seam 2 high ash - high sulfur coal. Etc.*)

Widodo, S., Sufriadin, M. Thamrin, Wahyufirmansyah & N. Jafar (2020)- Mineralogy and quality of Banti Coal, Baraka District, Enrekang Regency, South Sulawesi Province, Indonesia. IOP Conference Series: Earth and Environmental Science 473, 012112, p. 1-9.
(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/473/1/012112/pdf>)
(*Analysis of coal (no data on locality, age, thickness, etc.)*)

Wijaya, P.H., Subarsyah, J. Widodo, N.A. Kristanto, Susilohadi & L. Arifin (2007)- Seismic stratigraphy and tectonic of Gorontalo Basin and its implication for hydrocarbon trap potential. Proc. Joint Convention 32nd HAGI, 36th IAGI and 29th IATMI, Bali 2007, p. 963-969.
(online at: https://www.iagi.or.id/web/digital/28/2007_IAGI-Bali_Seismic-Stratigraphy-and-Tectonic-of-Gorontalo.pdf)
(*Same as Wijaya et al. 2007 paper, below*)

Wijaya, P.H., J. Widodo, N.A. Kristanto, Subarsyah, Susilohadi & L. Arifin (2007)- Data baru Cekungan Gorontalo perairan Teluk Tomini, Sulawesi: integrasi data seismik dan magnetik untuk mengidentifikasi potensi hidrokarbon. Mineral dan Energi 5, 1, p. 42-49.
(*New data from the Gorontalo Basin, Tomini Bay, Sulawesi: integration of seismic and magnetics for identification of hydrocarbon potential*)

Wijayanti, H.D.K. & S. Husein (2024)- Stratigraphy of Salodik Formation in Batutambung section, Toili, Luwuk, Central Sulawesi. Proc. Int. Conference Geological Engineering and Geosciences, Yogyakarta 2023, IOP Conference Series: Earth and Environmental Science 1373, p. 012065, p. 1-13.
(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1373/1/012065>)
(*Salodik Fm widespread, highly deformed Eocene- M Miocene limestone in E Arm of Sulawesi, representing marine drift sequence of Banggai-Sula microcontinental margin prior to collision with E Sulawesi Ophiolite. With sandstones in lower part. In Batutambung (Toili), Salodik Fm in NW-SE outcrop between two ophiolitic*)

masses. Stratigraphic section of 70m thick along Toili-Ampanan Tete road. Nine lithofacies reflect shallowing upward or prograding pattern with open marine, tidal channel, shoal, and restricted marine/ lagoon facies. Foraminifera and nannofossils suggest E Miocene age (N6 or NN4-NN6) and middle-outer neritic paleobathymetry. Salodik Fm in Batutambung equivalent with Matindok Fm in Tomori PSC. (N.B.: Two thin sections of Fig. 5d- 5f look like Late Cretaceous pelagic limestones with Globotruncana; not Miocene?; JTvG)

Wijayanti, H.D.K. & S. Husein (2025)- Mixed siliciclastic-carbonate marine system in Banggai Sula micro-continental margin; a case study from Poh Formation in Pagimana Area, Banggai, Central Sulawesi. Proc. 4th Int. Conf. Geological Engineering and Geosciences (ICGOES 2024), Yogyakarta, IOP Conference Series: Earth and Environmental Science 1517, 012005, p. 1-12.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1517/1/012004/pdf>)

(Poh Fm at N coast of East Arm of Sulawesi is distal facies Salodik Limestone, in East Sulawesi fold-thrust belt, representing imbricated cover of Banggai-Sula microcontinent. Poh Fm in study area Early to-Late Miocene in age. Increasing clastic detritus going upsection)

Wijbrans, J.R., H. Helmers & J. Sopaheluwakan (1994)- The age and thermal evolution of blueschists from South-East Sulawesi, Indonesia: the case of slowly cooled phengites. Mineralogical Magazine 58A (Goldschmidt Conference 1994), p. 975-976. *(Abstract only)*

(SE Sulawesi blueschist belt graphite-mica schists and metabasites of MORB affinity. Ar/Ar dates 20.8- 27.5 Ma)

Willems, H.W.V. (1937)- Contribution to the petrology of the crystalline schists of western Central Celebes (Netherlands East Indies). Doctoral Thesis University of Amsterdam, p. 1-147. *(Unpublished)*

(online at: <https://resolver.kb.nl/resolve?urn=MMKB21:040175000:pdf>)

(Descriptions of metamorphic rocks along two Sulawesi traverses collected by 1929 Celebes expedition (Brouwer, 1934). All are epi- to meso-metamorphic grade, with general increase in metamorphism from E to W. Calcareous rocks more numerous in southern traverse)

Williamson, A. (2011)- Discovery and development of Toka Tindung low sulphidation epithermal gold project. In: N.I. Basuki (ed.) Proc. Conference Sulawesi Minerals Resources Seminar, Manado 2011. Masyarakat Geologi Ekonomi Indonesia (MGEI), p. 259-266.

Wilson, M.E.J. (1995)- The Tonasa Limestone Formation, Sulawesi, Indonesia: development of a Tertiary carbonate platform. Ph.D. Thesis University of London, p. 1-520. *(Unpublished)*

Wilson, M.E.J. (1996)- Evolution and hydrocarbon potential of the Tertiary Tonasa Limestone Formation, Sulawesi, Indonesia. Proc. 25th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, 1, p. 227-240.

(Eocene- M Miocene Tonasa Lst of S Sulawesi started as transgressive sequence. By Late Eocene 100 km long Tonasa carbonate platform. Shallow-water sedimentation continuous until M Miocene on parts of platform, but active normal faulting caused basinal graben formation and subaerial exposure in other areas. Platform top mainly large benthic foraminifera facies. Facies belts trend E-W and relatively static through time. Tertiary exposure of shallow-water facies affected by block faulting. In grabens basinal marls interbedded with coarse redeposited carbonates. Lack of abundant aragonitic bioclasts and localized subaerial exposure result in little porosity development in platform top. Redeposited facies porous and permeable, and most likely to form hydrocarbon reservoirs)

Wilson, M.E.J. (1999)- Prerift and synrift sedimentation during early fault segmentation of a Tertiary carbonate platform, Indonesia. Marine and Petroleum Geology 16, 8, p. 825-848.

(online at: http://searg.rhul.ac.uk/pubs/wilson_1999%20Tonasa%20fault%20segmentation.pdf)

(Eocene- M Miocene Tonasa Fm carbonate platform in SW Sulawesi reflects Late Eocene- E Miocene rifting)

Wilson, M.E.J. (2000)- Tectonic and volcanic influences on the development and diachronous termination of a Tertiary tropical carbonate platform. Journal of Sedimentary Research 70, p. 310-324.

(online at: http://searg.rhul.ac.uk/pubs/wilson_2000%20Tonasa%20volcanic%20strat.pdf)

(Sulawesi Eocene- M Miocene syntectonic Tonasa carbonate platform developed W of volcanic arc and overlain by M-U Miocene volcanics. Greatest extent Late Eocene. Tectonics and volcanism influenced evolution and diachronous termination in 4 ways: (1) Paleogene volcanic activity limited E-ward extent of platform but had little effect in W S Sulawesi. (2) Late Eocene faulting resulted in platform segmentation, localized drowning in hanging wall areas and subaerial exposure on footwall highs. (3) E-M Miocene faulting around early stages of volcanism in W S Sulawesi resulted in localized tilting of fault blocks, formation of new graben, and exposure of footwall highs. (4) M Miocene volcanoclastics influx buried remaining areas of shallow-water carbonates. Carbonate production contemporaneous with volcanism in areas shielded from volcanoclastic input)

Wilson, M.E.J. & A. Ascaria (2000)- The Cenozoic carbonates and petroleum systems of South Sulawesi. IPA Field Excursion, October 2003, p. 1-55.

(online at: http://searg.rhul.ac.uk/pubs/wilson_ascaria_2003%20South%20Sulawesi.pdf)

Wilson, M.E.J., N.A. Ascaria, D.Q. Coffield & N. Guritno (1997)- The petroleum systems of South Sulawesi, Indonesia. In: J.V.C. Howes & R.A. Noble (eds.) Proc. Int. Conference Petroleum Systems of SE Asia and Australasia, Indonesian Petroleum Association (IPA), Jakarta, IPA97-PO-17, p. 561-567.

(S Sulawesi early Tertiary transgressive sequences marginal marine clastics passing upwards into carbonates overlain by deeper marine sediments. In S Sulawesi, late Tertiary magmatism and subsequent Pliocene orogenesis resulted in the formation of multiple kitchen areas)

Wilson, M.E.J. & D.W.J. Bosence (1996)- The Tertiary evolution of South Sulawesi: a record in redeposited carbonates of the Tonasa Limestone Formation. In: R. Hall & D.J. Blundell (eds.) Tectonic evolution of Southeast Asia, Geological Society, London, Special Publ. 106, p. 365-389.

(online

at:

http://searg.rhul.ac.uk/pubs/wilson_bosence_1996%20Tertiary%20evolution%20of%20South%20Sulawesi.pdf

(Redeposited carbonate facies of Eocene- M Miocene Tonasa Limestone Fm reliable indicators of tectonic activity. Immaturity and provenance of clasts indicate redeposited facies derived from faulted N margin of Tonasa Carbonate platform. Three main faulting phases indicated by redeposited facies: Late Eocene- E Oligocene, M Oligocene and E-M Miocene)

Wilson, M.E.J. & D.W.J. Bosence (1997)- Platform-top and ramp deposits of the Tonasa carbonate platform, Sulawesi, Indonesia. In: A.J. Fraser, S.J. Matthews & R.W. Murphy (eds.) Petroleum geology of Southeast Asia. Geological Society, London, Special Publ. 126, p. 247-279.

(online at: www.academia.edu/17164217/Platform_top_and_ramp_deposits_of_the_Tonasa_Carbonate_Etc.)

(Facies analysis of shallow-water platform and ramp deposits of SW Sulawesi Late Eocene- M Miocene Tonasa carbonate platform. Platform dominated by foraminifera and had ramp-type S margin. Facies belts on platform trend E-W, remaining remarkably stable through time indicating aggradation of platform-top. Outer ramp deposits prograded S at intervals into basal marls. Moderate- to high-energy platform top or redeposited carbonate facies may form hydrocarbon reservoirs)

Wilson, M.E.J., D.W.J. Bosence & A. Limbong (2000)- Tertiary syntectonic carbonate platform development in Indonesia. *Sedimentology* 47, p. 395-419.

(online at:

https://www.academia.edu/17164229/Tertiary_syntectonic_carbonate_platform_development_in_Indonesia)

(Evolution of syntectonic Eocene- M Miocene Tonasa Fm, SW Sulawesi. Deposited initially as part of transgressive sequence in backarc setting. By late Eocene shallow-water carbonates deposited over much of S Sulawesi forming 100-km long platform. Shallow-water sedimentation continued in parts of platform until M Miocene. Elsewhere, normal faulting created fault-block platforms, with local subaerial exposure of footwalls and formation of graben. Platform-top facies aggradational and dominated by larger foraminifera. Faults periodically active and formed steep escarpment margins. Regional subsidence and extension low on margins of backarc basin. Shallow-water accumulation rates for this foraminifera-dominated carbonate platform order of magnitude lower than those for modern warm-water platforms dominated by corals or ooids)

Wilson, M.E.J. & S.J. Moss (1999)- Cenozoic palaeogeographic evolution of Sulawesi and Borneo. *Palaeogeogr. Palaeoclim. Palaeoecology* 145, p. 303-337.

(online

at:

https://www.academia.edu/87229030/Cenozoic_palaogeographic_evolution_of_Sulawesi_and_Borneo
(Early Eocene- Pliocene paleogeographic maps on plate tectonic reconstructions illustrate evolution of Borneo and Sulawesi in Tertiary. Progressive accretion of continental and oceanic material from E onto E margin of Sundaland, with resultant development of volcanic arcs. Large tracts of W Sulawesi, E Borneo, E Java Sea and Makassar Straits formed extensive basinal area through much of Tertiary)

Wing Easton, N. (1918)- Rustig of dansend Celebes? Beschouwingen, studien en kritieken naar aanleiding van E.C. Abendanon's "Geologische en geografische doorkruisingen van Midden-Celebes". Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap 35, p. 606-677.

(online at: <https://www.delpher.nl/nl/tijdschriften/view?identificatie=MMUBA13:001664001:00687>)

(*'Quiet or dancing Sulawesi?' Lengthy, often critical review of Abendanon 1915 classic books on Sulawesi fieldwork. With one map*)

Witkamp, H. (1940)- Langs de Lariang rivier (West Celebes). Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap 47, p. 581-600.

(*'Along the Lariang River, W Sulawesi'. Report of travel up Lariang River, with some geological observations*)

Wu, S., G. Rosenbaum, X. Chen, X. Qian, J.B. Asis, X. Lu, Y. Wang (2025)- Closure of the easternmost Neo-Tethys Ocean in SW Sulawesi, Indonesia: Evidence from Late Cretaceous volcanic rocks in the Bantimala Complex. J. Asian Earth Sciences 279, 10644, p. 1-15.

(*SW Sulawesi located at intersection between Neo-Tethys and Paleo-Pacific tectonic domains. Assemblage of 'Barru Fm' diabase (~94 Ma), basalt (~91 Ma) and adakitite-type dacite (~90 Ma) from Bantimala Complex of SW Sulawesi. Magmatism marked closure of Mesozoic oceanic basin in C Indonesia at ~90 Ma. Arc-related rocks show Tethyan isotopic affinity, suggesting E-most Neo-Tethys subduction in this part of SE Asia*)

Wu, S., G. Rosenbaum, X. Qian, J. Asis, X. Lu, & Y. Wang (2023)- Timing of collision in the easternmost Neo-Tethys Ocean: Evidence from magmatism in South Sulawesi. (*"manuscript submitted to Lithos", p. 1-32.; never published?; manuscript online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4661913*)

(*Sulawesi in area where Neo-Tethys and Paleo-Pacific oceanic domains intersect. Three types of volcanic rocks (OIB-type basalt, adakitite dacite, arc-type diabase) emplaced at ~90 Ma in Barru Fm/ Bantimala Complex of S Sulawesi, likely associated with slab breakoff after collision. Pb isotopes in dacites compatible with Neotethys arc, not Pacific domain. S Sulawesi occupied E-most segment of Neo-Tethys Ocean, which closed at ~90 Ma (~Turonian), with slab break-off generating basaltic magmatism by decompression melting of deep asthenosphere, and adakitite magmatism by partial melting of subducted slab*)

Wu, S., Y. Wang, X. Qian, J. Asis, X. Lu, Y. Zhang & C.S. Gan (2022)- Discovery of the Late Cretaceous Barru adakite in SW Sulawesi and slab break-off beneath the Central Indonesian accretionary complex. J. Asian Earth Sciences 232, 105214, p. 1-14.

(*Newly discovered Late Cretaceous adakites in Bantimala Complex at Barru formed at ~ 87 Ma. Slab-derived high-Si melt with arc-like elemental pattern. Data argue for Tethyan affinity of C Indonesian Accretionary Complex. Barru adakite generated in response to Neotethyan slab break-off beneath C Indonesian Accretionary Complex and termination of Neotethyan subduction beneath Argoland at ~ 87 Ma*)

Wunderlin, W. (1913)- Beitrage zur Kenntnis der Gesteine von Sudost-Celebes. Sammlungen Geologischen Reichs-Museums Leiden, Ser. 1, 9, p. 244-280.

(online at: www.repository.naturalis.nl/document/552396)

(*'Contributions to the knowledge of rocks from SE Sulawesi'. Descriptions of rocks from SE Sulawesi and nearby islands Buton, Kabaena and Rumbia, collected by Elbert expedition in 1909. Includes ultramafic rocks (hartzburgite, serpentinite, gabbro) from Buton, Rumbia and Kabaena, metamorphics (amphibolite, glaucophane schist) from Rumbia island and Mendoke Mts on SE Sulawesi. Six types of glaucophane-bearing rocks*)

Xi, Z. & Y. Fang (2021)- Sedimentary evolution of rift basins in Sulawesi region, Indonesia, and its controls on hydrocarbon geological conditions. *Marine Geology Frontiers* 37, 5, p. 22-30. (in Chinese)
(online at: <http://en.cgsjournals.com/hydzqy/article/2021/5>)
(*S Makassar Straits and Bone basin review, with M Eocene- Pliocene paleogeographic maps*)

Yadi, V. (2011)- Successful geostatistical approach for a nickel ore deposit; a case study for nickel laterite deposit in central I pit, Kabaena nickel mine, Kabaena Island, southeast Sulawesi, Indonesia. Proc. 8th International Mining Geology Conference, Australasian Institute of Mining and Metallurgy (AusIMM), Melbourne, 8, p. 463-468.

Yamamoto, M., A. Maulana, K. Yonezu, K. Watanabe & A. Subehan (2015)- Geochemistry and mineralization characteristic of Sungai Mak deposit in Gorontalo, Northern Sulawesi, Indonesia. *Int. Journal of Engineering and Science Applications (UNHAS)* 2, 2, p. 99-105.
(online at: <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/154/109>)
(*Gold-copper mineralization associated with granodiorite of Sungei Mak in Gorontalo similar to other porphyry copper deposits in Tombolilato District (>3400m thick Late Miocene- Pleistocene island arc-type volcano-sedimentary pile)*)

Yang, T., C.C. Lu, T. Hao, N. Rawlinson, T. Xu, S. Widiyantoro, Alfian, M.T. Rafie & D.P. Sahara (2025)- Offshore crustal thickness variation along the Palu–Koro strike–slip fault in the Sulawesi region from OBS Receiver Function analysis. *EGUsphere*, Preprint, p. 1-17.
(online at: <https://egusphere.copernicus.org/preprints/2025/egusphere-2025-3105/egusphere-2025-3105.pdf>)
(*In NW Sulawesi, Palu-Koro left-lateral strike-slip fault connects with W-ward-extending North Sulawesi Trench, forming distinctive subduction-transform fault system. Ocean bottom seismometers data reveal shallow Moho (~8 km depth) beneath Celebes Sea, and significantly greater depths (~25 km) beneath E Kalimantan and N Sulawesi. Sharp variations in Moho depth near Palu-Koro fault suggest juxtaposition of two distinct crustal blocks*)

Yao, J., J. Xu, C. Wu, Z. Zhang, M.F. Rosana, X. Li & Z. Jin (2023)- Origin of high-Cr podiform chromitites from Kabaena Island, Southeast Sulawesi, Indonesia: constraints from mineralogy and geochemistry. *International Geology Review* 65, 19, p. 2943-2960.
(*East Sulawesi Ophiolite one of three largest ophiolites in world. Contains important podiform chromitites. Detailed mineralogy of chromitites from Kabaena Island, SE Sulawesi. Estimated T-P conditions of parental magma of Kabaena chromitites are 950-1010°C and 7.0–8.4 Kbar. Formed by reaction of depleted mantle and boninitic magma beneath juvenile island arc, implying initiation of new subduction in Miocene*)

Yoshida, T., C. Hasbullah & T. Ohtagaki (1982)- Kuroko-type deposits in Sangkaropi area, Sulawesi, Indonesia. *Mining Geology* 32, 175, p. 369-377.
(online at: https://www.jstage.jst.go.jp/article/shigenchishitsu1951/32/175/32_175_369/_pdf/-char/en)
(*'Kuroko-type' deposits in Miocene (more likely Late Eocene- E Oligocene?; JTvG) rhyolitic pyroclastic arc volcanics in central part of W Sulawesi. Ore deposits in Sangkaropi area associated with submarine volcanism. Some deposits stratiform, covered with thin barite layer. Ore minerals include sphalerite, galena, chalcocopyrite, pyrite, tetrahedrite, bornite, etc.*)

Yulianto, I. (2003)- Neogene magmatic arc in the Minahasa Region, North Sulawesi, Indonesia. In: B. Ratanasthien et al. (eds.) *Pacific Neogene paleoenvironments and their evolution*, Proc. 8th International Congress on Pacific Neogene Stratigraphy: Pacific paleoenvironments and their evolution, Chiang Mai, 2003, p.

Yulihanto, B. (2004)- Hydrocarbon play analysis of the Bone Basin, South Sulawesi. In: R.A. Noble et al. (eds.) *Proc. Deepwater and frontier exploration in Asia & Australasia Symposium*, Jakarta, Indonesian Petroleum Association (IPA), DFE04-OR-003, p. 333-348.
(*Bone Basin of S Sulawesi between SW volcanic arc and SE collision complex. Rimmed by N-S faults. Tertiary sedimentation M-Late Eocene or older syn-rift deltaic-shallow marine sediments (Toraja/ Malawa Fm), followed by Oligo-Miocene marine carbonates and clastics (Tonasa/ Makale Fm). M Miocene- Pliocene*)

clastic/volcanoclastic deposits with carbonates in parts of basin. Late Miocene shallow marine carbonates (Camba Fm, Tacipi Fm), laterally changing to deep marine sediments, followed by Late Miocene-Pliocene progradational sediments (Walanae Fm). M-Late Eocene deltaic-shallow marine syn-rift sediment potential source rock that reached maturity in M-Late Miocene. With facies maps for 5 time slices)

Yusuf, N.J., Y.I. Arifin, R. Hutagalung & I.N. Manyoe (2023)- Study of Boalemo red limestone for geotourism development based on lithological, geochemical analysis and geological heritage assessment. *J. Geoscience Engineering Environment Technology (JGEET)* 8, 3, p. 212-220.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/12075/5603>)

(Mainly discussion of geotourism potential (but no map included) of outcrop of rare red limestones in Eocene-Oligocene Tinombo Fm in Dimito and Lahumbo villages in Boalemo Regency, Gorontalo Province, N Sulawesi. Red pelagic limestone steeply dipping with manganese, hematite and M- Late Eocene planktonic foraminifera. Wonosari red limestone zone P15, Tilamuta Red Limestone with zone P12 planktonics (part of ocean floor deposits on which N Sulawesi magmatic arc was built?; JTvG))

Yuwono, Y.S. (1987)- Contribution a l'etude du volcanisme potassique de l'Indonesie. Exemples du Sud-Ouest de Sulawesi et du volcan Muria (Java). *Doct. Sciences Thesis, Universite de Bretagne Occidentale, Brest, vol. 1, p. 1-285, vol. 2, p. 1-166. (Unpublished)*

('Contribution to the study of potassic volcanism of Indonesia; examples from SW Sulawesi and the Muria volcano (Java)')

Yuwono, Y.S. (1988)- G. Lompobotang, Sulawesi Selatan, petrologi dan mineralogi. *Proc. 17th Annual Conv. Indonesian Association Geologists (IAGI)*, p.

('Lompobotang Mountain, S Sulawesi, petrology and mineralogy'. See also paper below)

Yuwono, Y.S. (1989)- Petrologi dan mineralogi Gunung Lompobattang, Sulawesi Selatan. *Geologi Indonesia (IAGI)* 12, 1 (Prof. Dr. J.A. Katili 60 years Special Volume), p. 483-509.

('Petrology and mineralogy of Lompobattang Mountain, S Sulawesi'. Lompobattang is youngest volcano in SE part of SW Arm of Sulawesi, with K-Ar ages of K-rich, Plio-Pleistocene volcanics 0.77- 2.3 Ma. Volcanism not likely related to subduction)

Yuwono, Y.S. (1990)- Produk vulkanik Pare-Pare (Sulawesi Selatan): contoh deret shoshonitik di Indonesia. *Proc. 19th Annual Conv. Indonesian Association Geologists (IAGI)*, 2, p. 68-90.

('Volcanic products of Pare-Pare (S. Sulawesi): an example of a shoshonitic sequence in Indonesia'. Late Miocene - Pliocene potassic volcanism in S Sulawesi))

Yuwono, Y.S., H. Bellon, R. Soeria-Atmadja & R.C. Maury (1985)- Neogene and Pleistocene volcanism in South Sulawesi. *Proc. 14th Annual Conv. Indonesian Association Geologists (IAGI)*, Jakarta 1985, p. 169-179.

(online at: https://www.iagi.or.id/web/digital/40/PIT_IAGI_1985_paper16.pdf)

(S-most Sulawesi volcanics late M Miocene (12 Ma) - Pleistocene (1.2 Ma), not typical calc-alkaline subduction volcanics. Most rocks silica-undersaturated. Paleocene subduction responsible for arc volcanics. Second W-dipping subduction phase in E Miocene, terminating with collision of W and E arms and obduction of oceanic fragments. From end M Miocene- Pleistocene high K volcanism not linked to subduction, but developed in extensional intraplate context (Late Miocene Cindako, Sopeng, Camba Fms) and Pliocene (Parepare Fm) to Pleistocene (Lompobatang Formation: 1.2 m.y))

Yuwono, Y.S., S. Digdowirogo, J. Cotton, H. Bellon & B. Priadi (1995)- Petrology of some magmatic rocks from North Sulawesi, Indonesia. *Jurnal Teknologi Mineral (ITB)* 2, 3, p. 21-32.

(Fourteen magmatic rock samples from N Sulawesi, collected in 1989-1990. Four samples selected for K/Ar dating. Subduction-type magmatism with orogenic tholeiitic and calc alkaline affinities from Oligocene? to M Miocene. Post-M Miocene magmatic activity of shoshonitic affinity believed to be post subduction. Evolution of N Sulawesi similar to C portions of magmatic arc of W Sulawesi, with subduction ending in M Miocene, coinciding with start of collision between E and W Arms of Sulawesi)

Yuwono, Y.S., R.C. Maury, R. Soeria-Atmadja & H. Bellon (1988)- Tertiary and Quaternary geodynamic evolution of South Sulawesi: constraints from the study of volcanic units. *Geologi Indonesia* 13, 1, p. 32-48. (*S Sulawesi M Miocene and older volcanic rocks are of 'orogenic origin'. Volcanics younger than M Miocene, not related to subduction*)

Zaccarini, F., A. Idrus & G. Garuti (2016)- Chromite composition and accessory minerals in chromitites from Sulawesi, Indonesia: their genetic significance. *Minerals (MDPI)* 6, 46, p. 1-23. (*online at: <https://www.mdpi.com/2075-163X/6/2/46/pdf>*) (*Chromite from S and SE Arms of Sulawesi varies from Cr-rich to Al-rich. Small platinum-group minerals (PGM) in chromitites mainly laurite. Accumulation of Cr-rich chromitites probably at deep mantle level, Al-rich chromitites close or above Moho-transition zone. All laurites considered to be magmatic in origin*)

Zaidani, M.A., B. Priadi, I.G.B.E Sucipta, V. Susanto & A. Saepuloh (2023)- Petrogenesis of Adang and Talaya volcanic rocks, in the Mamuju area and its surrounding, West Sulawesi. *Proc. 2nd Int. Seminar on Earth Sciences and Technology (ISEST-2023)*, Bandung, IOP Conference Series: Earth and Environmental Science 1245, 012029, p. 1-12.

(*online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1245/1/012029>*)

(*M Miocene Adang and Talaya Volcanic complexes in Mamuju area, W Sulawesi, consist of pyroclastic, volcanoclastic and basic-intermediate lavas with main minerals leucite and clinopyroxene. Three groups: sodic, potassic and ultrapotassic. Tectonic setting: alkaline arc magmatism or continental extension after collision of Banggai-Sula microcontinent with W Sulawesi, influenced by pre-collision subduction of oceanic lithosphere*)

Zakaria, Z. & Sidarto (2015)- Aktifitas tektonik di Sulawesi dan sekitarnya sejak Mesozoikum hingga kini sebagai akibat interaksi aktifitas tektonik lempeng tektonik utama di sekitarnya. *Jurnal Geologi dan Sumberdaya Mineral (JGSM)* 16, 3, p. 115-127.

(*online at: <http://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/36/37>*)

(*'Tectonic activity in Sulawesi and surrounding areas since the Mesozoic to Recent as a result of the interaction of tectonic activity of the surrounding main tectonic plates'. Review of tectonic development of Sulawesi region'. Nickel laterite in SE Sulawesi is of high-nickel/ low-iron garnierite-type, with average nickel 2.0% and iron 17.6%. Serpentine and olivine main nickel minerals with nickel concentrations of av. 3.65% and 1.73%*)

Zen, M.T. & M. Alzwar (1974)- Tondano pyroclastics. *Proceedings Institut Teknologi Bandung (ITB)* 8, 1, p. 7-19.

(*online at: <https://journals.itb.ac.id/index.php/jmfs/article/view/9690/3674>*)

(*Almost all of Minahasa (N Sulawesi) covered by widespread pyroclastic flows sheets. Along Tondano Lake 15-20m thick. Probably originated from fissure-like eruptions in longitudinal rift valley on crest of 'Minahasa geanticline'. In C and E Minahasa covered by younger andesitic volcanics*)

Zhang, J., T. Hao, D. Miao, Ya Xu, B. Wang, Y. Ai & G. Fang (2021)- Investigation of geothermal structure of the Sulawesi, using gravity and magnetic method. *Science China Earth Sciences* 64, 2, p. 278-293. (*online at: <https://dds.sciengine.com/cfs/files/pdfs/view/1674-7313/8518E68298364B508AB8E8CA0E87130B-mark.pdf>*)

(*Heat flow study of Sulawesi. Celebes Sea basin formed during M-L Eocene and nearly half of Eocene oceanic crust has subducted below N Sulawesi Trench. Oceanic area shows high geothermal gradient and low thermal conductivity; land area shows low geothermal gradient and high thermal conductivity. Highest geothermal gradient in transition zone from Celebes Sea to N Sulawesi Island, corresponding to subducting spreading ridge of SW-moving Celebes Sea Basin. Average geothermal gradient 4.96°C/ 100m.*)

Zhang, X., S.L. Chung, C.Y. Tien, A. Maulana, M. Mawaleda, H.Y. Lee, P.P. Liu & J. Xi (2023)- Mid-Cretaceous to early Eocene Neo-Tethyan subduction records in West Sulawesi, Indonesia. *Geological Society of America (GSA) Bull.* 136, 5-6, p. 2558-2567.

(*online at: https://www.researchgate.net/publication/374702035_Mid-Cretaceous_to_early_Eocene_Neo-Tethyan_subduction_records_in_West_Sulawesi_Indonesia*)

(*New U-Pb-Hf isotopic data of detrital zircons from SW and NW Sulawesi constrain M Cretaceous-Eocene magmatic tempo. Zircon age peaks ~105-80 Ma (peak at ~90 Ma-Turonian; same as SE Borneo and Myanmar*)

Wuntho-Popo arc peaks; JTvG) and ~70-45 Ma (also 6-7 Ma in Miocene conglomerate). High positive $\epsilon_{\text{Hf}}(t)$ indicate derivation from juvenile sources with limited continental crustal contamination, suggesting M Cretaceous- E Eocene Andean-type continental margin in W Sulawesi. Magmatic ages similar to Neotethys subduction from S Lhasa (Tibet) to Sumatra (but not with Paleo-Pacific subduction-related arcs in SE China, SE Vietnam, E Malaysia and NW Borneo). W Sulawesi volcanic arc may be SE-most extent of Neo-Tethys arc (7500 km, from S Tibet (Gangdese) through Wuntho-Popo Arc (W Burma) to SE margin of Sundaland))

Zhang, X., T.N. Huang, S.L. Chung, A. Maulana, M. Mawaleda, C.Y. Tien, H.Y. Lee & P.P. Liu (2022)- Late Eocene subduction initiation of the Indian Ocean in the North Sulawesi Arc, Indonesia, induced by abrupt Australian plate acceleration. *Lithos* 422-423, 106742, p. 1-14.

(online at: www.researchgate.net/publication/360707708_Late_Eocene_subduction_initiation_of_the_In_Etc) (Calc-alkaline I-type felsic rocks in N Sulawesi Arc developed at ~29.7-16.7 Ma. Subduction initiation evidenced by last vanishing of BAB-type mafic basement rocks at ~37 Ma and first appearance of calc-alkaline felsic arc magmatism at ~30 Ma in N Sulawesi Arc, as well as ~36-32 Ma ophiolite and ~34-29 Ma metamorphic sole in nearby East Sulawesi Ophiolite. Late Eocene Indian Ocean subduction initiation probably linked to sharp Australian plate acceleration)

Zhang, X., C.Y. Tien, S.L. Chung, A. Maulana, M. Mawaleda, M.F. Chu & H.Y. Lee (2020)- A Late Miocene magmatic flare-up in West Sulawesi triggered by Banda slab rollback. *Geological Society of America (GSA) Bull.* 132, 11-12, p. 2517-2528.

(online at: www.researchgate.net/publication/340522943_A_Late_Miocene_magmatic_flare-up_Etc) (New geochemical and zircon U-Pb-Hf isotope data of Late Miocene (~7-6 Ma) plutonic/volcanic rocks from W Sulawesi indicate dominant magma source from underlying continental crystalline basement. U-Pb zircons ages of 7.2-6.1 Ma represent crystallization ages of host magmas, consistent with age peaks (7.3-6.3 Ma) in detrital zircons from sediments. Magma flare up across W Sulawesi attributed to resumed Banda slab rollback)

Zhang, Y., J. Qie, X.F. Wang, K. Cui & T. Fu & J. Wang & Y. Qi (2020)- Mineralogical characteristics of the nickel laterite, Southeast Ophiolite Belt, Sulawesi island, Indonesia. *Mining Metallurgy Exploration* 37, 1, p. 79-91.

(online at: https://www.researchgate.net/publication/337133708_Mineralogical_Characteristics_of_the_Nickel_Laterite_Southeast_Ophiolite_Belt_Sulawesi_Island_Indonesia)

(Review of the characteristics of 'rotten rock layer' deposited in SE Sulawesi Ophiolite Belt. Ni-laterite typical high-nickel and low-iron garnierite-type laterite, with nickel 1.99 wt% and iron 17.55 wt%. Serpentine and olivine main nickel minerals (Ni 3.65 wt% and 1.73 wt%))

Zheng, T., Q. Qiu, J. Lin & X. Yang (2023)- Raised potential earthquake and tsunami hazards at the North Sulawesi subduction zone after a flurry of major seismicity. *Marine and Petroleum Geology* 148, 106024, p. 1-11.

(online at: <https://www.sciencedirect.com/science/article/pii/S0264817222005025>) (N Sulawesi subduction zone ruptured by series of large earthquakes ($M_w > 7$) since 1990s, triggering small to moderate tsunamis. 2018 Sulawesi M_w 7.5 earthquake ruptured west subduction zone and induced large tsunami. These earthquakes, especially the deeper thrust events, generated stress loading to shallow megathrust that could rupture to trigger exceptional tsunami hazard. Etc.)

Zhu, Z., C. Zhao & Z. Yang (2008)- Distribution and geochemical characteristics of adakites and adakite-like rocks in Sulawesi, Indonesia. *J. Jilin University (Earth Science Ed.)*, 39, p. 80-88.

(In Chinese with English summary. Published information suggests 25 medium-acidic rock samples that may be considered as normal or adakite-like rocks in S, C, NW and N Sulawesi, forming Cenozoic adakite belt at Sundaland margin. Sulawesi adakites belong to tholeiitic, calc-alkaline and high K calc-alkaline series, characterized by low Y and Yb of heavy REE elements and high Sr. Two types: (1) oceanic island arc and/or continental margin arc and high K calc-alkaline series related to continental adakites)

Zulfiah & N. Supardi (2023)- Palynomorph biozonation of the Malawa Formation, Barru Region, South Sulawesi. *Jambura Geoscience Review* 5, 2, p. 71-85.

(online at: <https://ejurnal.ung.ac.id/index.php/jgeosrev/article/view/18792/7044>)

(Padanglampe section in Tanete Riaja, Barru Regency. Exposed Malawa Fm 10.5 m thick with sandstones at base overlain by shales with 1.5m thick coal bed, capped by sandstones and thin limestone. Palynomorphs in 36 samples grouped in 6 biozones, containing 64 pollen and 17 spore taxa, most common Moraceae, Palmaepollenites, Spinizonocolpites echinatus, Pandanidites, Proxapertites operculatus, Laevigatosporites, Acrostichum, and Anthocerisporites, suggesting M-U Eocene age. Also Verrucatosporites usmensis)

Zulkarnain, I. (1994)- Lingkungan tektonik kompleks Bantimala: implikasinya terhadap kualitas mineral garnet sebagai batu mulia. Proc. 30th Anniversary Symposium, Research Development. Centre for Geotechnology (LIPI), p.

(*Tectonic environment of the Bantimala complex: implications for quality of garnet minerals as gemstones*)

Zulkarnain, I. (1999)- Cretaceous tectonic events of the Bantimala area, South Sulawesi, Indonesia; evidence from rock chemistry. Jurnal Teknologi Mineral (ITB) 6, 2, p. 65-77.

(*Bantimala Complex melange, Albian-Cenomanian chert, basalt, ultramafics and various grade metamorphic rocks, dated as 132-114 Ma. Wide SiO₂ range (44-86%) in 36 metamorphic rocks precursor rocks vary from basaltic to granitic to sedimentary rock. Glaucofane indicates origin in subduction system, exhumed from different levels of Benioff zone. High-P metamorphic rocks granitic and sedimentary character indicating derivation from micro continent. Subduction system ceased when micro continent subducted in Mid-Cretaceous. Exhumation of metamorphic rocks just after metamorphism and before deposition of chert*)

Zulkarnain, I. (2001)- Rock chemistry of Quarternary volcanics around Manado and Siau Island, North Sulawesi. Jurnal Teknologi Mineral (ITB) 8, 1, p. 37-52.

(online

at:

https://www.academia.edu/21588273/Rock_chemistry_of_quaternary_volcanics_around_Manado_and_Siau_island_North_Sulawesi?email_work_card=view-paper)

(*Volcanic rocks around Manado two suites based on position in subduction zone: (1) trench-side (E of Manado; lower trace element content (Ba, Nb, Rb, Sr), and longer crystallization history, producing wide range in composition from basaltic to dacitic) and (2) backarc (N and W of Manado; more primitive with narrow range in composition (basaltic to andesitic) and higher content of trace elements). Volcanics from Siau Island classified as trench-side type*)

Zulkarnain, I., J. Sopaheluwakan, K. Miyazaki & K. Wakita (1995)- Elements transfer during basalt metamorphism: the case of Bantimala eclogite. J. Riset Geologi dan Pertambangan (LIPI) 1, 1, p. 42-55.

(online at: <http://pustaka.geotek.lipi.go.id/wp-content/uploads/2016/02/Riset-Vol.1-No.1-1995-.pdf>)

(*On transfer of elements during basalt metamorphism to greenschist, blueschist and eclogite in Triassic-Jurassic-age Bantimala Complex of SW Sulawesi (mainly introducing water, removing calcite)*)

Zulkarnain, I., J. Sopaheluwakan & E.T. Sumarnadi (1993)- Komplek malihan Bontoria, daerah Mangilu, Kabupaten Pangkepene Kepulauan, Sulawesi Selatan. Seminar of Research results of R&D Centre for Geotechnology LIPI, p.

(*Bontoria metamorphic complex, Mangilu area, Pangkajene Kepulauan District, S Sulawesi*)

Zulkarnain, I., J. Sopaheluwakan, K. Wakita & K. Miyazaki (1993)- The origin of the Bantimala eclogite: a preliminary view. Proc. 22nd Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 1, p. 147-158.

(*Bantimala complex 50km N of Makassar, SW Sulawesi, with Bontoria Fm high-pressure metamorphics (glaucofane schist, eclogite) underlying Late Cretaceous Balangbaru Fm flysch. K/Ar date of muscovite in schist 132 Ma; exhumation probably several 10's of Myrs later. Precursor rock is trench greywacke sandstone (most other blueschists from basalt or oceanic crust), probably subducted to 10's of km to 350-520°C, 8-18 kb*)

Zulkarnain Bakkar, U., M. Kasim, N. Akase & A.I. Rompo (2020)- Karakteristik alterasi dan mineralisasi hidrotermal daerah Hulawa, Gorontalo, Indonesia. Jambura Geoscience Review 2, 1, p. 1-15

(online at: <https://ejurnal.ung.ac.id/index.php/jgeosrev/article/view/2472/1699>)

(“Alteration characteristics and hydrothermal mineralization in the Hulawa area, Gorontalo, Indonesia’. Research in CoW of PT Gorontalo Sejahtera Mining shows Oligocene granodiorite and Pliocene rhyodacite and diatreme breccia that acted as host rock for mineralization. Right lateral-E-W faulting pre-mineralization, while NNE-SSW left-lateral faulting nterpreted as syn-mineralization. Hydrothermal deposits controlled by geological structure and volcanism. Mineralization in stockwork quartz veins and hydrothermal breccia, epithermal deposits of low sulphidation deposit)

V.2. Banggai Archipelago, Tomori Basin

Abimanyu, R. (1990)- The stratigraphy of the Sulawesi Group in the Tomori PSC, East Arm of Sulawesi. Proc. 19th Annual Conv. Indonesian Association Geologists (IAGI), Bandung 1990, 1, p. 99-118.

(online at: [https://www.iagi.or.id/web/digital/47/19th-\(11-13-Des-1990\)-Book-I-107-126.pdf](https://www.iagi.or.id/web/digital/47/19th-(11-13-Des-1990)-Book-I-107-126.pdf))

(Union Texas overview of stratigraphy of post-orogenic 'Sulawesi Molasse in east part of Tomori Basin, East Sulawesi. ((Latest Miocene?-) Pliocene -Pleistocene clastics-dominated Kintam Fm). Paper documents latest Miocene or basal Pliocene (zone N17 or N18- N19/20) bathyal flysch-type fine clastics sedimentation recording the foreland deepening/flexural loading of Banggai Sula block during collision with E Sulawesi ophiolite. Followed by Biak Fm coarse clastics in latest E Pliocene (N20-?N21), reflecting post-orogenic uplift/ erosion in E Pliocene ('Sulawesi Molasse'))

Ahmad, M., D. Ramdan, Y. Herdiana, A. Nurhasan & A.B. Mulyawan (2021)- Confirming reservoir geometry and exploration opportunity through 5D interpolation PSDM in the sub-ophiolite zone, Banggai-Sula Basin, Central Sulawesi. Proc. 45th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA21-G-147, p. 1-20.

(Seismic processing around WOL-001 (2017) and WOL-002 (2020) successful sub-ophiolite gas tests in Miocene Mentawa reefal limestone in Banggai-Sula basin of E Sulawesi (NW extension of Donggi gas field))

Armanda, R., S. Hartanto, E. Kusumawijaya, Jaenudin, B. Harnest, T. Irano, I Wayan Yuda et al. (2017)- Integrated Study of carbonates fracture reservoir distribution and its use to optimize field development program. Proc. Joint Convention HAGI-IAGI-IAFMI-IATMI (JCM 2017), Malang, 2017, p. 1-6.

(online at: https://www.iagi.or.id/web/digital/5/2017_IAGI_Malang_Integrated-Study-of-Carbonates-Fracture-Reservoir-Distribution_compressed.pdf)

(Study of Miocene carbonate reservoir in Pertamina-Medco Tiaka field, offshore Toili Block, Tomori Basin, E Sulawesi, indicates presence of fractures with average porosity 12%.)

Baasir, A., S. Sukmono, R. Abimanyu & N. Pudyo (2004)- Tiaka Field, Sulawesi- the only one known example of thrust anticline play type in Indonesia. European Association of Geoscientists & Engineers (EAGE) 66th Conference & Exhibition, Paris, 2004, p.

(Tiaka Field in E Sulawesi is thrust anticline. Hydrocarbon reservoir mainly Miocene carbonate of Tomori Fm, overlain by Matindok and Minahaki Fms)

Badaruddin, D.F. & A. Fahrudin (2021)- Evaluasi batuan induk pada Sumur Loku-1 dan Alpha-1A, dan penentuan rekomendasi area untuk eksplorasi rinci pada cekungan Taliabu. Lembaran Publikasi Minyak dan Gas Bumi (Lemigas) 55, 2, p. 59-73.

(online at: <https://journal.lemigas.esdm.go.id/index.php/LPMGB/article/view/605>)

('Evaluation of source rocks in Loku-1 and Alpha-1A wells, and determination of recommended areas for detailed exploration in the Taliabu basin'. Taliabu Basin in Sula islands with gas seepage in N part of Mangole Island and gas from Loku-1 well. Geochemical study of samples from Loku-1 and Alpha 1A wells (BP-1990; TD in Triassic- earliest Jurassic Banggai Granite). Loku 1 with effective (gas) source rock in M Jurassic Buya Fm, 131m thick, at depth of 2727 - 2858 m, with Ro maturity of 0.58%. Kerogen types II and III. No source rock potential found in Alpha-1A. Likely hydrocarbon migration from N part of Taliabu Basin towards S)

Bahesti, F., G. Purnomo Adi, I. Amrullah & B. Guspuudin (2021)- Deep dive into the Mesozoic play potential beneath the Batui thrust: a case study in the offshore Matindok, the Eastern Arm of Sulawesi. Proc. 45th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA21-G-118, p. 1-21.

(Review of Mesozoic hydrocarbon potential in Banggai Basin, offshore Matindok, Eastern Arm of Sulawesi, in Late Triassic-Paleogene passive margin sequence of underthrust Banggai-Sula block, etc. (not much new?))

Barmi, O., F. Urip & E. Purnomo (2003)- The Donggi gas field discovery- a challenge for Pertamina for finding and developing new hydrocarbon reserves in the future. Proc. 29th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA03-B-074, p. 1-16.

(2001 Donggi discovery on Tomori/ Matindok Block, East arm of Sulawesi, may exceed 2.7 TCF gas. Reservoir Late Miocene carbonates of Mentawa Mb of Minahaki Fm, with 13-34% porosity. Oligo-Miocene Tomori Fm carbonates directly on 'Australian' granitic basement)

Charlton, T.R. (1996)- Correlation of the Salawati and Tomori basins, eastern Indonesia: a constraint on left-lateral displacements of the Sorong fault zone. In: R. Hall & D. Blundell (eds.) Tectonic evolution of Southeast Asia, Geological Society, London, Special Publ. 106, p. 465-481.

(online at: https://www.researchgate.net/publication/240675098_Correlation_of_the_Salawati_and_Tomori_Basins_eastern_Indonesia_A_constraint_on_left-lateral_displacements_of_the_Sorong_fault_zone)

(Salawati Basin of W New Guinea and Tomori Basin of E Sulawesi may have formed single sedimentary basin before displacement on Sorong Fault system, implying left-lateral displacement of ~900 km, probably largely in latest Miocene-Quaternary, contemporaneous with deposition of clastic sediments)

Damayanti, C., S. Sismanto, L. Handayani & A. Setiawan (2025)- Identifying the basement structure of the Sula fault zone in the Banggai-Sula microcontinent region, Molucca Sea, based on 2D Gravity Inversion Modelling using Particle Swarm Optimisation and 3D Modelling using Grablox. Rudarsko-Geolosko-Naftni Zbornik (Mining-Geology-Petroleum Engineering Bulletin), Zagreb, 40, 2, 73, p. 137-152.

(online at: <https://hrcak.srce.hr/ojs/index.php/rgn/article/view/34001/17659>)

(Gravity study to delineate N boundary of Banggai-Sula microcontinent basement. Derivative analysis indicates E-W trending faults in FZ 1 and FZ 2, which align with tectonic characteristics of Banggai-Sula microcontinent. South Sula fault is a horizontal fault (?) extending E to Irian Jaya, believed to have facilitated left-lateral translation of Banggai Sula Microcontinent (supporting maps not that obvious?; JTvG).)

Davies, I.C. (1990)- Geological and exploration review of Tomori PSC, eastern Indonesia. Proc. 19th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, 1, p. 41-67.

(Tomori PSC, E Sulawesi, two tectonostratigraphic units: (1) Banggai-Sula microcontinent and (2) 'trapped' E Sulawesi Ophiolite Belt, thrust over Banggai-Sula microcontinental block in E Pliocene. Structural styles developed, firstly as Banggai-Sula moved W to present position, and secondly as it entered collision zone with E Sulawesi Ophiolite Belt. N area characterized by normal and wrench faults, S area by imbricate thrusts. Pre-collision Miocene sequence two carbonate reservoir units: (1) E Miocene platform limestones, with Tiaka oil field in complex thrust zone in S part of PSC; (2) Late Miocene mixed platform- reefal carbonate with Minahaki and Matindok gas fields. Source rocks for hydrocarbons in Miocene. Generation and migration in Pliocene/Pleistocene, as prior to this, insufficient overburden to create mature source)

Dzakirin, D.F., P.Y. Pratama, W.B. Raharjo, S. Hartanto, R. Armanda, Jaenudin et al. (2017)- Development and controlling factors of Miocene carbonate buildups: an example from the Senoro gas field, Central Sulawesi. Proc. Joint Convention HAGI-IAGI-IAFMI-IATMI (JCM 2017), Malang, p. 1-3.

(online at: https://www.iagi.or.id/web/digital/5/2017_IAGI_Malang_Development-and-controlling-factors-of-miocene-carbonate-buildups.pdf)

(Senoro gas field in E Sulawesi divided into two carbonate reservoir areas: (1) North Senoro with Late Miocene Mentawa Reef Mb carbonate buildup facies, and (2) South Senoro with M-L Miocene Minahaki Fm platform carbonate facies)

Dzakirin, D.F., P.Y. Pratama, W.B. Raharjo & R. Wijaya (2017)- Facies characterization and depositional environment relationship of Miocene carbonates reservoir in Senoro Block, Central Sulawesi. Proc. Joint Convention HAGI-IAGI-IAFMI-IATMI (JCM 2017), Malang, p. 1-3.

(online at: https://www.iagi.or.id/web/digital/5/2017_IAGI_Malang_Facies-Characterization-and-Depositional.pdf)

(Related to paper above. Senoro gas field in East Arm of C Sulawesi, with Minahaki Fm platform facies of mainly muddy wackestone/packstone facies (poor porosity) and overlying Mentawa Fm coral reefal carbonates with grainstone/floatstone facies with more reefal organism such as corals. Most of porosity in buildup facies secondary (vuggy and mouldic porosity from leached coral-algal framework). In platform facies fracture and vuggy porosities. Increasing thickness of Mentawa reef carbonate from NE to SW)

Fahrudin, R.S. Wicaksono, J. Wahyudiono & W. Gunawan (2012)- Deformasi cekungan Banggai pada zaman Tersier di Kabupaten Banggai, Sulawesi Tengah. Proc. 41st Annual Conv. Indonesian Association Geologists (IAGI), Yogyakarta, 2012-GD-26, 1 p. (Abstract only)

(online at: https://www.iagi.or.id/web/digital/9/2012_IAGI_Yogyakarta_Deformasi-Cekungan-Banggai-pada-Zaman-Tersier.pdf)

(*'Deformation of the Banggai Basin in Tertiary time, in Banggai Regency, C Sulawesi'. M Miocene collision between Banggai-Sula and E Sulawesi ophiolite blocks, followed by first Sulawesi Molasse (Kintom, Bongka Fm) in Late Miocene. Etc..*)

Ghozali, N.Q., D.A. Pradipto & A.K.H. Panguriseng (2021)- Biogenic gas identification of Donggi-Matindok area in Banggai Basin Indonesia. Proc. Joint Convention HAGI-IAGI-IAFMI-IATMI, Bandung (JCB), p. 1-12.

(online at: https://www.researchgate.net/publication/395773328_Biogenic_Gas_Identification_of_Donggi-Matindok_Area_in_Banggai_Basin_Indonesia)

(*Indications of biogenic gas in Banggai basin, like generated by E Pliocene Kintom Fm*)

Halim, A. & D. Heru (2003)- Successful extreme underbalance perforation in exploration well Donggi gas field, Sulawesi. Proc. SPE Asia Pacific Oil and Gas Conference (APOGCE). Jakarta 2003, p. 1-5.

Handiwiria, Y.E. (1990)- The stratigraphy and hydrocarbon occurrences of the Salodik Group, Tomori PSC area, East Arm of Sulawesi. Proc. 19th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 1, p. 69-98.

(*Rel. comprehensive overview by Union Texas geologist of Late Eocene- Miocene carbonate-rich Salodik Group on Banggai-Sula Plate (Late Eocene- E Miocene Tomori Fm, M Miocene clastic Matindok Fm, M-L Miocene Minahaki Fm carbonates, still with Lepidocyclina). Eocene Tomori Fm in Tiaka wells with Lacazinella. Late Eocene- E Oligocene missing in northern area (Mantawa-Minahaki-Matindok). Latest Miocene- E Pliocene basin deepening and Kintom Fm flysch deposition. Basement penetrations metamorphic rocks. Tiaka 2 well TD in granite and schist, with K-Ar date of 224 ± 9 Ma = ~E Norian*)

Haryono, A. Susilo, E. Purnomo & Tasiat (2002)- Donggi gas discovery of Matindok in Banggai Basin Sulawesi: a success story by using a new G & G approach. In: F.H. Sidi & A. Setiawan (eds.) Proc. Giant field and new exploration concepts seminar, Indonesian Association Geologists (IAGI), Jakarta 2002, p. 6-18.

(*On 2001 Donggi-1 gas discovery in Miocene carbonate buildup in Matindok Block, Banggai Basin, E Sulawesi. Net gas column 134m*)

Hasanusi, D., R. Abimanyu, E. Artono & A. Baasir (2004)- Prominent Senoro gas field discovery in Central Sulawesi. In: R.A. Noble et al. (eds.) Proc. Deepwater and Frontier Exploration in Asia & Australia Symposium, Jakarta, Indonesian Petroleum Association (IPA), Jakarta, p. 177-197.

(*Senoro gas field 1999 discovery in S part of E arm of Sulawesi. Reserves of 3.7 TCF gas and 65 MB condensate. Three play types in Tomori area: Miocene carbonate buildups, wrench-fault anticlines and thrust-sheet anticlinal structures. Two potential hydrocarbon sources: Jurassic and Miocene marine shales and coals. Geochemical analyses indicate seeps and oils and gas from wells relate to E-M Miocene rocks. Hydrocarbon generation commenced in E-M Pliocene due to Pliocene sedimentation and loading by thrust sheets. Some remigration of hydrocarbons due to regional basin tilting caused by uplifting of fold belt in Pleistocene*)

Hasanusi, D., E. Adhitiawan, A. Baasir, L. Lisapaly & R. van Eykenhof (2007)- Seismic inversion as an exciting tool to delineate facies distribution in Tiaka carbonate reservoirs, Sulawesi- Indonesia. Proc. 31st Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA07-G-008, p. 1-13.

(*Tiaka field produces oil from E Miocene Tomori limestone, while limited gas bearing zones can be found in M-L Miocene Minahaki limestone. Six oil wells and one dry well drilled. Seismic inversion confirmed dry well was drilled in tight limestone area, while oil wells were drilled in porous limestone area*)

Hasanusi, D., D. Kurniawan, R.M. Iman Argakoesoemah & W. Darmawan (2012)- Fractured carbonate reservoir of Tiaka Field, Eastern Sulawesi, Indonesia (T-3 Carbonate Cores). In: AAPG Geoscience Technology

Workshop (GTW) on reservoir quality of a fractured limestone reservoirs, Bali 2012, Search and Discovery Article 20145, p. 1-23. (*Brief Abstract + Presentation*)
(online at: www.searchanddiscovery.com/documents/2012/20145hasanusi/ndx_hasanusi.pdf)
(*Tiaka oil filed 1885 discovery in NE-SW low angle thrust anticline. Reservoir rel. tight, fractured Miocene Tomori Fm carbonate*)

Hasanusi, D., Kwartono & R. Wijaya (2012)- Carbonate reservoir characterization and its use on reservoir modeling: A case study of Senoro Field. In: SPWA 18th Formation Evaluation Symposium of Japan JOGMEC-TRC, Japan Formation Evaluation Society (JFES), Chiba, SPWLA-JFES-2012-I, p. 1-5.
(online at: <http://firagiel.com/download.php?arg1=paper-carbonate.pdf>)

Hasanusi, D. & M. Petricola (2006)- A surprise discovery using cased hole logs in the Tiaka Field. Proc. Jakarta 2006 International Geoscience Conference Exhib., Indonesian Petroleum Association (IPA), Jakarta, 06-VSL-05, p. 1-8.
(*Discovery of new gas sand behind casing in M-L Miocene Minahaki Fm ?Limestone in Tiaka Field*)

Hasanusi, D. & A. Priyantoro (2011)- Diagenetic events as the controlling improvement reservoir quality of the carbonate reservoirs in the Senoro field and surrounding areas, Banggai-Sula basin, Central Sulawesi. Proc. 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-028, p. 1-20.
(online at: https://www.iagi.or.id/web/digital/10/2011_IAGI_Makassar_Diagenetic-Event-as-the-Controlling.pdf)
(*On reservoir quality and diagenesis of M-U Miocene Mentawa Mb reefal build-ups (common recrystallization and dissolution, creating good porosity- permeability) and Minahaki Fm 'platform carbonate' (composed of deeper water globigerinid limestones; good porosity but low permeability)*)

Hasanusi, D., J. Sumarianto, R. Wijaya & D. Hendrian (2015)- The Tiaka-Tiara fault bend fold structures and its implication to control hydrocarbon entrapment within fracture carbonate reservoir in the Eastern Arm of Sulawesi, Indonesia. AAPG/SEG Int. Conference Exhibition, Melbourne, p. 1-11. (*Extended Abstract*)
(online at: https://www.searchanddiscovery.com/documents/2015/51213hasanusi/ndx_hasanusi.pdf)
(*Tiaka-Tiara fault bend fold structures in tectonically complex area of Banggai Basin, offshore E arm of Sulawesi, formed by Late Miocene- Pliocene collision between Banggai Sula microcontinent and E Sulawesi ophiolite belt. SW-NE oriented major fault and series of SSE-NNW oblique minor fault bend folds, affecting Miocene Minahaki and Tomori fractured carbonate reservoirs*)

Hermanto, B. (2014)- Perkembangan kerangka tektonik Laut Maluku, Kepulauan Banggai-Sula dan lajur ofiolit Sulawesi Timur. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 15, 2, p. 69-74.
(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/62>)
(*'Tectonic framework development of the Molucca Sea, Banggai-Sula islands and ophiolite belt in Eastern Sulawesi'. Brief review; not much new?*)

Hermanto, B. (2015)- Usulan baru titik bor eksplorasi minyak dan gas bumi di lapangan Tiaka dan Senoro, cekungan Luwuk- Banggai. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 16, 1, p. 45-53.
(*'Proposed new oil and gas exploration drillings in Tiaka and Senoro fields, Luwuk-Banggai Basin'*)

Koolhoven, W.C.B. (1930)- Verslag over een verkenningsstocht in den Oostarm van Celebes en de Banggai Archipel. Jaarboek Mijnwezen Nederlandsch-Indie 1929, Verhandelingen, p. 187-228.
(*'Report of a reconnaissance survey in the East arm of Sulawesi and the Banggai Archipelago'. Banggai islands basement crystalline schists intruded by granodiorites, unconformably overlain by E Miocene micaceous sandstones and limestones with Spiroclypeus and Miogypsina, unconformably overlain by ?Plio-Pleistocene Peling Limestone. M or Late Miocene folding event and up to 1000m Quaternary uplift*)

Kurniasih, A., E. Kusumawijaya, Ferdy, Fahrudin & R. Setyawan (2021)- Biostratigraphy analysis of Barbatos-1 exploration well in Tomori Block, Banggai Basin, East Arm of Sulawesi. Riset Geologi dan Pertambangan (LIPI) 31, 1, p. 51-62.

*(online at: <http://jrisetgeotam.lipi.go.id/index.php/jrisgeotam/article/view/1150/pdf>)
(Sediments in interval 4030-9800' in offshore Barbatos-1 well in Tiaka oil field, Tomori block, deposited in M Miocene-Holocene time. Lowest layer is planktonic foram zone N10-N12 (lower M Miocene), in bathyal environment. Overlain by N12-N14 (upper M Miocene) in neritic environment and N14-N17 (M-L Miocene) in bathyal environment. Topmost interval N17-N23 (Pliocene- Holocene) in bathyal environment. Top two layers with reworked fossil fragments from Early Tertiary)*

Kurniawan, A.P., G.P. Adi, M. Arifin, A.S. Arifin, K. Sani, S. Pamungkas, A.D. Guntara & T. Suroso (2017)- Imaging Miocene duplex carbonate play beneath ophiolite belt zone using seismic synthetic modeling approach. Proc. 41st Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA17-60-G, p. 1-8.
(Seismic suggestive of carbonate duplex structure under ophiolite in Banggai-Sula foreland basin imbricate thrust zone (= Batui Thrust belt), East Arm of Sulawesi)

Kurniawan, A.P., G.P. Adi, M. Arifin, A.S. Ningrum & A.S. Arifin (2017)- Pliocene deep water carbonate turbidites play evaluation in the Banggai-Sula foreland basin. Proc. 41st Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA17-59-G, p. 1-14.
*(Banggai-Sula Foreland Basin in Matindok Block, E Sulawesi, is product of Late Miocene- E Pliocene collision between Banggai Sula microcontinent and E Sulawesi Ophiolite-magmatic arc of Sundaland. Onshore wells Matindok-7 and Penyus-1, and discovered gas-condensate in M-52 carbonate layer of Plio-Pleistocene Celebes Molasse. M-52 turbiditic carbonate 3 layers, with (reworked?) Miocene *Lepidocyclina*, porosity 10-20%)*

Kurniawan, A.P., G.P. Adi, W.T. Sundari, M. Arifin, M.J. Panguriseng, S. Hartanto & N. Herawati (2018)- Pliocene deep water channel system of Celebes Molasse as new exploration play in Banggai Sula foreland basin, Eastern Sulawesi-Indonesia. Proc. 41st HAGI Annual Conv. Exhib. 2016, IOP Conference Series: Earth and Environmental Science 132, 012005, p. 1-7.

*(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/132/1/012005/pdf>)
(Banggai-Sula foreland basin product of Late Miocene- E Pliocene collision of Banggai-Sula microcontinent and E Sulawesi Ophiolite/magmatic arc of Sundaland. Proven petroleum plays Miocene carbonates, sealed by post collision Plio-Pleistocene Celebes Molasse. Seismic data from onshore Matindok block show possible NE-SW channels in deeper marine Celebes Molasse. Fining upward sequences observed in several wells. Thicknesses of channel bodies 50-150 m, sand-shale ratio up to 40 %. Potential new gas exploration play)*

Kurniawan, A.P., C.D. Ardianto, M.J. Panguriseng, M. Arifin, I. Firman & G.P. Adi (2016)- Possible Mesozoic graben system in the offshore Matindok Block: a new evaluation of prospective kitchen using 2D PSDM dataset. Proc. 40th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA16-41-G, p. 1-7.
(2D seismic dataset in Matindok Block, E Sulawesi, suggests possibility of NNE-SSW trending Mesozoic graben system in Tolo foredeep of Banggai-Sula foreland beneath Miocene platform carbonate. Several Mesozoic half-graben inversions. This may have consequences for distribution of Jurassic mature source rock (but crude oils tested so far with Tertiary biomarkers, probably tied to E-M Miocene Tomori Fm))

Kurniawan, A.P., M. Arifin, I. Firman & H. Budiarto (2015)- Regional vitrinite reflectance (Ro) trend for predicting kitchen area beneath Batui Thrust in the onshore area of Matindok Block, Eastern Sulawesi-Indonesia. Proc. 39th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA15-G-140, p. 1-4.
(Vitrinite Reflectance modelling used to predict kitchen area beneath Batui Thrust, onshore E Sulawesi)

Kurniawan, A.P., M. Arifin, W.T. Sundari, Sardjito, N. Budi & H. Nurudin (2016)- Interval velocity modeling of Celebes Molasse as post collision in Banggai-Sula foreland basin, Eastern Sulawesi, Indonesia. Proc. 40th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA16-44-G, p. 1-7.
(Banggai-Sula Foreland Basin product of Late Miocene- E Pliocene collision between Banggai-Sula microcontinent and E Sulawesi ophiolite-magmatic arc of Sundaland. Post-collisional Celebes Molasse deposited E-ward into basin in Plio-Pleistocene, with thickness 1500-2700m. Interval velocity modeling of molasse to improve interpretation of underlying Top Miocene carbonate surface)

Kurniawan, A.P., M. Arifin, R.A. Wibawa, H. Budiarmo, N. Budi & H. Nurudin (2015)- Understanding imbricate thrust sequences of Miocene carbonate platform in the southwest offshore area of Matindok Block, Eastern Sulawesi- Indonesia. Proc. Joint Convention HAGI-IAGI-IAFMI-IATMI, Balikpapan, JCB2015-346, p. 1-4.

(Imbricate thrust zone in SW offshore area of Matindok Block area, Tolo Bay, E Sulawesi, product of Late Miocene- E Pliocene collision between Banggai-Sula microcontinent and E Sulawesi Ophiolite/magmatic arc. Unconformably overlain by Pliocene Celebes Molasse. Oilfield in Tiaka thrust, but dry holes in Kalomba-1 and Tolo-1 thrust prospects. NW-SE regional seismic line shows 6 thrust slices (38% shortening), in front of upthrust ophiolite (penetrated by Dengkala 1 well). Older imbricate thrust sequences lower porosity)

Kurniawan, A.P., I. Firman, E. Nurjadi, A. Prasetyo & I.G. Widyoseno (2018)- Unlocking potential plays of unexplored back-bulge in the Banggai-Sula foreland basin. Proc. 42nd Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA41G, p. 1-17.

Kurniawan, A.P., A. Mardianza, I. Firman, M. Fajar & Fatahillah (2019)- New biomarker evidences of Mesozoic petroleum systems in the unexplored Tokala area, Eastern Sulawesi. Proc. 43rd Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA19-G-350, p. 1-14.

(New biomarker data from oil seep in Menyoe area on flank of Tokala Mountain, W part of Tomori basin, show low oleanane values, suggesting Mesozoic origin. Other oil seeps in E Sulawesi high oleanane index, suggesting Cenozoic origin. Menyoe seep oil likely correlates with organic matter of shale facies of Triassic Tokala Fm)

Kurniawan, A.P., A.S. Ningrum, C.D. Ardianto, I. Firman, E. Nurjadi, A. Prasetyo & I.G. Widyoseno (2018)- Hydrocarbon potential of unexplored Tokala area in the Eastern Arm Sulawesi as part of Australian fragment: a preliminary result. Proc. 42nd Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA18-29-G, p. 1-18.

Kurniawan, D., F.F. Baskaraputra, Sugiyanto, A. Baasir & D.H. Febrianto (2011)- Integrated reservoir modeling and characterization of 'SNR' Field. Proc. Joint 36th HAGI and 40th IAGI Annual Conv., Makassar, JCM2011-346, p. 1-15.

(Reservoir model of SNR (= Senoro) gas field, discovered in 1999 in Late Miocene Mantawa Mb carbonate buildup, Senoro-Toili Block, E Sulawesi)

Kwartono, K.W.A., D. Hasanusi & R. Wijaya (2013)- Integrated reservoir characterization and static geomodeling of Senoro Field, Senoro-Toili Block, Sulawesi, Indonesia. In: Petroleum Geoscience Conf. Exhib. (PGCE 2013), Kuala Lumpur 2013, p. 1-7. *(Extended Abstract)*

(Miocene Minahaka Fm carbonate platform reservoir characterization study at Senoro gas field, C Sulawesi)

Kwartono, N. Herawati, Sugiyanto & A. Baasir (2013)- Understanding the uncertainties in geomodeling process, an awareness for risks mitigation case study of Senoro Field, Senoro-Toili Block, East Sulawesi. Proc. Joint Convention 38th Indonesian Association Geophysicists (HAGI) - 42nd Indonesian Association Geologists (IAGI), Medan 2013, p. 1-8.

(online at: https://www.iagi.or.id/web/digital/8/2013_IAGI_Medan_Understanding-The-Uncertainties.pdf)

(On uncertainties in geomodeling of M-L Miocene Minahaki Fm limestone reservoir in Senoro gas field, E Sulawesi)

Laya, K.P., B.G. Adhiperdana, P.Y. Pratama, R. Helbet, A. Yumansa, A. Khawarizmy et al. (2002)- Integrated microfacies and sedimentology analysis of Minahaki Fm: analogue for carbonate ramp depositional model and microporosity-dominated reservoir performance. Proc. 51st Annual Conv. Indonesian Association Geologists (PIT IAGI 51), Makassar 2002, p. 1-7.

(online at: <https://www.iagi.or.id/web/digital/71/PITIAGI-22-P-Abs-166.pdf>)

(M Miocene Minahaki Fm. carbonates in onshore Banggai Basin, E Sulawesi, massive, 750' thick platform carbonates with 13-28% porosity but low permeability. Five types of microfacies)

Luthfi, A., E. Purnomo & S. Riadhy (2002)- Big fish discovery in Banggai Basin, Sulawesi, Indonesia- a success story using PSDM Technique. In: 64th EAGE Conference & Exhibition, Florence, G-07, p. 1-4. *(Extended Abstract)*

(In 1998-2001 Pertamina drilled three wildcat wells in Banggai Basin, onshore E Arm of Sulawesi. Two wells hit gas-bearing zones in Miocene carbonates, with net pay of reservoir 140-207m)

Mirmanda, E., D. Kusnida, T.B. Nainggolan, B. Setyanta & Subagio (2024)- Gravity field and crustal structure of the Eastern Arm of Sulawesi and the Banggai Archipelago, Eastern Indonesia. Interpretation (SEG-AAPG), 12, 3, p. T331-T339.

(Investigation of crustal structures of E Arm of Sulawesi and Banggai Archipelago by means of gravity. Occurrence of ophiolite masses and development of Batui-Balantak foreland thrust-fold belt on East Arm of Sulawesi result of Neogene collision of Sulawesi Island Arc and Banggai-Sula microcontinent. Rel. low levels of gravity anomalies in most areas of outcropping E Sulawesi Ophiolite in East Arm suggest lack of high density root (thin thrust sheet), except in Poh Head area, where high density root of ~2500m deep is suggested. Slight thickening in crustal block beneath central part of East Arm region. Area exhibits significant fracturing and attenuation. Crustal block dipped NE-ward in response to ascent of Molucca Sea oceanic crust) (Same paper as Sardjono & Mirmanda, 2007?)

Muhartanto, A. & T. Purwanto (2011)- Potensi batuan induk di Cekungan Banggai, Sulawesi Tengah. MINDAGI 2, 1, p. 29-40.

(online at: https://www.academia.edu/11327966/Potensi_Batuan_Induk_Cek_Banggai)

(‘Source rock potential in the Banggai Basin, Central Sulawesi’. Banggai/Tomori Sub-Basin oil and gas source rocks are Tomori and Matindok Fms, but only E-M Miocene Tomori Fm contains moderately rich organic material and in wells tends to be immature)

Nainggolan, T.B. & N.I.T.P S Halawa (2023)- Evaluation of carbonate reservoir with integration of petrophysical analysis and seismic impedance inversion in Banggai Basin, Sulawesi. Proc. Int. Conference on Geoscience and Earth Resources Engineering, IOP Conference Series: Earth and Environmental Science 1288, 012005, p. 1-8.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1288/1/012005/pdf>)

(Petrophysical and seismic impedance evaluation of hydrocarbons in Miocene carbonate reservoir in offshore Siotu-1 well, Banggai Basin, near Tiaka oil field. Well drilled into thrust anticlinal structure. Five reservoir zones with porosity of 10-> 25% . Net pay in reservoir zone 4 only 4.5 feet thick. Siotu-1 well penetrated good Miocene carbonate reservoir rock, but insignificant hydrocarbons)

Natawidjaja, D.H. & A. Kadarusman (1994)- The structural natures of the Pre-Tertiary rock complexes of the Sula Islands and their tectonic significances: a preliminary view. Proc. 23rd Annual Conv. Indonesian Association Geologists (IAGI), Jakarta 1994, p. 433-446.

(online at: <https://www.iagi.or.id/web/digital/62/34.pdf>)

(Structural analysis of Pre-Tertiary rocks of Banggai-Sula suggests two or more deformation phases. Significant differences between Taliabu/Mangole and Sulabesi islands, suggesting tectonic block rotation. Most granitoids highly fractured. Mesozoic sediments only slightly deformed and gently dipping)

Nurhidayah, E.M., Akmaluddin, D.H. Barianto, S. Husein & A. Saripudin (2024)- Nannoplankton biostratigraphy from Banggai-Sula Basin, Central Sulawesi. J. Tropical Biodiversity and Biotechnology (JTBB) (UGM), 9, 1, p. 1-20.

(online at: <https://journal.ugm.ac.id/jtbb/article/view/85308/38409>)

(Nannoplankton from ditch cuttings from MH-2 well (probably Minahaka 2 well; W of Senoro gas field), Banggai-Sula Basin, coastal southern East Arm of Sulawesi, suggest age range of M Miocene- M Pliocene (13.7- 3.7 Ma). Age of pre-collisional Minahaki Fm carbonates is Middle - Late Miocene (NN5- NN7 zone). Post-collisional Kintom Fm flysch is Late Miocene -Early Pliocene (Zone NN11- NN15), and post-collisional Biak Fm molasse is E-M Pliocene (Zone NN16). Apparent hiatus in Late Miocene at 8150', at top Minahaka carbonate, spanning zones NN8-NN10 (10.6-8.2 Ma). All samples also have reworked Jurassic-Cretaceous nannofossils (but in case of Minahaka carbonates possibly also cavings?; JTvG))

Padmawidjaja, T. (2019)- Konfigurasi Cekungan Tomori berdasarkan data gayaberat. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 20, 1, p. 27-36.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/402/387>)

(‘Tomori Basin configuration based on gravity data’)

Pertamina/BPPKA (eds.) (1996)- Banggai Basin (E Sulawesi). In: Petroleum Geology of Indonesian basins, VI, Jakarta, p. 1-24.

Prabawa, G., A. Jambak, B. Harnest, T. Irano & I. Ibrahim (2020)- Rejuvenating the concept of the Salodik Group reservoir of the Banggai basin through surface geological mapping and multi-method analyses. Proc. Digital Technical Conference 2020, Indonesian Petroleum Association (IPA), IPA20-G-209, p. 1-15.

(*Depositional environments and tectonic events of M Eocene- E Pliocene Salodik Group limestones in E Sulawesi (equivalent of Tomori-Minahaki-Mentawa Fms). Alveolina-dominated limestone in Eocene*)

Pratama, P.Y., D.F. Dzakirin, R. Luqman, R. Rahadian, R. Helbet et al. (2019)- Facies analysis using biostratigraphy data and also development and controlling factors of Miocene carbonate buildups, Central Sulawesi. Proc. SPE/IATMI Asia Pacific Oil & Gas Conference Exhib., Bali 2019, SPE-196348-MS, p.

(*Analysis of Late Miocene-Pliocene carbonates in Banggai Basin*)

Ramli, T., I.S. Gumilar, A. Yogi, R.A. Fadhillah, R. Fakhruddin & Praptisih (2023)- Geochemistry of potential source rock and natural gas seepages in the Mangole-Taliabu Archipelago, North Maluku, Indonesia. Rudarsko-Geolosko-Naftni Zbornik (Mining-Geology-Petroleum Engineering Bulletin), Zagreb, 38, 4, p. 1-17.

(online at: <https://hrcak.srce.hr/file/447301>)

(*Potential source rock for 6 natural gas seeps on N Mangole island: (1) E-M Jurassic non-marine Bobong Fm; (2) previously confirmed M Jurassic- E Cretaceous marine Buya Fm. Oligo-Miocene Salodik Fm not potential source rock, as suggested before. Natural gas seeps not only coal-derived gas but also oil-type gas. Ro of coal-derived gas source rock 0.8% - 1.0%; gas source rock from 0.5%-1.3%. Gas-source correlations: Bobong Fm likely for RAG/88/012 and RAG/88/014 gas samples, Buya Fm is source for Binono Seep, RA/21/33, RA/21/34, and RA/21/35 gas samples In N part of Taliabu-Manggole maturity of potential source rock immature- mature; same sediments in S Mangole post-mature for oil generation (in Alpha 1 well to N offshore Bobong Fm still immature)*)

Ryacudu, R., T. Wibodo & Y.E. Handiwiria (1993)- Exploration for carbonate reservoirs in the Banggai Sula microcontinent, eastern Indonesia. Proc. 22nd Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 2, p. 679-692.

(online at: [https://www.iagi.or.id/web/digital/53/22nd-Volume-2-\(6-9-Des-1993\)-73-86.pdf](https://www.iagi.or.id/web/digital/53/22nd-Volume-2-(6-9-Des-1993)-73-86.pdf))

(*Widespread Miocene pre-collisional Salodik carbonate platform on Banggai-Sula Block. End-Miocene collision between Banggai-Sula block and E Sulawesi terminated carbonate deposition, changing depositional regime to foreland basin with Plio-Pleistocene Celebes Molasse (area with Tiaka oilfield)*)

Sardjono & E. Miranda (2007)- Gravity field and structure of the crust beneath the East Arm of Sulawesi and the Banggai Archipelago. Proc. 31st Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA07-G-024, p. 1-11.

(*Gravity modeling suggests Banggai- Sula Archipelago composed of blocks of severely attenuated continental crust. East arm of Sulawesi is predominantly continental, with thick Neogene sediment cover and thickened continental crustal block in middle part. Only E tip (Poh Head) may have deep-rooted ultramafic rocks*)

Sari, R., E.P. Hernanto, A.M. Adiwarta, I.H.B. Kartoadmodjo & S. Husein (2024)- Sedimentation dynamic of pre-collision to post-collision sediment as a new perspective for exploration play in Banggai-Sula foreland basin, Eastern Sulawesi Indonesia. Proc. 48th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA24-G-335, p. 1397-1407.

(*Banggai-Sula foreland basin formed by collision between Banggai-Sula Microcontinent and East Sulawesi Ophiolite, which started in Late Miocene. Tomori -Matindok Fms not deposited at same time in onshore: N*

Senoro area larger unconformity (N8-N16) than S Senoro area (N12- N14-N17), caused by uplift prior to collision event along Batui Thrust. Following collision, molasse clastics (Kintom Fm) deposited from multiple provenances (all with mafic detritus))

Sartono, S., K.A.S. Astadiredja & H. Murwanto (1991)- East Arm Sulawesi: Banggai microplate- Sunda subduction zone collision. Proc. 20th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 376-395.

(online at: [https://www.iagi.or.id/web/digital/49/20th-\(10-12-Des-1991\)-25.pdf](https://www.iagi.or.id/web/digital/49/20th-(10-12-Des-1991)-25.pdf))

'At the end of the Cretaceous W and E parts of Sulawesi were Laramic tectonic wedges situated in the Tertiary Banda subduction zone'. 'The most westerly New Guinea-derived terrane, Banggai-Sula, collided with the non-volcanic arc of Sulawesi, giving rise to obduction of ultramafic-mafic rock and mixing these with tectonic melanges'. Oldest formation in East Arm is Triassic Toala Fm, with Misolia; also Permo-Carboniferous? Etc.)

Satyana, A.H. & S. Zaitun (2016)- Origin of oils and gases at Banggai-Sula microcontinent, Eastern Sulawesi-North Moluccas: constraints from biomarkers and isotope geochemistry- implications for further exploration of Cenozoic and Pre-Cenozoic objectives. Proc. 40th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA16-575-G, p. 1-27.

(Oils in Banggai foreland basin oil-gas fields (Tiaka, Senoro, Minahaki, etc.) and onshore seeps (Kolo, Dayuk, Toikli, etc.) with common oleanane and relatively high sulfur sourced from marine E Miocene Tomori Fm carbonates- shaly carbonates (type A oils) and M Miocene Matindok shales- calcareous shales (type B oils). No evidence of petroleum contribution from Jurassic- Cretaceous rocks in Banggai Basin, although gas seeps on Sula islands tied to Pre-Cenozoic source rocks in graben areas of offshore Taliabu-Mangole Shelf)

Sayaf, I.U., V. Isnaniawardhani, B. Muljana & W. Suganda (2025)- Facies characteristics and depositional environment reconstruction of the Minahaki Formation, "DM" Field, Banggai Basin. Jurnal Geoelebes 9, 2, p. 237-252.

(online at: <https://journal.unhas.ac.id/index.php/geoelebes/article/view/45784/13673>)

(Four main carbonate lithofacies in M-L Miocene Minahaki Fm in ?? field, onshore East Arm of Sulawesi (part of Banggai-Sula Basin). Interpreted as rimmed carbonate platform)

Setyawan, R., Y. Aribowo, A. Kurniasih, Fahrudin, R.K. Ali, Najib, Ferdy, E.K. Wijaya, N. Qadaryati et al. (2024)- Provenance analysis based on petrographic samples on EXIA-1 Well, Banggai Basin, East Sulawesi, Indonesia. J. Geoscience Engineering Environment Technology (JGEET) 9, 2, p. 109-115.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/13367/6601>)

(Study of Miocene limestone cuttings in Tomori Basin well (EXIA fictitious well name, but near Tiaka/ Senoro fields) (not much new?))

Subarsyah & Sahudin (2010)- Identifikasi sub-cekungan di cekungan Tomini bagian Selatan, berdasarkan penampang seismik 2D dan anomali gaya berat. J. Geologi Kelautan 8, 2, p. 95-104.

(online at: <http://ejournal.mgi.esdm.go.id/index.php/jgk/article/view/190/180>)

('Identification of sub-basins in the southern part of the Tomini basin, based on 2D seismic lines and gravity anomalies')

Subroto, E.A., B.Y. Afriatno & P. Sumintadireja (2007)- Prediction of the biogenic gas occurrences in Indonesia based on studies in East Java and Tomori (Central Sulawesi). Jurnal Teknologi Mineral (ITB), 14, 3, p. 115-124.

(online at: www.ftm.itb.ac.id/galeri/prediction.pdf)

(Biogenic gas dry (>99% methane and, light carbon-isotopes:-61 to -67‰) is bacterial in origin. One of fields producing biogenic gas in E Java Basin. Sediments most likely producing biogenic gas from Plio-Pleistocene, characterized by high sedimentation rates, low geothermal gradients and high organic matter content)

Suherman, D., M.A. Isnandar, S. Damuar, A. Sukutjo & S. Soemardan (2008)- Reservoir characteristics of Donggi Field, Central Sulawesi, using inversion and AVO analysis methods. Proc. 32nd Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA08-G-077, p. 1-12.

(Donggi gas field in Matindok Block, C Sulawesi, reservoired in Miocene carbonate build-up, with satisfactory porosity at almost all intervals)

Sukamto, R. (1975)- Geologi daerah Kepulauan Banggai dan Sula. Geologi Indonesia 2, 3, p. 23-28.
(‘Geology of the Banggai and Sula islands region’. Includes two broad K-Ar ages for Mangole Volcanics on Mangole Island: radiometric ages of 330 ± 90 Ma (Carboniferous?) and 210 ± 25 Ma (Late Triassic?). Basal metamorphic complex radiometric age 305 ± 6 Ma (Late Carboniferous), Banggai granite radiometric ages 235 ± 10 Ma to 245 ± 25 Ma (M Triassic))

Sukmono, S., A. Baasir, R. Abimanyu & N. Pudyo (2005)- Tiaka Field, Sulawesi: a recognized potential thrust anticline play type in Sulawesi- Indonesia. Proc. 66th EAGE Conference & Exhibition, Paris, B043, p. 1-4.

(Extended Abstract. Tiaka Field in Miocene carbonate in thrust anticline in E Sulawesi. NE-SW structure with Tiaka primary thrust faults at E side and Kalomba thrust faults in W. Porosity of Tomori carbonate 5-23%, Minahaki carbonate 10-29% and Matindok clastics 18-39%)

Supandjono, J.B. & E. Haryono (1993)- Geology of the Banggai Sheet, Sulawesi-Maluku. Map at scale 1:250,000, with brochure, Geological Research Development Centre (GRDC), Bandung.

(Geology of Banggai Islands, SE of East Arm of Sulawesi. Oldest rock Carboniferous? metamorphics (schist, gneiss, amphibolite, quartzite). (Permian-?) Triassic Banggai Granite and co-magmatic Mangole Fm volcanics (rhyolite, ignimbrite, etc.) (K-Ar ages of Banggai Granite ~224-240 Ma; Harahap et al. 2003). Unconformably overlain by Late Jurassic Bobong Fm conglomerate, sandstones with coal and Buya Fms shales and quartz sandstones, Cretaceous Tanamu Fm marls, Eocene- Miocene Salodik Fm limestones-marls)

Surjono, S.S., M.R. Asy’ari & A. Gunawan (2019)- Application of seabed core geochemistry for further exploration in Banggai-Sula area. In: F. Rossetti et al. (eds.) The structural geology contribution to the Africa-Eurasia geology, etc., First Conference Arabian Journal of Geosciences (CAJG-1), Tunisia 2018, Springer Advances in Science, Technology & Innovation, p. 171-173. *(Extended Abstract)*

(online at: [https://www.researchgate.net/publication/330003896_Application_of_Seabed_Core_Geochemistry_for_Etc.](https://www.researchgate.net/publication/330003896_Application_of_Seabed_Core_Geochemistry_for_Etc))

(Brief report on hydrocarbon seepages in seabed cores from deep water north of Banggai-Sula Platform (TGS-NOPEC work))

Surono (1989)- Hubungan stratigrafi antara Kepulauan Banggai-Sula dan lengan Timur Sulawesi. Bull. Geological Research Development Centre (GRDC) 13, p. 46-60.

(‘Stratigraphic relationship between the Banggai-Sula Islands and the East Arm of Sulawesi’. Different types of basement and overlying rocks, but both overlapped by similar Late Miocene-Pliocene Celebes Molasse)

Syahputra, G.A., W. Utomo & A. Rahman (2020)- Potensi batuan induk Formasi Salodik Pulau Peleng Bagian Barat, Cekungan Banggai. Lembaran Publikasi Minyak dan Gas Bumi (Lemigas) 53, 2, p. 97-109.

(online at: <https://journal.lemigas.esdm.go.id/index.php/LPMGB/article/view/358>)

(‘Source rock potential of the Salodik Formation of West Peleng Island, Banggai Basin’. Eocene-Miocene source rock of the Salodik Fm at W side of Peleng Island. Carbonaceous shale interbedded with reefal limestones organic-rich, kerogen types II/III, but immature. If buried at optimum maturity, could generate oil and gas)

Yumansa, A., K.P. Laya, P.Y. Pratama, A. Prasetya & I.H.B. Kartoatmodjo (2023)- Integrated core analysis of Salodik Group: the pioneering success for future potential of collision margin carbonate mega-sequence in Eastern Indonesia Region. Proc. 47th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA23-G-07, p. 1-15.

(Compilation of core-based information of Miocene Salodik Gp carbonate units (Mantawa (youngest; Late Miocene), Minahaki (M-L Miocene) and Upper Tomori Fm (basal Salodik; Late Oligocene- E Miocene), the main hydrocarbon reservoirs in Banggai Basin. With paleomagnetic reconstruction of Banggai Block, drifting N

from Gondwanaland near South Pole region in mid-Cretaceous towards Sundaland in Equatorial region today. It also experienced ~150° CCW rotation along way)

Zaitun, S., D.H. Amijaya, J. Setyowiyoto & A.H. Satyana (2016)- Oil classification and genetic type of gas in Tiaka, Matindok, Donggi, Senoro fields and surrounding area in Banggai Basin, Central Sulawesi. Proc. 14th Regional Conference Geology and Mineral Resources of SE Asia (GEOSEA XIV) and 45th Annual Conv. Indonesian Association Geologists (IAGI) (GIC 2016), Bandung, p. 509-523.

(Tiaka offshore oil field and Matindok, Minahaki, Donggi and Senoro onshore gas fields Banggai Basin, E Sulawesi, sourced from Tertiary (high oleanane). Two oil types, A and B, generated from marine carbonate and shale source rocks. Senoro gas thermogenic, formed from secondary cracking. Matindok gas thermogenic, generated from mixed gas source and most mature gas)

V.3. Buton, Tukang Besi

Ali, J.R., J. Milsom, E.M. Finch & B. Mubroto (1996)- SE Sundaland accretion: palaeomagnetic evidence of large Plio-Pleistocene thin skin rotations in Buton. In: R. Hall & D. Blundell (eds.) Tectonic evolution of Southeast Asia, Geological Society, London, Special Publ. 106, p. 431-444.

(Tukang Besi Platform docked with Sundaland/East Buton in Pliocene. Wide array of paleomagnetic results of surface sediments suggest thin-skinned block rotations)

Alviyanda, G.M.L. Junursyah, I.S. Gumilar & U. Mardiana (2014)- Interpretation of subsurface structure in Tersier sediment based on magnetotelluric data, South Buton Area. Proc. 38th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA14-SG-0545, p. 1-13.

Arifin, L. & T. Naibaho (2015)- Struktur geologi Pulau Buton Selatan. J. Geologi Kelautan 13, 3, p. 143-151.

(online at: <http://ejournal.mgi.esdm.go.id/index.php/jgk/article/view/269/259>)

('Geological structure south of Buton island'. Shallow reflection seismic lines in waters S of Buton and Muna)

Arisona, A., M. Nawawi, U.K. Nuraddeen & M. Hamzah (2016)- A preliminary mineralogical evaluation study of natural asphalt rock characterization, southeast Sulawesi, Indonesia. Arabian J. Geosciences 9, 272, p. 1-9.

(Bitumen content of 'Asbuton' (Buton Asphalt) 10-40%. Geoelectrical resistivity survey and x-ray fluorescence show Ca is dominant element in asphalt rock (40-90%), indicating limestone (surprise!?!))

Arisona, S. Alfian, N.K. Praja & A. Okto (2022)- Studi diagenesis Batugamping di Desa Wakorumba, Kecamatan Wakorumba Selatan, Kabupaten Muna, Provinsi Sulawesi Tenggara. Jurnal Geologi dan Sumberdaya Mineral (JGSM) 23, 3, p. 155-162.

(online at: <https://jgsm.geologi.esdm.go.id/index.php/JGSM/article/view/710>)

('Diagenesis study of limestones in Wakorumba Village, South Wakorumba District, Muna Regency, Southeast Sulawesi Province' W Buton Island. Study of diagenesis of Miocene Wapulaka, Sampolakosa, and Limestone Members of the Tondo Formations. (with poor thin section photos; impossible to verify- JTVG)

Asharun, N., Harisma, E.S.Hasan, Hasria, E. Anshari & R.I.M. Cendrajaya (2021)- Studi fasies dan diagenesis batuan karbonat Formasi Rumu daerah Kumbewaha dan sekitarnya, Kabupaten Buton, Provinsi Sulawesi Tenggara. Ophiolite: Jurnal Geologi Terapan 2, 1, p. 22-32.

(online at: <https://ojs.uho.ac.id/index.php/Ophiolite/article/view/19584/13407>)

('Study of facies and diagenesis of Rumu Fm carbonate rocks in Kumbewaha area, Buton..'. Remarkably uninformative discussion of limestone on Buton, of Jurassic age(?), with unidentified fossils- JTVG)

Asrim & L.M.Y. Amsah (2021)- Tektonik Pulau Buton dan implikasinya terhadap endapan bahan galian. Akademika Jurnal 18, 2, p. 36-40.

(online at: <https://ejournal.lppmunidayan.ac.id/index.php/akd/article/view/334/294>)

('Tectonics of Buton Island and its implications for mineral deposits'. Brief literature review)

Astjario, P. & D.A. Siregar (2003)- Kecepatan pengangkatan Pulau Buton dan jejak perubahan muka air laut di Zaman Kuartar. J. Geologi Kelautan 1, 2, p. 19-28.

(online at: <https://ejournal.mgi.esdm.go.id/index.php/jgk/article/viewFile/96/86>)

('Uplift rate of Buton Island and indications of sea level changes in the Quaternary Period'. Uplifted Late Quaternary coral reef terraces along South Buton coast up to 250 m above present sea level, dating back to >44 ky B.P. Average tectonic uplift rate at Tira and Cape Labokeh about 0.7- 0.8 mm/ year. Buton uplift faster than nearby Muna).

Beets, C. (1943)- Beitrage zur Kenntnis der angeblich oberoligocenen Mollusken-Fauna der Insel Buton, Nederlandsch-Ostindien. Leidsche Geologische Mededelingen 13, p. 256-328.

('Contributions to the knowledge of the supposedly Oligocene-age mollusc fauna of Buton Island, Netherlands East Indies'. Description of molluscs from asphalt beds on Buton in collections in The Netherlands. Looks like diverse, but endemic faunas (51 new species and 11 species described by Martin 1933- 1935, 1937). Age of fauna uncertain, but possibly Late Oligocene as suggested by Martin (in Beets 1952 believed to be younger))

Beets, C. (1943)- On *Waisiuthyrina*, a new articulate brachiopod genus from the Upper Oligocene of Buton (S.E. Celebes), Dutch East Indies. Leidsche Geologische Mededelingen 13, p. 341-347.

(online at: www.repository.naturalis.nl/document/549268)

(Description of new species of terebratulid brachiopod *Waisiuthyrina margineplicata* from ?Miocene asphalt rocks of Buton. Brachiopods are generally very rare in Tertiary of Indonesia)

Beets, C. (1943)- Weitere Verwandtschaftsbeziehungen zwischen den Oberoligocaenen Mollusken von Buton (S.E. Celebes) und den Neogenfaunen des Ostindischen Archipels. Leidsche Geologische Mededelingen 13, p. 349-355.

(online at: www.repository.naturalis.nl/document/549308)

(Additional relationships between the Upper Oligocene molluscs from Buton (SE Sulawesi) and the Neogene faunas of the East Indies archipelago'. So-called 'Oligocene' Buton mollusc faunas mostly endemic in character, but most similarities with Late Neogene of Ceram and Nias)

Beets, C. (1952)- Reconsideration of the so-called Oligocene fauna in the asphaltic deposits of Buton (Malay Archipelago). 1. Mio-Pliocene mollusca. Leidsche Geologische Mededelingen 17, 1, p. 237-258.

(online at: www.repository.naturalis.nl/document/549592)

(Molluscs from asphaltic marls of Buton previously considered Oligocene- lowermost Miocene in age, but here re-interpreted as Mio-Pliocene, partly based on associated diatoms (Reinhold) and foraminifera (Keijzer). The low % of Recent species because this is deep water fauna, of which Recent representatives were poorly known)

Bothe, A.C.D. (1928)- De asfaltgesteenten van het eiland Boeton, hun voorkomen en economische betekenis. De Ingenieur 1928, 19, Mijnbouw 4, p. M27-M45.

(online at: <https://www.delpher.nl/nl/tijdschriften/view?identificatie=dts:2945099:mpeg21:0001>)

(The asphalt rocks of Buton Island, distribution and economic significance'. Oldest rocks on Buton Triassic dark grey bituminous limestones and marls with plant debris, occurring in both N and S Buton. Contain *Monotis salinaria*, *Halobia*, etc. Older rocks unconformably overlain by 10 or more coral reef terraces, up to 400-500 above sea level. Intensely folded Cretaceous *Rosalina* (= *Globotruncana*) limestones. Oil and asphalt seeps partly in Triassic, partly in Tertiary sediments. Etc. Calls Buton sediments part of Tethys)

Bothe, A.C.D. (1928)- Voorkomen en winning der asfaltgesteenten van Boeton. De Mijningenieur, 1928, p. 88.

(Occurrence and exploitation of asphalt rocks of Buton')

Chamberlain, M.I., R.D. Seago, Soebardi & Sumitra (1990)- Hydrocarbon prospectivity of Buton Island, SE Sulawesi, Indonesia. Earth Resources Inst. (ESRI) Report EIB90-1, p. 1-232. (Unpublished Report)

Corne, C.P. & Soehartono (1989)- Utilization of Buton Island rock asphalt in road pavements. In: R.F. Meyer & E.J. Wiggins (eds.) Proc. 4th UNITAR/UNDP Int. Conference on Heavy crude and tar sands, Edmonton 1988, 2, Alberta Oil Sands Technology and Research Authority, p. 397-412.

Davidson, J.W. (1991)- The geology and prospectivity of Buton island, southeast Sulawesi, Indonesia. Proc. 20th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, p. 209-234.

(Stratigraphy-structure Buton different from SE Sulawesi-Muna; more similar to Timor, Seram, Buru. Sedimentation controlled by four tectonic events: (1) 'Pre-Rift'- Permian(?) metasediments, unconformably overlain by E Triassic turbidites derived from Australia- New Guinea continent; (2) 'Rift-Drift'- Late Triassic rifting (turbidites), M Jurassic breakup, and Late Jurassic- Oligocene NW drift (deep marine calcilutites) from Australia- New Guinea; (3-4) 'Syn and Post-Orogenic'- E-M Miocene coarse clastics, Late Miocene fine clastics, and Pliocene marls-claystones. Coarse clastics deposited in intra-thrust basins, generated by E-M Miocene collision of Buton microcontinent with Muna/ SE Sulawesi. Pliocene sedimentation coincided with regional subsidence of Buton following accretion of island to Sulawesi, and E shift of subduction zone)

Emmerton, S., A.R. Muxworthy, M.Sephto, M. Aldana, V. Costanzo-Alvarez, G. Bayona & W. Williams (2013)- Correlating biodegradation to magnetization in oil bearing sedimentary rocks. *Geochimica Cosmochimica Acta* 112, p. 146-165.

(Study on relationship between biodegraded tar sands and magnetization. Includes analyses on tar sands of Tondo Fm at Kabungka and Lawele on Buton island)

Escher, B.G. (1920)- Atollen in den Nederlandsch-Oost-Indischen Archipel. De riffen in de groep der Toekang Besi-eilanden. Mededeelingen Encyclopedisch Bureau, Batavia, 22, p. 1-18.

(‘Atolls in the Netherlands East Indies Archipelago: the reefs in the Tukang Besi Group’. Some of modern Tukang Besi reefs off SE Sulawesi true atolls up to 48km long, some small barrier reefs around islands up to 274m in height. Reefs arranged in four NW-SE trending rows, possibly controlled by two anticlinal axes (with barrier reefs) and two synclinal axes (with atolls))

Fortuin, A.R., M.E.M. De Smet, S. Hadiwasastra, L.J. van Marle, S.R. Troelstra & S. Tjokrosapoetro (1990)- Late Cenozoic sedimentary and tectonic history of south Buton, Indonesia. *J. Southeast Asian Earth Sciences* 4, 2, p. 107-124.

(Late Cenozoic deposition started at 11 Ma after main pre-Neogene deformation, presumably related to collision of Buton microplate with SE Sulawesi. Rapid Late Miocene- E Pliocene subsidence, initially with coarse clastic Tondo Fm gravity flows, followed by later Late Miocene Sampolakosa Fm pelagic deposition. Late Pliocene (3.5 Ma) start of uplift, probably caused by collision between Buton and Tukang Besi Platform submerged microcontinent, and causing 60° clockwise rotation of S Buton)

Hadiwisastra, S. (2009)- Kondisi aspal dalam Cekungan Buton. *J. RISET Geologi dan Pertambangan (LIPI)* 19, 1, p. 49-57.

(online at: <https://jrisetgeotam.lipi.go.id/index.php/jrisgeotam/article/view/22/38>)

(‘Condition of asphalt in the Buton Basin’. Buton heavy asphalt in outcrop in S Buton. Reservoired in Neogene marine Sampolakosa and Tondo units in SW-NE trending Lawele Graben)

Hadiyanto, S.M. Tobing & H. Fujiono (2009)- Oil shale prospect in the Buton Island, Southeast Sulawesi, Indonesia. In: 29th Oil Shale symposium, Colorado School of Mines, Golden CO 2009, p. 1-47.

(Abstract+ presentation online at: www.costar-mines.org/oss/29/presentations/PRES_12-3_Hadiyanto_Fujiono_-_Hendro.pdf)

(Two types of oil shale on Buton: primary oil shale in Late Triassic Winto Fm and secondary asphalt rock/ tar sand in Mio-Pliocene Sampolakosa and Tondo Fms. Hypothetical resource of primary shale is 158 mT oil, secondary 3.6 billion tons asphalt (=226 MB Oil))

Harisma, M.Z. Firihi, V.I. Variani, Muliddin & E.S. Hasan (2025)- Distribution of Tondo clastics in the Wakoko and Wambona Rivers, Buton Island, Southeast Sulawesi. *Proc. Int. Conference on Geosciences and Geotechnology (ICOGEST 2024)*, Makassar, IOP Conference Series: Earth and Environmental Science 1525, 012011, p. 1-7.

(online at: <https://iopscience.iop.org/article/10.1088/1755-1315/1525/1/012011/pdf>)

(Study of Miocene clastics of Tondo Fm in SE Buton (Wakoko River coarse conglomerates) and NW Buton (Wambona River conglomerates and sandstones. All clasts are sedimentary rocks (apparently nothing more to report; JTvG))

Hasria, La Hamimu, A.B. Prawira, Arisona, L.I. Juarzan & S. Septiana (2024)- Petrogenesis of metamorphic rock in the Mukito Formation at Sorawolio region, Bau-Bau City, Buton Island, Southeast Sulawesi Province, Indonesia. *J. Geoscience Engineering Environment Technology (JGEET)* 9, 3, p. 1-8.

(online at: <https://journal.uir.ac.id/index.php/JGEET/article/view/14949/6818>)

(Pre-Triassic metamorphic rocks of Mukito Fm on Buton Island, in (fault?) contact with Triassic Winto Fm and Kanpatoreh Ultrabasic Complex (in W). Several types of metamorphic rocks: serpentinite, phyllite, hornblende schist, chlorite schist and amphibolite. Two types of metamorphic facies: greenschist and amphibolite. Protoliths from tholeiitic oceanic-island arc basalt)

Hasria, A. Okto, M.A. Samsuriq, Muliddin, Masri, Bahdad E.S. Hasan, La Hamimu, S.R. Haraty et al. (2023)- Petrogenesis of metamorphic rocks at Baubau city, Buton Island, Southeast Sulawesi Province, Indonesia. Proc. 4th Int. Conference on Earth, Science, Mineral and Energy (ICEMINE 2021), Sleman, AIP Conference Proceedings 2598, 020006, p. 1-13.

(online at: https://www.researchgate.net/publication/371511946_Petrogenesis_of_metamorphic_rocks_at_Baubau_city_Buton_Island_Southeast_Sulawesi_Province_Indonesia)

(*Study of pre-Triassic Mukito Fm metamorphic phyllites and schists in basement of Kaisabu area, Sorawolio District, Baubau City, SW Buton. Common mafic minerals suggest gabbro and basalt protoliths. Regional metamorphic facies greenschist to amphibolite facies, formed at depths of 8-20 km*)

Hetzl, W.H. (1930)- Over de geologie der Toekang Besi eilanden. De Mijnningieur 11, 3, p. 51-53.

(*'On the geology of the Tukang Besi islands'. Uplifted islands of Tomea, Wangiwangi and Kaledupa mainly composed of Late Neogene marly Globigerina limestones (similar to equivalent rocks on S Buton), covered by 3 or more terraces of uplifted reefal limestones. On Kaledoepa breccious limestone with Lepidocyclina. Strike of folded Late Tertiary beds at right angles to the very young NW-SE trend of rows of raised islands and atolls, suggesting earlier phase of folding, followed by later block-faulting*)

Hetzl, W.H. (1936)- Verslag van het onderzoek naar het voorkomen van asfaltgesteenten op het eiland Boeton. Verslagen en Mededeelingen betreffende Indies delfstofkunde en hare toepassingen, Dienst Mijnbouw Nederlandsch-Indie, Landsdrukkerij, Batavia, 21, p. 1-56.

(online at: <https://www.delpher.nl/nl/boeken/view?identifier=MMKB24:078914000:00011>)

(*'Report of an investigation of the occurrence of asphalt-bearing rocks on Buton Island'. Detailed descriptions of surface asphalt deposits, probably originated from Triassic oil. Bitumen impregnations in Miocene sandstones and Pliocene Globigerina marls, unconformably over highly folded, deep marine Triassic-Cretaceous (-Eocene?) sediments. Late Eocene Wani Beds in N Buton are a thin interval within pelagic carbonates-marl section, and is composed of sandstone and polymict conglomerate with Late Eocene larger forams (Pellatispira, Spiroclypeus vermicularis, Lepidocyclina boetonensis, Discocyclina, Astero-cyclina and small Nummulites), and fragments of reworked Upper Cretaceous Globotruncana limestone and serpentinite. With 1:200,000 scale geologic map of Buton and detail maps of asphalt terrains*)

Hetzl, W.H. (1936)- Boetoniet, een bijzonder gesteente van het eiland Boeton (ZO Celebes). De Ingenieur in Nederlandsch-Indie (IV) 5, 10, p. IV.151- IV.155.

(online at: <https://www.stichtingblauwelijn.nl/assets/files/1938-10.pdf>)

(*'Boetoniet, a peculiar rock type from Buton island'. Dark, glassy rock named 'boetonite' found along margins of peridotite outcrops. Mainly in S Buton, at W side of Kapantoreh Mountains. Commonly as veins in Triassic and Neogene. Contain chromite and marcasite. Possibly hydrothermal weathering product near ultrabasic rocks (also in Handelingen 8e Ned.-Indisch Natuurwetenschappelijk Congres, Surabaya 1938, p. 481-485)*)

Horizon/ Robertson (2004)- Buton prospectivity screening study. Multi-client study, PT Horizon, Jakarta, 118p. (Unpublished report by Jan Bon, Andy Livsey et al.)

Janssen, A.W. (1999)- Euthecosomatous gastropods (Mollusca: Heterobranchia) from Buton (SE Sulawesi, Indonesia), with notes on species from Viti Levu, Fiji; systematics, biostratigraphy. Geologie en Mijnbouw 78, 2, p. 179-189.

(online at: <https://drive.google.com/file/d/0B7j8bPm9Cse0U0hWNzdiWjUWnM/view>)

(*Revision of Neogene pteropoda from asphaltic deposits of Buton (Sampolakosa Beds?). Faunas first described by Martin (1935) and Beets (1943, 1950, 1953). Beets recognized this as deep marine fauna, of probable Mio-Pliocene age. With planktonic gastropods (pteropods), incl. Styliola subula, Cavolinia bituminata, C. mexicana. and Diacria mbaensis. Comparison with Fiji associations suggests Late Miocene age for Buton faunas (Tortonian-Messinian; fits with ages concluded from microfaunas by Fortuin et al. 1990; JTvG))*)

Kanehara, K. (1943)- Boeton Island (Dutch East Indies), its geology, asphalt and manganese ore. J. of Geography (Chigaku Zasshi), Tokyo, 55, 653, p. 237-264.

(*Review of Hetzel (1936) original report on geology of Buton island*)

Keijzer, F.G. (1945)- Upper Cretaceous smaller foraminifera from Buton (D.E.I.). Proc. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam, 48, p. 338-339.

(online at: <https://dwc.knaw.nl/DL/publications/PU00017937.pdf>)

(Tertiary asphalt-bearing marls of Buton generally pure Globigerina-Globorotalia-marls, probably Neogene. One sample with angular white and grey pieces of limestone (resembling Cretaceous Globotruncana-limestones), grey and black pieces of chert, and common reworked Upper Cretaceous planktonic foraminifera, incl. Globotruncana arca, Gt. calcarata, Pseudotextularia varians, Planoglobulina acervulinoides, Bolivinoidea seranensis, Globorotalia velascoensis (= Paleocene?; JTvG), etc.). Fauna very similar to U Cretaceous fauna from Seram, described by Van der Sluis (1949))

Keijzer, F.G. (1953)- Reconsideration of the so-called Oligocene fauna in the asphaltic deposits of Buton (Malay Archipelago). 2. Young-Neogene foraminifera and calcareous algae. Leidsche Geologische Mededelingen 17, p. 259-293.

(online at: www.repository.naturalis.nl/document/549557)

(Buton asphalt-bearing marls deep marine facies and Pliocene in age, not Oligocene as previously postulated. With 333 species of deep marine benthic foraminifera, incl. many species of Bolivina, Cassidulina, Cristellaria, Dentalina, Lagena, Nodosaria, Planulina, Siphogenerina, Sphaeroidina, etc. Also planktonics, incl. Globorotalia tumida flexuosa and Gq. altispira. Also: (1) breccia with reworked U Cretaceous clasts and Globotruncana planktonic forams (indicative of mud volcanism?); (2) sample W-10 from Wariti asphalt field with M Miocene larger forams Katacycloclipeus, Miogypsina, Lepidocyclina (T.) rutteni; (3) Halimeda. With appendix on sample from Bawean with E-M Miocene larger forams Lepidocyclina (N) and Miogypsina primitiva. (Amphimorphinella butonensis Keijzer indicator of hydrocarbon seepage?; Hayward et al. 2011))

Koswara, A. & D. Sukarna (1994)- Geological map of the Tukang Besi sheet, Southeast Sulawesi. Geological Research Development Centre (GRDC), Bandung. 14p.

(Tukang Besi islands mainly Quaternary coral reef limestone, unconformably over core of latest Miocene-Pliocene Ambeuwa Fm Globigerina marls, dipping 15-30°. Wowoni Island N of Buton has juxtaposed ?Triassic metamorphics, Cretaceous? ultramafics overlain by M-L Miocene Lampeapi Fm conglomerate, sandstones with coals, overlain by Late Miocene- Pliocene Lansilowo Fms marls, limestone and sandstones)

Kuenen, P.H. (1928)- Geologische problemen in verband met de Toekang-Besi eilanden. Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap, ser. 2, 45, 2, p. 236-247.

('Geological problems associated with the Tukang Besi islands'. Tukang Besi islands SE of Sulawesi four rows of atolls, possibly all associated with young NW-SE trending anticlinal structures)

Kuenen, P.H. (1933)- The formation of the atolls in the Toekang-Besi-group by subsidence. Proc. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam 36, 3, p. 331-336.

(online at: <https://dwc.knaw.nl/DL/publications/PU00016412.pdf>)

(As described by Escher (1920), Tukang Besi islands are atolls and raised islands arranged along NW-SE fault trends. Post-Pleistocene subsidence produced atolls where reef growth kept up with subsidence)

Ling, H.Y. & R.B. Smith (1995)- Role of Eocene and Cretaceous radiolarians from Buton Island in the Eastern Indonesian collision tectonics. Proc. Int. Symposium Geology of SE Asia and adjacent areas, Journal of Geology, Hanoi, Geological Survey Vietnam, 5-6, p. 160-161. (Abstract only)

(Pre-Neogene Wolio collision complex of N Buton includes samples with early M Eocene radiolaria (U Tobelo Fm of Turumbia Bay) and well-preserved Cretaceous Aptian- Albian radiolaria (Tobelo Fm at Rumu River section of SE Buton))

Ma, G., J. Wang, L. He, X. Li & H. Sui (2020)- The nature of the Indonesian carbonate asphalt rocks and its insights into the separation processes. J. Petroleum Science and Engineering 195, 107752, p. 1-8.

(Buton asphalt rocks composed of (Miocene-Pliocene) porous foraminifera fossils, with asphalt covering porous particles and also penetrated into chambers through pores. Microstructure main reason hindering

separation of asphalt from carbonate mineral surface using hot water extraction method. Etc. With interesting images of foram grains from Lawele and Kabungka mines)

Martin, K. (1933)- Eine neue Tertiäre Molluskenfauna aus dem Indischen Archipel. Leidsche Geologische Mededelingen 6, 1, p. 7-32.

(online at: www.repository.naturalis.nl/document/549740)

('A new Tertiary mollusc fauna from the Indies Archipelago'. Mollusc assemblage of 26 new species from Buton asphalt-bearing marls/ limestones, which are unconformable over folded Mesozoic sediments. Assigned Late Oligocene or E Miocene age (Later interpretations favor Late Miocene-Pliocene ages (e.g. Beets 1952, Keyzer 1953, Fortuin et al. 1990, Janssen 1999))

Martin, K. (1935)- Oligocaene Gastropoden von Buton. Leidsche Geologische Mededelingen 7, 2, p. 111-118.

(online at: www.repository.naturalis.nl/document/549589)

('Oligocene gastropods from Buton'. Molluscs from asphalt-bearing limestones of Buton 35 species, all extinct, suggesting pre-Neogene (Oligocene) age. Nine new gastropod species described here (since then age corrected as Mio-Pliocene; JTvG))

Martin, K. (1937)- Die oligocaenen Mollusken von Buton als Auswurflinge eines Schlammsprudels betrachtet. Leidsche Geologische Mededelingen 8, p. 311-314.

(online at: www.repository.naturalis.nl/document/549248)

('The Oligocene molluscs from Buton, interpreted as clasts of a mud volcano'. Molluscs from Buton originally dated as Oligocene, but Sampolakosa Fm now regarded as Late Neogene age by Hetzel (1936). Older material may be explained as mud volcano ejecta (see also Beets 1952, who argues for Miocene-Pliocene age of Buton molluscs)

Milsom, J. (1992)- Structure and collision history of the Buton continental fragment, Eastern Indonesia. AAPG International Conference, Sydney 1992, Search and Discovery Article 91015, 1p. (Abstract; full paper below)

(online at: <https://www.searchanddiscovery.com/abstracts/html/1992/international/abstracts/1117b.htm>)

(Fragment of Australian continental margin now exposed on Buton, SE of Sulawesi. Asphalt reserves support significant local industry. Buton Terrane underwent significant relative rotations and extends beneath adjacent island of Muna. Tukang Besi platform E of Buton may be distinct, unrelated, unit. Ophiolitic rocks exposed on Buton not attached to deep roots and are thin overthrust sheets not marking terrane boundary)

Milsom, J., J. Ali & Sudarwono (1999)- Structure and collision history of the Buton continental fragment, Eastern Indonesia. American Assoc. Petroleum Geol. (AAPG) Bull. 83, p. 1666-1689.

(Buton is Australian-derived continental terrane. Gravity defines present-day W limits of Buton terrane and suggests terrane includes Tukang Besi platform in E. Ophiolitic rocks on Buton no deep roots, but thin and isolated overthrust sheets, and do not mark terrane boundary. Buton separated from Australia in Jurassic or Late Triassic, and collided with Eurasian margin in SE Sulawesi in Oligocene or E Miocene. Extension dominated recent history of area, producing minor separation of Tukang Besi from Buton and dispersion of other fragments, some of which have been incorporated in collision zone in Outer Banda arc. Oil seeps and asphalt deposits of Buton show hydrocarbons can be sourced from these fragments)

Mubroto, B. & J. Ali (1998)- Tectonic rotations indicated by the late Cenozoic paleomagnetic rocks in Buton Island, Southeast Sulawesi, Indonesia. In: J.L. Rau (ed.) Proc. 33rd Session Coord. Comm. Coastal and Offshore Programmes E and SE Asia (CCOP), Shanghai 1996, 2, p. 246-258.

(Buton island continental fragment impacted, accreted and uplifted when Tukang-Besi platform began docking with SE Sulawesi in Pliocene (2-3 Ma). Two major structural orientations; N-S in N part, NE-SW in S part, suggesting 60° clockwise rotation of S Buton with respect to N Buton (Fortuin et al. 1989). Data from 41 paleomagnetic sites from Miocene-Pliocene Tondo and Sampolakosa Fms suggest N Buton rotations of ~30° CW and CCW, probably local, C Buton small rotations, and S Buton 30-60° CW rotation. Data imply thin-skinned sheets associated with collision)

Mujito, S. Hadipandoyo & T.H. Sunarsono (1998)- Hydrocarbon resource assessment of the micro continent Buton Basin, southeast Sulawesi, Indonesia. In: J.L. Rau (ed.) Proc. 33rd Session Coord. Comm. Coastal and Offshore Programmes E and SE Asia (CCOP), Shanghai 1996, 2, p. 1-9.

(Buton basin assessment of hydrocarbon potential. Primary source rock Late Triassic Winto Fm with up to 16% TOC. Main reservoir Miocene Tondo Fm sandstones. Oil potential max. 1.373 million tons, expected value 0.205 million tons. Gas potential max. 0.412 milliards m³, expected value 0.061 milliards of m³)

Nolan, S.C., M.E.M. de Smet, M. Chamberlain, S. Gafoer, S. Santosa & Soebardi (1989)- Hydrocarbon prospectivity of Buton Island, S.E. Sulawesi, Indonesia. Earth Resources Institute (ESRI) Report, p. 1-99.
(Unpublished)

Okhotnikova, E.S., Y.M. Ganeeva, E.E. Barskaya, G.V. Romanov, T.N. Yusupova et al. (2016)- Composition and physicochemical properties of natural bitumen from the Pasar Wajo deposit (Indonesia). Petroleum Chemistry 56, 8, p. 677-682.

(Bitumen from Pasar Wajo, Buton island, classified as asphalt. Low concentrations of sulfur and trace elements and lack of normal-chain hydrocarbons)

Pedoja, K., L. Husson, A. Bezos, A.M. Pastier, A.M. Imran, C. Arias-Ruiz, A.C. Sarr, M. Elliot, E. Pons-Branchu, M. Nexer & V. Regard (2018)- On the long-lasting sequences of coral reef terraces from SE Sulawesi (Indonesia): distribution, formation, and global significance. Quaternary Science Reviews 188, p. 37-57.

(online at: <https://hal-normandie-univ.archives-ouvertes.fr/hal-01983439/document>)

(Late Cenozoic coral reef terraces identified on 23 islands of Tukang Besi and Buton archipelagos. Reef terrace sequences from Wangi-Wangi (Buton) and islands of Ular, Siumpu and Kadatua with terraces from last interglacial maximum (MIS 5e; ~122 ka) at elevations <20m, at 34m on W Kadatua. On SE Buton reef terraces up to 650m, with >40 undated strandlines. On Sampolawa Peninsula 18 strandlines up to 430m, possibly as old as 3.8 ± 0.6 Ma)

PT Elnusa Geosains (2005)- Hydrocarbon potential of Buton Basin. Petromin 31, 6, p. 14-20.

PT Robertson Research Utama Indonesia (1989)- A geochemical evaluation of field samples (of rock, asphalt, water and gas) from Buton Island, S.E. Sulawesi. Report 139, p. *(Unpublished)*

(Triassic Winto Shale good oil source rock, but presence of gammacerane in widespread asphalts appears to preclude Winto Shale as source)

PT Robertson Research Utama Indonesia (1989)- Results of petrographic analyses Buton Island outcrop samples. Report 140, p. *(Unpublished)*

(Triassic Winto sandstones almost entirely lithic, derived from sediments and metamorphic rocks, and locally common igneous material)

PT Robertson Research Utama Indonesia (1989)- A petroleum geochemical evaluation of four asphaltic stained shallow cores from Lawele Pit, Buton Island. Report 197, p. *(Unpublished)*

(Asphalt analyses suggest degraded oil isotopically light and derived from terrestrial organic matter. Presence of gammacerane may indicate a hypersaline, marine carbonate or restricted lacustrine source)

Reinhold, T. (1952)- Reconsideration of the so-called Oligocene fauna in the asphaltic deposits of Buton (Malay Archipelago). 3. Report on diatoms. Leidsche Geologische Mededelingen 17, p. 294-297.

(online at: www.repository.naturalis.nl/document/549751)

(Diatoms from (Mio-Pliocene) asphaltic marls of Buton with species related to Upper Miocene Globigerina marls of Java: Actinodiscus, Coscinodiscus, Hemidiscus, etc.)

Rochmanto, B. & L.M. Adam (2007)- Sedimentary environment of Sampolakosa Formation at Gonda Baru, subdistrict Sorawolio, Bau-Bau, Southeast Sulawesi. Proc. Joint Convention 32nd HAGI, 36th IAGI and 29th IATMI, Bali, JCB2007-251, p. 1-3.

(online at: www.iagi.or.id/web/digital/28/2007_IAGI-Bali_Sedimentary-Environment-of-Sampolakosa-Formation.pdf)

(Studied 61m of outcrop of middle part of Sampolakosa Fm at Gonda Baru, Buton. Lithology marine marl with thin limestones and diatomites in middle and lower part. Age Early Pliocene (N18), environment middle shelf-lower slope. Not much detail, no figures)

Rochmanto, B. & Darwin (2007)- Depositional environment of the Tondo Formation at Wakoko River Pasar Wajo Area, District of Buton, Southeast Sulawesi. Proc. 31st Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA07-G-101, p. 1-6.

(Student paper about 15m of late M Miocene (zone N14) Tondo Fm section at Wakoko River, S Buton. Coarsening-upward shale-sand packages, interpreted as deltaic depositional environment with tidal and fluvial dominance)

Saleh, I., R. Husain & R. Langkoke (2022)- Sulphide minerals in limestone: Trap rock of Buton asphalt on block Kabungka mine C Pt Wijaya Karya Bitumen, Buton regency, South East Sulawesi. Proc. 4th EPI Int. Conf. Science and Engineering (EICSE) 2020, AIP Conference Proceedings 2543, 050012, p. 1-6.

(online at: <https://aip.scitation.org/doi/abs/10.1063/5.0095489>)

(Sulphide minerals in asphalt-bearing Late Miocene- E Pliocene bathyal Sampolakosa marly limestone (called 'asbuton'): pyrite, chalcopyrite, bornite, covellite)

Sartono, S., I. Hendrobusono, H. Murwanto & B. Suprpto (1990)- Tektonik akresi di Buton: olistostrom dan melange diapir. Proc. 19th Annual Conv. Indonesian Association Geologists (IAGI), Bandung, 2, p. 1-26.

('Accretion tectonics of Buton: olistostrome and melange diapir'. Late Miocene- Pliocene collision complex on Buton with Sampolakosa sedimentary olistostrome with olistoliths including ophiolitic and igneous rocks (with zone N18-N19 planktonic foraminifera))

Satyana, A.H. (2011)- World-class asphalt deposits of Buton Island, SE Sulawesi, Indonesia: geology, geochemistry, mining status and problems. Proc. Sulawesi Mineral Resources Seminar, Manado 2011, Indonesian Soc. Economic Geology (MGEI), p. 1-15.

(Review of asphalt deposits of Buton Island, known since 1920s and intermittently exploited since 1925. Reserves 100-132 Mtonnes of asphalt. Asphalt sourced by Triassic Winto Fm marine shales. Originally medium gravity oils migrated into uplifted and thrust carbonates of Pliocene Sampolakosa or sandstones of Miocene Tondo Fm, now biodegraded)

Satyana, A.H., N.A. Ascaria, A. Krisnabudhi & R.D. Prasetyo (2023)- Prospectivities of Buton area, Southeast Sulawesi: new insights from revisiting integrated geological-geophysical-geochemical data. Proc. 47th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA23-G-68, p. 1-20. *(online at:*

https://tektonesia.org/wp-content/uploads/2024/07/satyana-et-al-2023-ipa_revisit-petrol-buton.pdf)

(Comprehensive review of complex geology with asphalt deposits and remaining hydrocarbon prospectivity of Buton area. Buton-Tukang Besi, SE Sulawesi and Banggai-Sula microcontinents collided with Sulawesi sequentially during M Miocene. Sediments younger than M Miocene (Tondo Fm) are post-collisional. Mid-Miocene collision obducted Pretertiary Kapantoreh ophiolite, exposed in S Buton. Etc.)

Satyana, A.H., C. Irawan & W. Kurniawan (2013)- Revisit geology and geochemistry of Buton asphalt deposits, SE Sulawesi: implications for petroleum exploration of Buton area. Proc. 37th Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA13-G-170, p. 1-18.

(Asphalt deposits of Buton Island, known since 1920's, contain 15-35% asphalt/ bitumen, mainly impregnations in Pliocene Sampolakosa Fm carbonates and Miocene Tondo Fm sandstones, in uplifted and intensively thrust anticlines. Asphalt deposits biodegraded crude oils derived from marine Type II kerogen, tied to Triassic calcareous shales and bituminous limestones of Winto Fm. Sulfur content generally high (2.5- 9.3%). Five exploration wells on Buton between 1976-2012, all dry, some with oil shows in Miocene. Nunu oil seep on W Buton contains oleanane, indicating Tertiary source)

Schreiter, R. (1932)- Der Boetonasphalt mit seinen Foraminiferen. Asphalt und Teer, Strassenbautechnik, Berlin, 32, p. 659-661.

'The Buton asphalt with its foraminifera'. Obscure reference characterizing Buton asphalt-bearing rocks as bituminous Globigerina marls, with planktonic foraminifera Pulvinulina (=Globorotalia) menardii and Orbulina universa. This suggests M Miocene or younger age, not Oligocene as originally suggested by Martin (1934), etc.). (from summary by F. Musper in Neues Jahrbuch Mineralogie Geologie Palaeontologie 1937, p. 316)

Sikumbang, N., P. Sanyoto, R.J.B. Supandjono & S. Gafoer (1995)- Geologic map of the Buton Quadrangle, Southeast Sulawesi, 1:250, 000. Geological Research Development Centre (GRDC), Bandung.
(Geologic map SE Sulawesi Buton/ Muna islands between 4.15 and 5.45° S. Oldest rocks pre-Triassic Mukito Fm metamorphics. Jurassic-Triassic low-metamorphic Doole Fm (?). Oldest sediments Triassic Winto Fm shale, ~750m thick sandstone and limestone, with bivalves Halobia, Daonella and Monotis salinaria, ammonite Juvavites ceramensis and radiolaria. Early Jurassic Ogena Limestone, pelagic, with ammonites Phylloceras, Psiloceras and Arietites and foraminifera Involutina liassica, Epistomina. Late Jurassic Rumu Fm ~150m red pelagic limestone-marl with manganese deposits and Belemnopsis gerardi, Malayomaorica, Stomiosphaera moluccana and Cadosina fusca. Cretaceous Tobelo Fm deep marine calcilutite with radiolaria, Globotruncana, Heterohelix, etc. Unconformably overlain by 1300m Miocene Tondo Fm limestone and clastics with oil seeps-asphalt in S Buton (basal limestone latest Oligocene?; JTvG), Pliocene Sampolakosa Fm marls. Late Oligocene collision between Buton Block and SE Sulawesi caused folding-thrusting of Pre-Miocene rocks)

Smith, R.B. (1983)- Sedimentology and tectonics of a Miocene collision complex and overlying late orogenic clastic strata, Buton Island, Eastern Indonesia. Ph.D. Thesis University of California, Santa Cruz, p. 1-254. *(Unpublished) (Buton exposes M Miocene collision complex, overlain by clastics derived from erosion of uplifted complex. In Wolio Complex, lower part of ophiolite sequence juxtaposed with Triassic- Upper Eocene or Oligocene sediments in imbricate series of W-dipping thrust sheets with deep water limestones. Age of collision later in Sulawesi East Arm (Late Miocene) than in Buton (M Miocene). Buton- E Sulawesi collision zone evolved from W-dipping subduction zone. M- Late Miocene clastic strata (Tondo Fm) mostly bathyal marine sediments which accumulated in two separate basins. Lasalimu basin formed just E of uplifted ophiolite thrust front, which provided most of detritus to basin, forming coastal fan-deltas, slope and base-of-slope deposits. Langkalome basin turbidites accumulated W of uplifted ophiolite belt. (N.B.: 'post-orogenic' Tondo Fm limestone member contains Spiroclypeus, signifying Early Miocene age?; suggesting collision older than E Miocene?; JTvG)*

Smith, R.B. (1987)- Diachronous Neogene microcontinent collision in Buton and Eastern Sulawesi, Indonesia. Geological Society of America (GSA) Annual Meeting 1987 and Exposition, Abstracts with Programs 19, 7, p. 850. *(Abstract only)*

Smith, R.B. & E.A. Silver (1991)- Geology of a Miocene collision complex Buton, Eastern Indonesia. Geological Society of America (GSA) Bull. 103, p. 660-678.
(Buton part of Neogene collision zone along E margin of Sulawesi. Miocene collision of microcontinents with W-dipping subduction zone emplaced Tukang Besi Platform (TBP) against Buton. Buton Wolio collision complex imbricated W-dipping thrust sheets and overturned folds with later steep faults offsetting imbricate stack and controlling present map patterns. Consists of (1) Turumbia Fm mainly Late Triassic- Late Eocene or Oligocene deep-water limestone in E, interpreted as deep-water facies of W TBP margin; (2) Massive peridotite in W, with full ophiolite succession suggested by clasts in overlying conglomerates; (3) Mukito Fm metabasite and metachert remnants of metamorphic sole at base of ophiolite. Pelitic phyllite and quartzite in NE Buton probably slice of TBP continental basement: similar rocks dredged from NE margin of TBP and also form pre-Mesozoic basement of SP. M-U Miocene Tondo Fm clastics derived from uplift and erosion of Wolio Complex, placing M Miocene upper limit on age of TBP collision. Oblique convergence continued into Late Miocene)

Smit Sibinga, G.L. (1928)- De geologische ligging der Boven-Triadische olie- en asfaltafzettingen in de Molukken. Natuurkundig Tijdschrift voor Nederlandsch-Indie 58, p. 111-121.
('The geological setting of the Upper Triassic oil and asphalt deposits in the Moluccas'. Triassic oil and asphalt deposits in Moluccas (in similar facies on Timor, Ceram, Buru, Buton, SE Sulawesi) formed at edge of Mesozoic Sundaland craton. No figures/ maps)

Soeka, S. (1988)- Late Jurassic (Upper Tithonian) radiolaria from Buton Island, Indonesia. In: New Zealand Radiolarian Workshop 1988, University of Auckland, New Zealand, p. 1-25.

Soeka, S. (1991)- Radiolarian faunas from the Tobelo Formation of the Island of Buton, Eastern Indonesia, Ph.D. Thesis, University of Wollongong, Australia, p. 1-399.

(online at: <https://ro.uow.edu.au/theses/1401/>)

(Tobelo Fm of Buton with low-latitude Tethyan radiolarian faunas, ranging from E Cretaceous- Oligocene. 128 species described, incl 3 new genera (Butonastrum, Discoconocaryomma, Paraxitus) and 29 new species (Butonastrum perkinsi, Triactiscus tumidus, Zanola deweveri, Z riedeli, Praeconocaryomma sutrismani, Sphaerostylus lukmani, etc.). E Cretaceous (Valanginian) to Oligocene 5 interval zones, 1 range zone and 3 barren zones. Ten datum planes for local biostratigraphic correlations proposed. Paleolatitude interpretation of Buton E Cretaceous (Valanginian-Hauterivian; S Tethyan; 22-30°S) and E Jurassic (Pliensbachian-Toarcian Ogena Fm; S Austral >40°S). M Jurassic 'breakup unconformity' between E Jurassic Ogena Fm and Late Jurassic Rumu Fm. Wani Fm with Late Eocene larger forams may be lateral equivalent of upper Tobelo Fm. Base of E Miocene (Te) Tondo Beds or Tondo Lst Fm is polymict conglomerate with peridotite debris, Mesozoic limestone, metamorphics, etc. is major unconformity over Oligocene? collision complex. Overlying Tono Fm clastics range into Middle-Late Miocene. Etc.)

Soeka, S. (1997)- Jurassic-Paleogene paleolatitudes of Buton (Indonesia) as indicated by radiolaria. Lemigas Scientific Contributions 20(?), p.

(not online, 2023, 2025)

Soeka, S. (2019)- New species of radiolaria from the island of Buton, South East Sulawesi. Scientific Contributions Oil and Gas (SCOG), Lemigas, 42, 2, p. 73-84.

(online at: <https://journal.lemigas.esdm.go.id/index.php/SCOG/article/download/378/226/885>)

(Six new species of Cretaceous radiolaria from Buton; previously flagged as 'Undetermined' in Soeka (1991))

Soeka, S. & Mudjito (1992)- Early Cretaceous- Paleogene radiolarian biostratigraphy from the microcontinent of Buton, eastern Indonesia. Abstracts 29 International Geological Congress, Kyoto, p. 252. (Abstract)

Soeka, S., Mudjito & Sunarto (1991)- Jurassic-Paleogene paleolatitudes of Buton (Indonesia) as indicated by radiolaria. Proc. 20th Annual Conv. Indonesian Association Geologists (IAGI), Jakarta, p. 609. (Abstract only)

(Three different radiolarian assemblages in Jurassic- Paleogene of Buton: (1) South Austral assemblage in E Jurassic (Pliensbachian- Toarcian) Ogena Fm, indicating paleolatitude of >40°S; (2) South Tethyan assemblage in E Cretaceous Lower Tobelo Fm (20-30°S) and (3) Tropical assemblage in Tertiary. Support interpretation that Buton was part of Australian continent in Triassic- E Jurassic)

Soeka, S., O.S.R. Ongkosongo, M.N. Suhartati & Helfinalis (2008)- Biostratigrafi dan penelusuran evolusi posisi lintang Pulau Buton sejak Mesozoikum dengan radiolaria. In: S. Husein et al. (eds.) Prosiding Seminar Nasional Ilmu Kebumihan 2008, Universitas Gadjah Mada, Yogyakarta, D11, p. 1-15.

(Biostratigraphy and investigation of the evolution of latitudinal position of Buton Island since the Mesozoic with radiolaria')

Suharni, Asrim & Sarman (2022)- Analisis penyebaran aspal Buton berdasarkan data bor di daerah Lawele. Jurnal Geomine 10, 2, p. 124-131.

(online at: <https://jurnal.teknologiindustriumi.ac.id/index.php/JG/article/view/1170/pdf>)

('Analysis of the distribution of Buton asphalt based on drill data in the Lawele area'. Little on geology)

Sulistiyani, L. & Surono (2006)- Facies analysis on the Limestone Member, the Tondo Formation, based on samples taken from Kaisapu Area, Buton, Southeast Sulawesi Province. Proc. Jakarta 2006 Int. Geosciences Conference and Exhib., Indonesian Petroleum Association (IPA), Jakarta, 06-SPG-04, p. 1-5.

(Extended abstract. With facies map of Early Miocene limestone member of Tondo Fm in area in S Buton. Limestone Mb underlain by ultramafic unit in N, interfingers with conglomerate of Tondo Fm Clastic Mb in W

and with Sampolakosa Fm in E and S. At time of limestone deposition, land was situated to W, with open marine conditions E of study area. Four limestone facies: mudstone, boundstone, packstone and wackestone)

Tanjung, H., N. Sukarno, I.T. Mandiri & S.H. Sinaga (2009)- Understanding the genesis of Mukito metamorphics: sole metamorphism and geological consideration. Proc. 38th Annual Conv. Indonesian Association Geologists (IAGI), Semarang, PITIAGI2009-085, 1p. (Abstract only)

(Mukito Fm metamorphics in Kapantoreh Mts in S Buton associated with Kapantoreh ophiolite. Metamorphics imbricated with Triassic Winto Fm to W and ophiolites to E. Predominance of amphibolite facies (hornblende schist, marble) towards ophiolite, rest in green-schist facies (epidotic calcite chlorite schist). Petrochemistry suggest calc-alkaline basalts protolith. Interpreted as metamorphic sole, due to ophiolite obduction, formed from metamorphosed Cretaceous-Paleocene Tobelo Fm limestones and basalt dykes (see also Hasria et al., 2024))

Tanjung, H., N. Sukarno, Y. Yuskar, H. Hermawan, A.D. Zeiza, B.P.H. Sinaga et al. (2008)- Field observation of southern Buton: an overview of hydrocarbon manifestation and geological setting. Proc. 32nd Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA08-SG-074, p. 1-18.

(Literature review of Buton geology, with some field observations and geochemical analyses of source rocks)

Tanjung, H., A.D. Zeiza & I.T. Mandiri (2007)- Trend of petroleum exploration in Buton: an insight from tectonic, stratigraphic and geochemical aspects. Proc. 31st Annual Conv. Indonesian Petroleum Association (IPA), Jakarta, IPA07-SG-030, p. 1-13.

(Literature review of Buton geology and hydrocarbon prospectivity. Buton is site of two collisions: (1) between Muna and Buton microcontinents in Miocene, (2) with Tukang Besi micro-continent from E in Plio-Pleistocene (This scenario is not commonly accepted; JTvG)).

Thoenes, D. (1936)- Het ontstaan van asfalt-bitumen. Doct. Thesis Technische Hoogeschool, Delft, p. 1-140.

(online at: <https://resolver.kb.nl/resolve?urn=MMKB21:037747000:pdf>)

('The origin of asphalt bitumen'. On chemistry and geology of bitumen and formation of natural asphalt, applied to Buton. Buton asphalt here thought to have formed directly from proto-bitumen, without crude oil as intermediate product. Mainly chemical study. With pictures of rich Mio-Pliocene planktonic foraminifera faunas in asphalt rocks (see also critical discussion by Ubaghs and Zeijlmans, 1947))

Tjia, H.D. (1968)- New evidence of Recent diastrophism in East Indonesia. Institute of Technology Bandung (ITB), Dept. Geologi Contribution 69, p. 71-76.

(Absence of two post-glacial sea levels in reef limestones of Tomea, Kaledupa and Wangi-wangi (Tukang Besi islands) interpreted to reflect warping of uplift after 3500-5000 BP)

Tobing, S.M. (2005)- Inventarisasi bitumen padat di daerah Sampolawa, Kabupaten Buton, propinsi Sulawesi Tenggara. Kolokium Hasil Lapangan DIM, 2005, p. 29/1- 29/10. *(online at:*

http://psdg.bgl.esdm.go.id/kolokium/Batubara/29.%20Prosiding%20SAMPOLAWA%20Buton_NO.8.pdf)

(Survey of oil shale seams in Late Triassic Winto Fm in S Buton. Thickness of seams 0.05- 1.5 m, alternating with lime-siltstone and fine-grained lime-sandstone. Only four oil shale seams >1 m. All samples contain lamalginite (0.5- 50%). Rocks seem immature (mean vitrinite Rv 0.2- 0.6%). Oil content in samples 5- 40 l/ton. Oil shale resources down to 100m depth in Winto Fm ~4.5 M ton, with 504k Barrels oil)

Tobing, S.M. (2008)- Kajian potensi bitumen padat/aspal Buton, Propinsi Sulawesi Tenggara. Proc. Pemaparan hasil kegiatan lapangan dan non lapangan tahun 2007, p.

('Study of the potential of solid bitumen/asphalt Buton, Southeast Sulawesi Province')

Tobing, S.M. (2008)- Aspal Buton: analisis dan kajian geokimia hidrokarbon. Buletin Sumber Daya Geologi 3, 2, p. 29-45.

(online at: <https://garuda.kemdikbud.go.id/documents/detail/746867>)

('Buton asphalt: analysis and study of hydrocarbon geochemistry'. Geochemical analyses of samples from Miocene Sampolakosa Fm asphalt, Triassic Winto Fm oil shale and Tondo Fm oil seep on Buton island. Winto

Fm oil shale good hydrocarbon generation potential, from Type II aquatic algal kerogen. Asphalt/bitumen believed to be from carbonate source, oil seep from lacustrine source. No positive correlation between oil seeps, asphalt/bitumen and Winto oil shale)

Triono, U. (2005)- The preliminary survey of solid bitumen accumulation of Kalisusu and surrounding area, Muna Regency, Southeast Sulawesi Province. Kolokium Hasil Lapangan, DIM, 2005, p. 31/1- 31/8.
(online at: http://psdg.bgl.esdm.go.id/kolokium/Batubara/31.%20Prosc%20Kalisusu_No.10.pdf)
(Brief evaluation paper on asphalt on North Buton. Bitumen contained in Late Triassic Winto Fm (resource estimates 2.8 MTons) and Miocene Tondo Fm (6.8 MTons). In Indonesian)

Ubaghs, J.G.H. & C.P.A. Zeijlmans van Emmichoven (1947)- De genese der asfaltafzettingen op het eiland Boeton. Bull. Bureau Mines and Geological Survey Indonesia 1, 1, p. 3-12.
(*'The genesis of the asphalt deposits on the island of Buton'. Authors dispute the dominant theory on formation of Buton asphalt deposits as impregnation of porous Tertiary strata by oil from Triassic source rocks (Zwierzycki 1925, Hetzel 1936, etc.). Preferred interpretation is that asphalt formed from Tertiary oil accumulation into specific Neogene reservoir zones (Tondo- Sampolakosa Fms), 500-800m above base Tertiary, not from underlying isoclinally folded Triassic). With discussions of known asphalt terrains. (Ubaghs and Zeijlmans were two of the few Dutch geologists remaining at Bandung Geological Survey shortly after the end of the Japanese occupation)*)

Umbgrove, J.H.F. (1943)- Corals from asphalt deposits of the Island Buton (East-Indies). Leidsche Geologische Mededelingen 13, 1, p. 29-37.
(online at: www.repository.naturalis.nl/document/549525)
(*Pliocene corals from Buton asphalt deposits at Waisiu. 9 species, 8 of which still living species, incl. Caryophyllia, Stephanotrochus, Cyphastrea, Goniastrea, Favia, Coeloria, Platygyra and Porites. Also illustration of fossil coconut*)

Verstappen, H.Th. (1957)- Een en ander over het rifpantser van het eiland Muna (Z.O. Celebes). Tijdschrift Koninklijk Nederlands Aardrijkskundig Genootschap 74, p. 441-449.
(*'On the reef cap of the island of Muna'. Reefal limestone over much of Muna island (W of Buton, SE Sulawesi), attributed to multiphase Quaternary uplift. Highest uplifted reefs on S sides of both Muna (445m) and Buton islands (700m); no elevated Quaternary reef cover in N. Muna island tilted WNW and cut by transverse faults and faults subparallel to Buton straits. Tilting cannot be attributed to horizontal shifting of geanticline, as postulated in literature)*)

Walley, C.D. & D.T. Moffat (1988)- A review of the geology and hydrocarbon potential of Buton Island, Indonesia. Earth Research Institute (ERI) Report EB88-1, 125p. (Unpublished study)

Wicaksono, S. (2013)- Tektono-stratigrafi dan evolusi tektonik Buton Utara dan Kepulauan Muna, Sulawesi Tenggara. Master's Thesis, Institut Teknologi Bandung (ITB), p. 1-150? (Unpublished)
(*'Tectonostratigraphy and tectonic evolution of North Buton and Muna islands, Southeast Sulawesi'. Early stratigraphic history of Buton Island and SE Sulawesi can be tied to NW Australian margin. Main evolution stages: Pre-Rift Permian (Doole Fm; metamorphics?), Syn-Rift E Triassic (Winto and Meluhu Fms) and Post-Rift Late Triassic-E Jurassic. Continental Drift Stage Cretaceous- M Miocene (Tobelo Fm). Post-Collision stage Syn-Orogenic (Tondo and Sampolakosa Fms) and Recent Uplift (Wapulaka Formation). Collision between Buton and SE Sulawesi/Muna in M Miocene, followed by collision between Buton and Tukang Besi)*)

Widarsono, B., D. Sunarjanto, T.M. Susantoro, Suliantara, H.L. Setiawan, P. Wahyudi, Sugihardjo et al. (2023)- Integrated approach to investigate the potential of asphalt/ tar sand on Buton Island, Indonesia. Lemigas Scientific Contributions Oil and Gas (SCOG) 46, 2, p. 65-85.
(online at: <https://journal.lemigas.esdm.go.id/index.php/SCOG/article/view/1583/pdf>)
(*Buton island large asphalt deposits known and studied since 1920s, and are the only asphalt deposits mined in Indonesia (but for road pavement only)*)

Wing Easton, N. (1937)- Gedachten en studies over petroleum en asfalt, 1. Van waar komt het bitumen der asfaltkalken en -zanden? *Geologie en Mijnbouw* 16, 3, p. 24-31.

(online at: <https://resolver.kb.nl/resolve?urn=MMSHCL02:017132003:pdf>)

(*'Thoughts and studies on petroleum and asphalt, 1- From where comes the bitumen of asphalt limestones and sandstones?'. Mainly critical discussion of Hetzel (1936) assertion that asphalt deposits in Neogene of Buton are sourced from Triassic bituminous shale. More likely source believed to be from Tertiary*)

Wirjosujono, S. & J.A. Hainim (1978)- Cenozoic sedimentation in Buton Island. In: S. Wirjosujono & A. Sudradjat (eds.) *Proc. Regional Conference Geology and Mineral Resources of SE Asia (GEOSEA)*, Jakarta 1975, Indonesian Association Geologists (IAGI), p. 109-119.

(*Exposed Cenozoic on Buton island starts with basal conglomerate of M-L Miocene Tondo Fm (with reworked Cretaceous, Eocene, Oligocene forams and clasts of peridotites and Mesozoic limestones), after Late Oligocene- E Miocene folding. Grades upward into flysch-type shale-silt, passing upward into >800m thick latest Miocene- Pliocene (N18-N21) bathyal Sampolakosa Fm marls. Late Miocene Tondo Fm deposited in tectonic trench. Both formations folded in latest Pliocene- E Pleistocene time. Quaternary reefal limestones uplifted to >700m in S Buton. Mesozoic on Buton starts with Late Triassic flysch. Absence of Lower Jurassic and Lower Cretaceous; U Cretaceous- Eocene Tobelo Fm bathyal pelagic limestones. Late Eocene- E Oligocene conglomeratic 'Wani Beds' folded with Mesozoic-E Paleogene? (paper points out similarities between Buton, Buru and Seram tectonostratigraphy)*)

Yuskar, Y. (2014)- Interpretasi fasies pengendapan Formasi Tondo, Pulau Buton, Sulawesi Tenggara berdasarkan data pemetaan geologi dan potensinya sebagai batuan reservoir minyak bumi. *J. Earth Energy Engineering (J-E3)*, p. 31-39.

(online at: <https://journal.uir.ac.id/index.php/JEEE/article/view/940>)

(*'Interpretation of the depositional facies of the Tondo Formation, Buton Island, SEt Sulawesi based on geological mapping data and its potential as a petroleum reservoir rock'. Tondo Fm in SW Buton gravel sandstone and claystone of Late Miocene age (N17-N18), porosity 8-25%, deposited in turbidite system (deep sea channel)*)

Zheng, C., M. Zhu & D. Zhang (2015)- Characterisation of asphaltenes extracted from an Indonesian oil sand using NMR, DEPT and MALDI-TOF. *Proc. 7th Int. Conference Applied Energy (ICAE 2015)*, Abu Dhabi, Energy Procedia 75, p. 847-852.

(*Chemical study into the molecular structure and properties of asphaltenes extracted from Buton oil sand. No geologically useful conclusions*)

Zwierzycki, J. (1925)- Olie in de Trias op Boeton. *De Mijningenieur* 6, 1, p. 15.

(*'Oil in the Triassic on Buton'. Isoclinally folded Upper Triassic platy limestones, mica-bearing sandstones, and dark claystones-marls with Late Triassic molluscs Halobia, Daonella and Monotis in S part of Buton with some asphalt (similar oil shale on Buru and E Timor?; JTvG). Also Jurassic red sandstone and shales with canaliculate belemnites and Jurassic and/or Cretaceous light colored limestones with foraminifera. Late Tertiary Globigerina marls impregnated with asphalt, derived from Triassic*)



Bibliography of Indonesian Geology