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Warta Geologi

Cover photo: An Early Miocene carbonate banked block, a wackestone sample in strongly cemented tallus facies (reef debris). Photo courtesy of John Jong and Franz Kessler taken in the Shen Yang quarry in Batu Niah, Northern Sarawak.

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Does the Caribbean hold lessons for SE Asia? Part 2

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Abstract: This note builds on an earlier Warta note (Doust, 2022) that summarised the geological development of the island of Trinidad and the margins of the Caribbean Sea. Parts of Southeast Asia can be readily compared to these areas and, I believe, the two provinces can provide valuable analogues for each other. I illustrate this by considering examples of tectonic style taken from transpressional fold belts in Trinidad and eastern Java, from the evolution of foreland and wrench basin stratigraphy and from striking similarities between the stratigraphy and structure of Borneo and Trinidad's Tertiary continent margin deltas.

Keywords: Geological evolution, Trinidad, Java, transpression, Borneo, deltas

INTRODUCTION

In this and a previous note I ask whether the overall geologic similarities between Southeast Asia and the Caribbean (Figure 1) are such that we can make use of aspects of their sedimentary and tectonic evolution to help mutual interpretation efforts. Accordingly, in part 1 (Warta Geologi, December 2022) I examined some of the geological characteristics of the Caribbean, as exemplified in the island of Trinidad and in this second note I have selected a few situations where I believe the geology there carries useful lessons for interpreting the geology in parts of SE Asia.

Rift sequences, characteristic of many Tertiary basins in SE Asia, are rare and scattered in the Caribbean and may not be present at all in Trinidad. However, many aspects of post-rift sag and collision cycles are very comparable, in particular where they record the impact of transpressional shear associated with young plate movements. Below I review a few striking examples.

TRANSPRESSIONAL FOLD AND THRUST BELTS

Figure 2 shows a cross-section through the Tertiary fold and thrust belt in Trinidad based on recent seismic data. The fold belt is oblique and adjacent to the Northern Range dextral wrench uplift zone and is sliced by WNW-ESE directed faults (such as the Los Bajos Fault). This transpressional style has contributed to the formation of stacked imbricated thrust culminations, possibly related to shear faults in both basement and overburden (e.g. Pindell & Kennan, 2002), separated by synclinal troughs. In both Trinidad and eastern Venezuela this results in the formation of disharmonic folds and out-of-sequence thrusts.

A similar transpressional situation is seen in the Tertiary fold belt of eastern Java (Figure 3), where a northward-directed Plio-Pleistocene thrust belt lies adjacent to a major Late Miocene east-west wrench zone, resulting in the development of opposing thrust belts. Subduction driven thrusts of the Kendeng zone border a developing foreland trough (the Randublatung zone), the northern part of which (the Rembang zone) forms a left-lateral wrench flower structure resembling the Northern Range of Trinidad (Figures 3,4). It is interesting to note that in both Trinidad and Java the wrench zones are aligned along crustal hinge lines and are often associated with important facies boundaries.

Much of the East Java fold belt lies below an active volcanic arc but recent interpretations (e.g. Clements *et al.*, 2009) have emphasised its extent along the trend of the Java subduction zone. In Sumatra, where the fold belt corresponds with the Barisan wrench zone (Figure 1), we could expect that the Trinidad model could provide valuable analogues.

Oil fields in Trinidad, charged from rich Late Cretaceous source rocks, are abundant in stacked thrust zones in the fold belt. Their structure is complicated by under-compaction driven by clay diapirism in the rapidly deposited foreland cycle sediments (as seen in eastern Java). A characteristic example is the SW-NE trending Penal/Barrackpore oilfield in the Central Ranges of Trinidad (Figure 5), which comprises multiple oil accumulations in isolated thrust blocks. Notably, sandy

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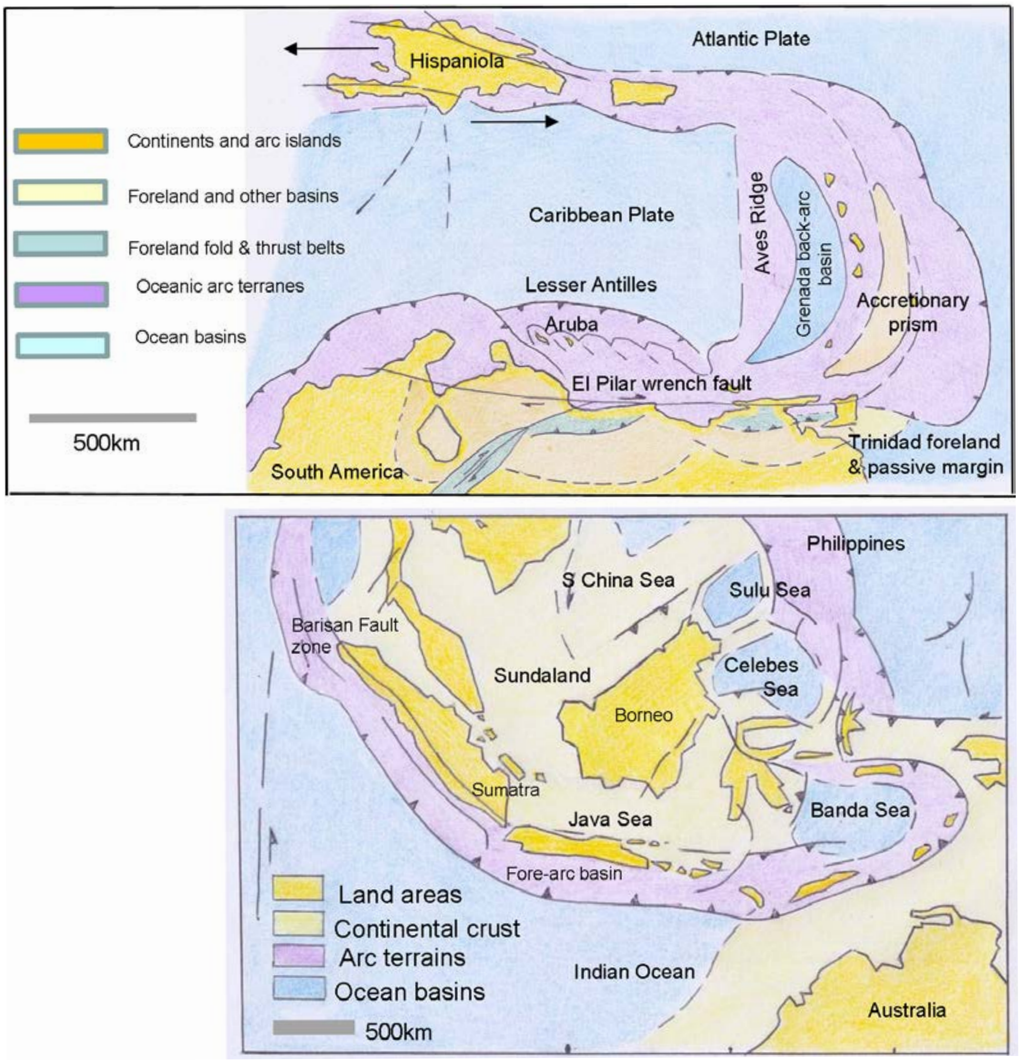


Figure 1: Simplified sketch maps of the eastern Caribbean Sea and SE Asia, highlighting the overall geodynamic similarity, whereby transpressional collisions of continental and oceanic crustal elements have resulted in arcuate deformation zones and the formation of small ocean basins. Note the arc-parallel extension along the Lesser Antilles deformed zone.

turbidite accumulations in depressions on continental slopes up-slope of developing syn-sedimentary thrusts had been recognised in Trinidad purely based on well penetrations, long before 3D seismic data over deep-water fold belts became available (Figure 5B). Similar geologic features form the focus of recent exploration in the deeper water areas of SE Asian Tertiary deltas (e.g. in western offshore Sabah, Grecula *et al*., 2018).

FORELAND BASIN SEDIMENTARY EVOLUTION

As the transpressional zone between the South American continent and the oceanic domain of the Caribbean reached Trinidad in the late Tertiary (Figure 1), the developing fold belt migrated southwards, gradually incorporating foreland cycle deposits into the thrusts and shifting the focus of foreland sedimentation southwards. This trend is seen in many fold belts, but thanks to the precision of age-dating it was already possible in the 1950's to map the displacement of the fold belt through the Oligocene to Pliocene in Trinidad with great accuracy (Figure 6) and to understand the local facies developments. Models like this may help interpretation of developing foreland sequences in, for instance, Java and Sumatra. Possible evidence for such foreland migration has been hinted at in eastern Sabah (Baluguru & Nichols, 2004).

PULL-APART AND "PERCHED" BASINS

These basin types are common in the wrenched tectonic zones of the southern Caribbean and Trinidad and in eastern SE Asia.

Classic examples of pull-apart basins occur in the Caribbean deformed zone north of the El Pilar wrench fault offshore eastern Venezuela, where fault-bounded basins

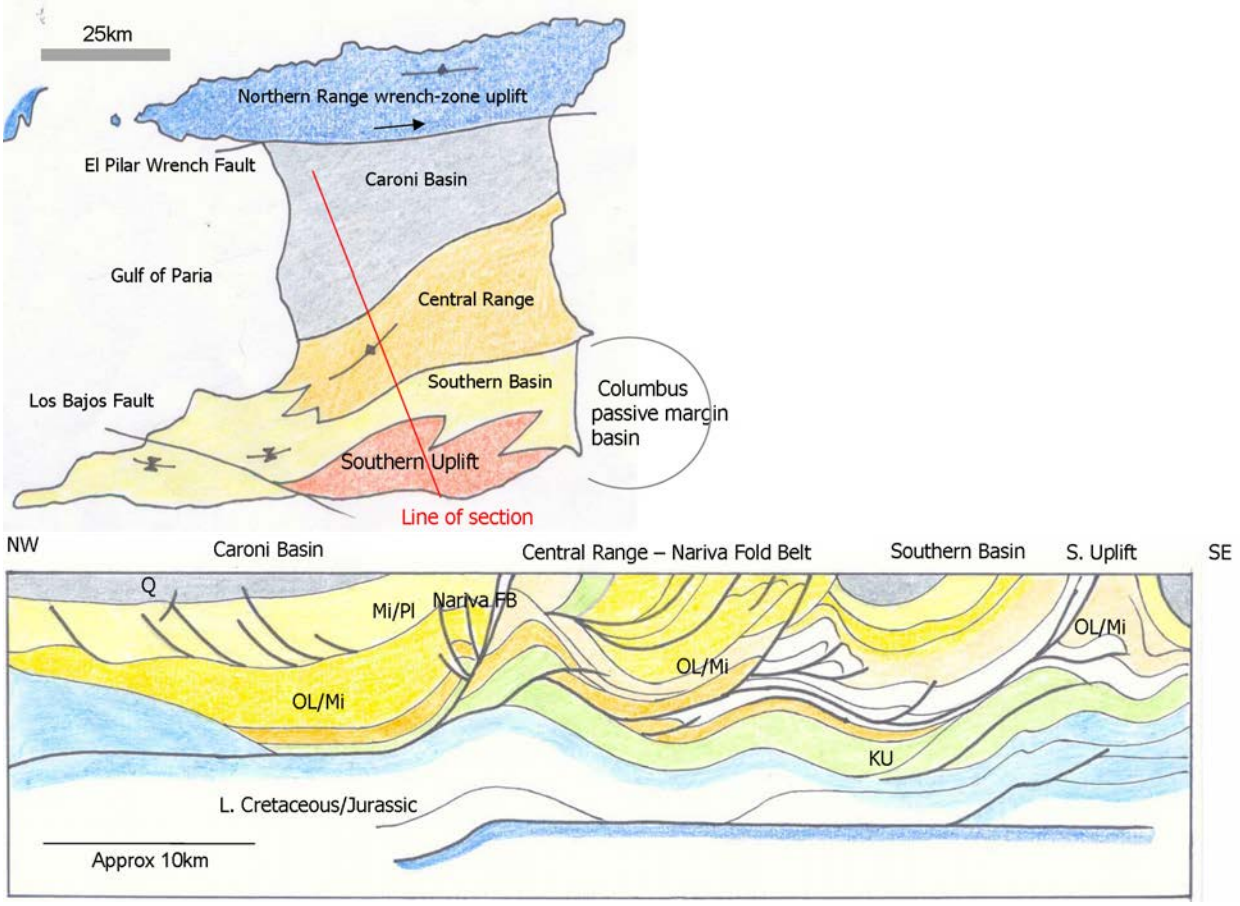


Figure 2: Simplified geologic map of Trinidad and a NW – SE seismic-based geologic section across the Trinidad fold belt (red line), redrawn and simplified from Osman & Moonan, 2019. Stacked imbricated fold trends are separated by synclinal troughs. Note the discordance between surface and subsurface structure. KU = Upper Cretaceous, OL/Mi = Oligo-Miocene, Mi-Pl = Mio-Pliocene, Q = Quaternary

filled mainly with deep marine Tertiary shales separate high blocks upon which the Lesser Antilles islands like Aruba are situated (Figure 1). These basins resulted from "arc-parallel extension" and are related to shear along the Caribbean and South American plate margins as the latter moved westwards.

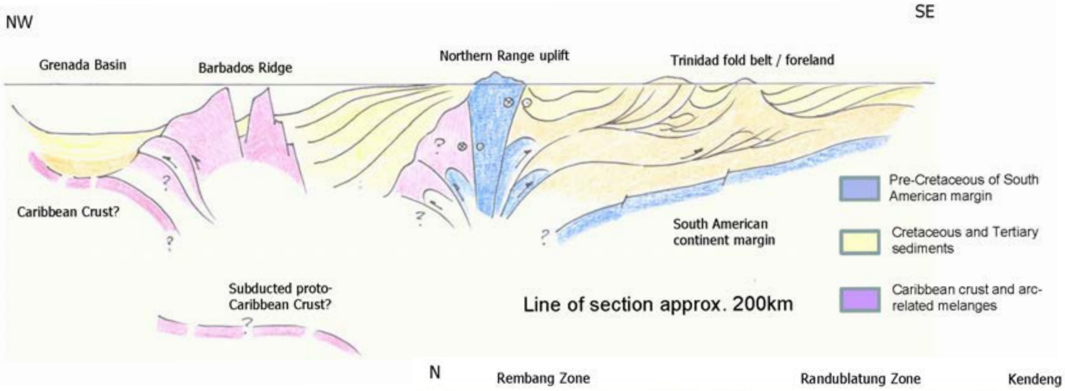
Similar pull-apart basins occur in the Sumatra and Java forearc zone (Berglar *et al*., 2008) and may characterise many of the Tertiary basins in eastern Indonesia and the eastern Philippines whose development has been affected by transcurrent movements (CCOP, 2002). Most of these basins contain gradually shallowing Neogene sequences starting with mainly deep water clastics lying on volcanic and melange basement, often with local carbonate reef developments. As they originated from young shear movements that are still in many cases active, many of them are subject to recent transpression and inversion or, as in the case of Java, volcanic arc migration.

Although "Perched" or "wedge-top basins" vary in structure and stratigraphy, Caribbean candidates include undeformed Plio-Pleistocene supra-fold belt synclines like the Caroni Basin, Gulf of Paria and Southern Basin in Trinidad (Figure 2). They may be tilted or faulted, but often comprise relatively undeformed sequences situated above active fold belts. Identification of these basin types in complex wrench SE Asian fold belts such as in Sabah (Balaguru & Nichols, 2004; Figure 7) and their relationships to underlying and adjacent cycles may help to clarify the structural history.

TERTIARY DELTAS

Growth-faulted SE Asian Tertiary deltas like the Mahakam and Baram deltas are characteristic of the continental margins in Borneo, where they form important petroleum provinces. Their basic structure and stratigraphy, including their petroleum system development, show striking similarities to those of Caribbean deltas such as the Plio-Pleistocene Columbus Basin of offshore Trinidad (Figure 8), also an important petroleum-producing province.

The Columbus Basin developed on an older Tertiary and Cretaceous sequence that lies on Atlantic Ocean crust



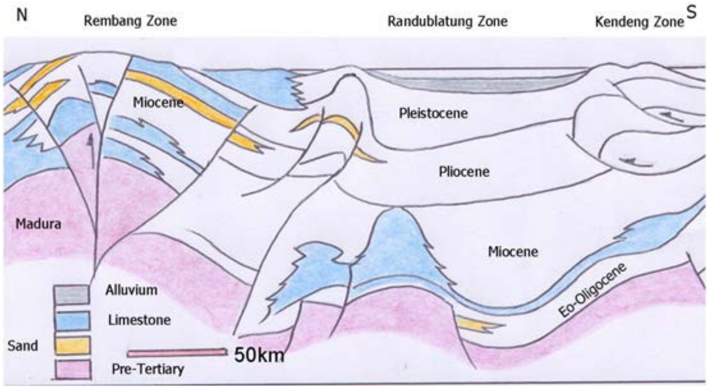
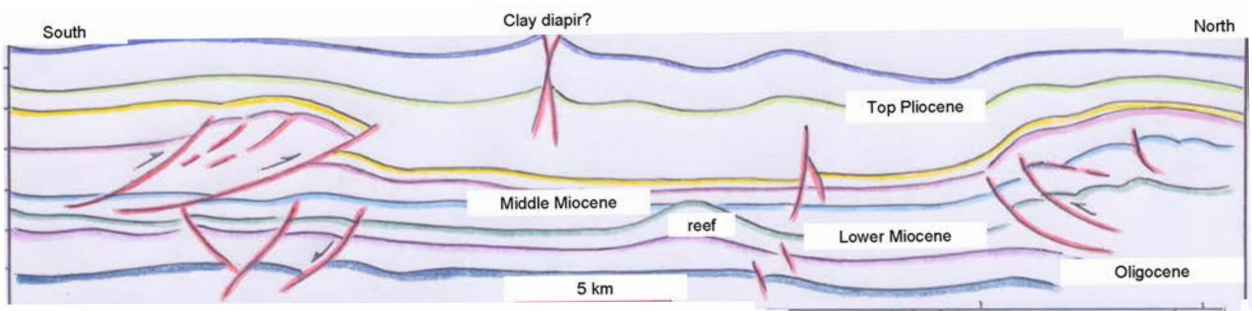
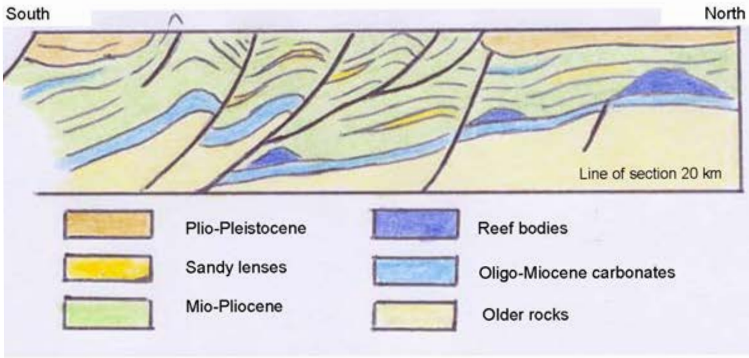


Figure 3: Top: Sketched interpretation of structural provinces in the Trinidad area, compiled and interpreted from various sources (see Doust, 2022). Below: N – S structural cross section through East Java and Madura Island redrawn from Sharaf *et al*., 2005.





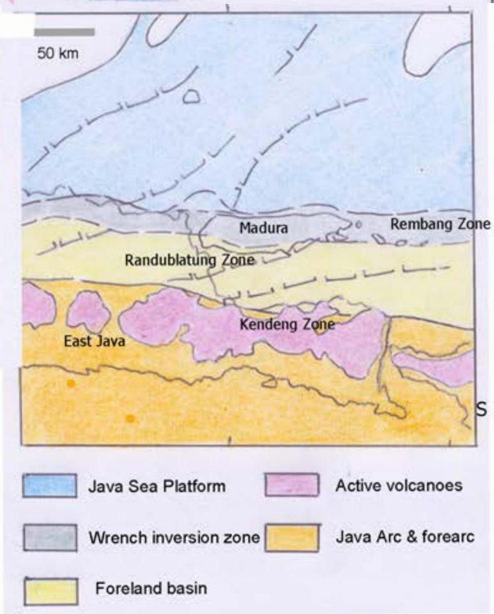


Figure 4: East Java fold belt and wrenched foreland. Top: Interpretation of the Radublatung foreland zone showing opposing thrusts originating from the Kendeng (left) and Rembang (right) trends (From Ran Weimin *et al*., 2019). Below: Detailed structural cross section through the Liman area, Kendeng thrust belt, highlighting the Plio-Pleistocene foreland cycle (ochre colour). Redrawn from Indonesia 2021 bidding round brochure (www.scribd.com). Right: Structural provinces of East Java. Note the oblique fault zones in the Randublatung zone.

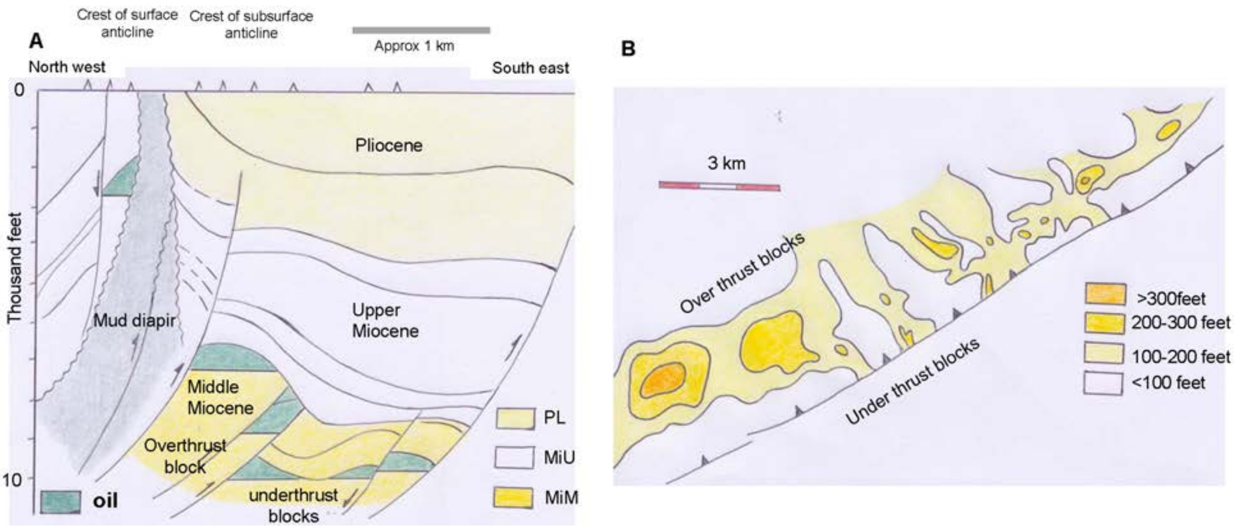


Figure 5: Penal/Barrackpore Field, southern Trinidad. A: NW-SE cross section showing crestal clay diapir and structural offset of surface and subsurface structure. B; Map showing thickness of porous Herrera turbidite sand (middle Miocene) in the overthrust block from well control, showing feeder channels ponded behind and in places breaking through the syn-depositional thrust anticline. From Dyer & Cosgrove, 1992.

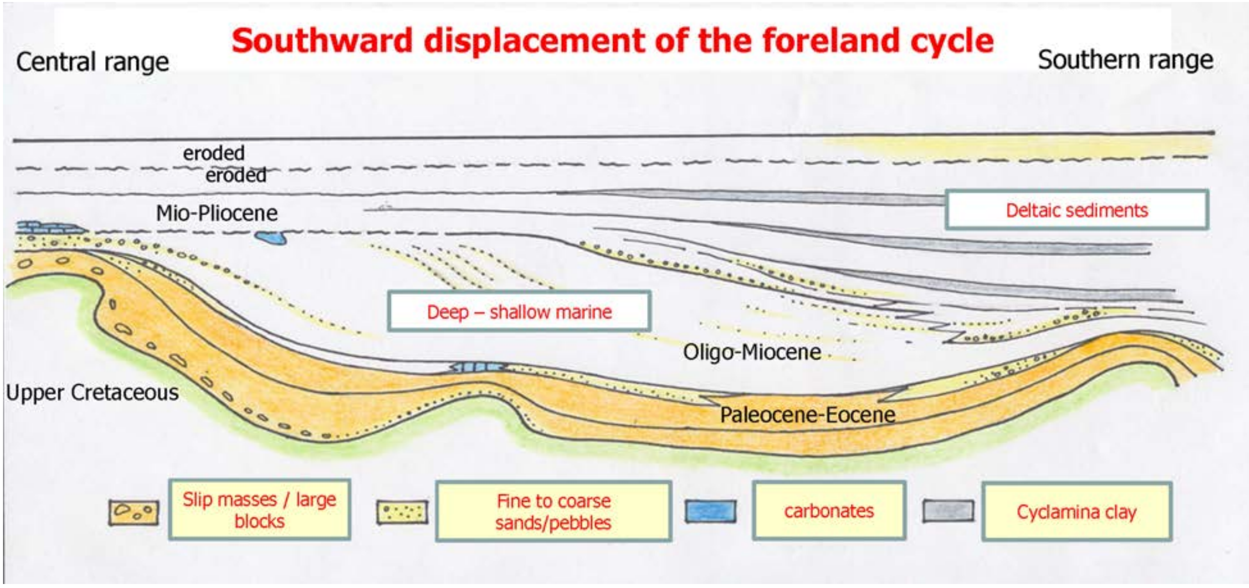


Figure 6: Southward movement of the foreland cycle deltaic sequences during the development of the transpressive collision cycle through the Oligo-Miocene and Mio-Pliocene. Follows the line of section on Figure 2. Redrawn from Kugler & Saunders, 1967 (in Kugler, 1996).

east of the Trinidad fold-belt, outside the zone of Caribbean deformation. It contains a thick sequence of fluvial to deep marine clastics derived from the Orinoco River and forms a classic prograding passive margin delta, in which a full range of depositional environments is developed throughout its Late Pliocene to Pleistocene evolution. As a result of the time-transgressive progradation, the sequence becomes successively more proximal (indicated by upward coarsening trends) through time (Figure 8a). As in other continental margin deltas, the north-eastward prograding delta sequence is cut by a series of down-to-the-basin syn-sedimentary growth faults, here trending NNW-SSE. Movement along a series of NE-SW directed wrench faults in the pre-deltaic (?Cretaceous) basement has resulted in local uplifts that form subtle structural culminations that intersect with the growth fault trends. The main gas fields in this province are situated in these culminations.

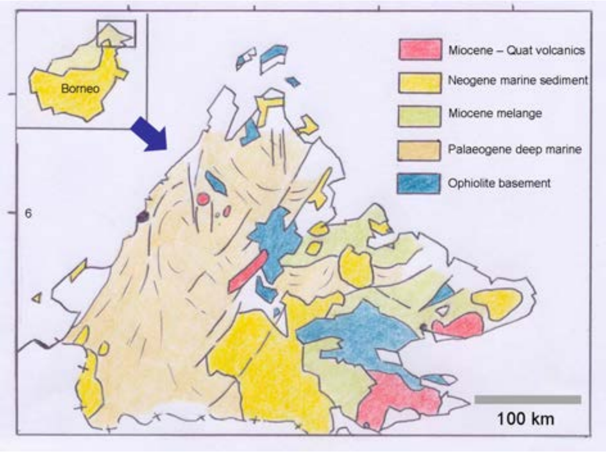


Figure 7: Geological map of Sabah showing the complex relationships of the tectonic units. Uplifted ocean basement, forearc Palaeogene formations and Neogene melange are in places overlain by Neogene shallow marine sediments and volcanics belonging to a foreland cycle. From Balaguru & Nichols, 2004.

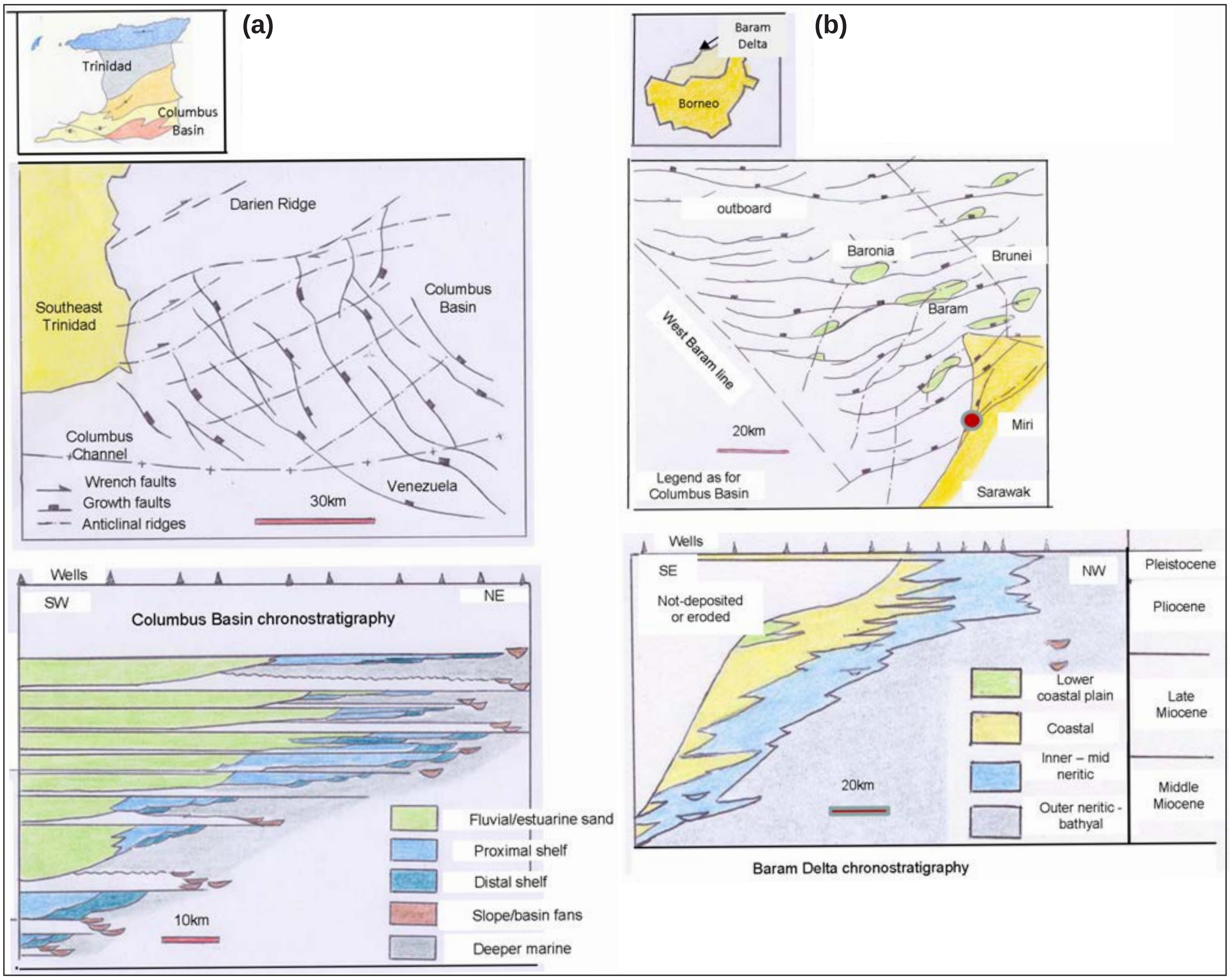


Figure 8: (a) Structure and chrono-stratigraphy of the Columbus Basin, southeast offshore Trinidad. From Wood, 2000.
(b) Structure and chronostratigraphy of the Baram Delta, offshore Sarawak and Brunei with some larger oil fields. Modified from Sandal, 1996 and Petronas, 1999.

The Baram Delta (Sandal, 1996; Petronas, 1999) is also characterised by a succession of prograding offlap sequences of Late Tertiary shallow to deep marine clastics cut by trains of E – W trending growth faults in much the same manner as in the Columbus Basin (Figure 8b). As in the latter, the growth faults are intersected by subtle anticlinal culminations that define the locations of the main oil and gas fields. These culminations are related to a north-westward prograding front of inversion, which according to Tingay *et al*. (2005) is related to 'basement-associated' tectonics, probably associated with transpression along the northwest Borneo continental margin. A notable difference between the Baram and Columbus deltas is the almost complete absence of coastal plain (fluvial) facies in the former due to erosion as a consequence of harsher inversion.

FINAL WORDS

In these two notes (this and previous Warta article), I make a plea for a super-regional approach to sedimentary basin evaluation. I hope I have shown that parts of these two provinces have much in common and that they lend themselves to sharing experiences. Differences do, of course exist, both in style and in detail, but I believe that incorporating data and interpretations of the common issues [in analogue basins] can contribute to new insights, especially when we struggle with limited data and, as in these areas, complex tectono-stratigraphic histories.

ACKNOWLEDGEMENTS

I am grateful for the opportunity I have had to study these fascinating areas and am indebted to those who enabled me to indulge in my attempts to rationalise their basin evolution for myself! Constructive comments from two anonymous reviewers are kindly acknowledged.

CONFLICT OF INTEREST

I declare that there is no conflict of interest in this note.

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The sea level rose fast, but Sarawak was rising faster

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Abstract: Since the end of the last glacial period, around 15550 years ago, melting ice caused the sea level to rise on average by about 110 m, or 7 mm/year. Data collected at the Tusan Cliff section indicate that during the same time span, the Borneo coastline south of Miri was elevated by 132 m. The average rate of uplift of the coastline was estimated to be in the order of 8.5 mm/year, which exceeded the average rate of sea level rise by 1.5 mm. As a result, a prominent cliff section is now exposed. The uplift may be continuing today but may be outpaced in the future by a much faster sea-level rise.

Keywords: Sea level rise, Borneo, uplift, Pleistocene, Holocene

OBJECTIVE AND METHODOLOGY

The objective of this paper is to review the C-14 age record of the coastal terraces at the Tusan Cliff location (Sarawak; Kessler & Jong, 2011; 2014), south of Miri, in the light of improved global sea level data and the availability of better field geology data. Additional photographic material is added to document the cliff section, which is in a setting characterized by very strong coastal erosion. The Tusan Cliff is seen as a particularly reliable data point (among several others), endowed with well-stratified outcrop sections, and without fluvial incisions.

RISING SEA LEVEL, RISING LAND, CLIFFED COAST

Sea level

The context of global sea level rise and tectonic uplift on the northern Sarawak coast resembles a horse race, in which two stallions are galloping side by side and neck to neck, and with an open outcome.

Abundant sea level measurements around the world (Figure 1a) have indicated that sea level has risen by more than 110 m since the last Ice Age ended, when large ice caps melted. At the onset of deglaciation about 19,000 years ago, a brief, at most 500-year long, glacio-eustatic event may have contributed as much as 10 m to the sea level rise at an average rate of about 20 mm/year. During the remaining part of the early Holocene, the rate of sea level rise varied from about 6.0–9.9 mm/year to as high as 30–60 mm/year during brief periods of accelerated sea level rise (Blanchon, 2011; Cronin, 2012). The above range of 6.0-9.9 mm/year is well in line with the estimated yearly 7 mm measured in Tusan. The sea level rise led to a submergence of coast lines all around the world, and the continued sea level is threatening low-lying lands and coastal cities.

Uplift, wave action and age determination

As everywhere else, the sea level is rising along strip of coastline between Kpg. Bakam and Pantai Bungai in Sarawak. The mentioned coastline south of Miri has the characteristics of a cliffed coast (Figure 2, and Kessler & Jong, 2011; 2014). The cliff originated at the end of the last Ice Age, when the platform, the High Terrace (Figure 3), was at sea-level and the coastline laid some 200 m -10 km further land landwards. The (paleo)coastline can be mapped only in places, due to the widespread land clearance for oil palm plantation and other infrastructure projects. Due to the steep seaward dip of the cliff-forming formations, the cliff is highly unstable as the waves and longshore currents scour its base. Wave-cut notches (Figure 2, 4) will eventually cause the collapse of the rock above, as it happened at the "Drinking Horse" location (Kessler & Jong, 2020, and Figure 5).

The elevation of the cliff varies along the coast. There is a scatter of C-14 values from the coaly sands of the High Terrace (Kessler & Jong, 2011; 2014 and Table 1), which suggests minor vertical movements since the end of the Pleistocene. The age dates of the coaly clasts suggests that individual segments of the High Terrace, with their mangrove swamp facies developed at slightly different times. The Tusan section was selected as a suitable location to compare the sea-levels with uplift as it provides a good stratigraphic outcrop section at the cliff, and the elevation of the High Terrace is at a constant elevation of approximately 22 m relative to the immediate surroundings.

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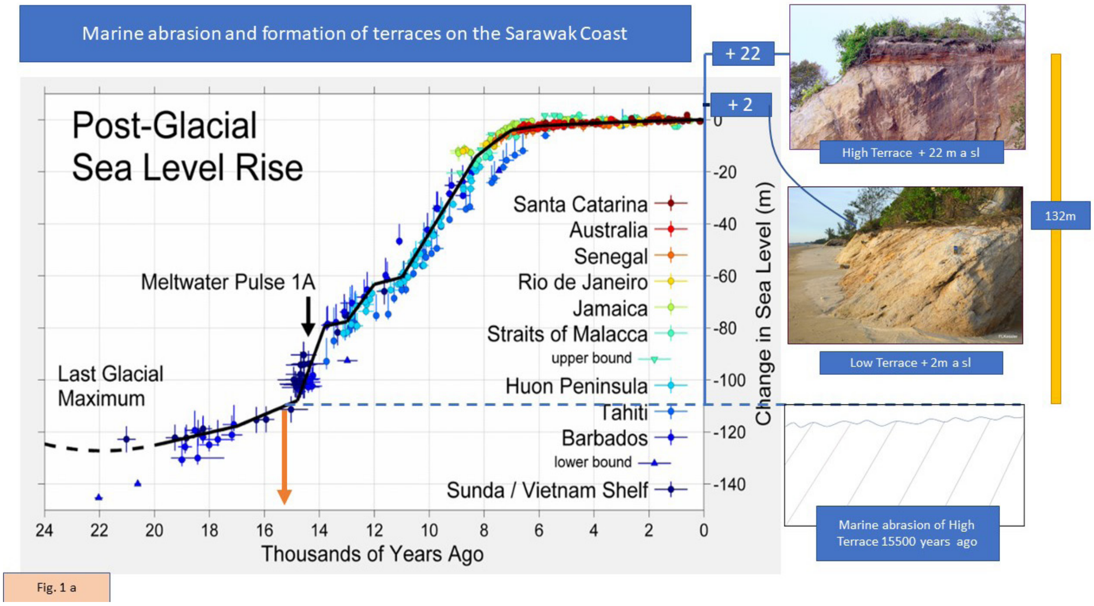

Figure 1a: A comparison of sea level rise and coastal uplift data. This figure shows sea level rise the end of the last glacial episode based on data from Fleming *et al*. (2012), and Milne *et al*. (2005). These papers collected data from various reports and adjusted them for subsequent vertical geologic motions, primarily those associated with post-glacial continental and hydro-isostatic rebound. Fleming *et al.* (2012) refers to deformations caused by the weight of continental ice sheets pressing down on the land. The latter (Milne *et al*. 2005) refers to uplift in coastal areas resulting from the increased weight of water associated with rising sea levels. Because of this and associated uplift, many islands, especially in the Pacific, experienced higher local sea levels in the mid-Holocene than they do today. The coastal uplift information of the Sarawak coast near Miri is based on extended field work by the author, during the period 2004-2022. The C-14 measurements are from Kessler & Jong, 2011 and 2014.

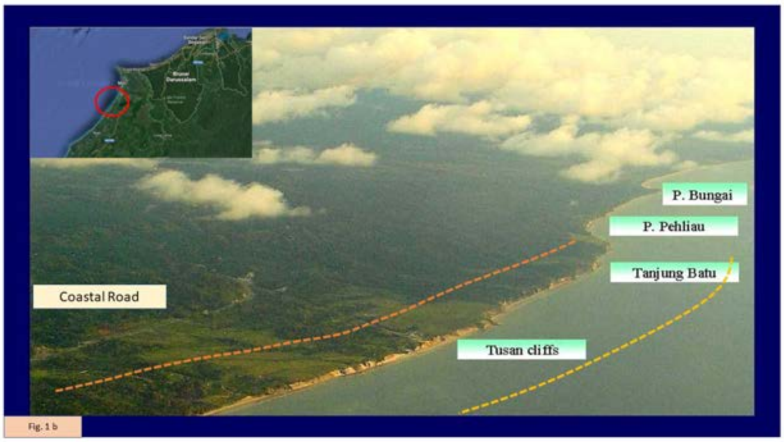

Figure 1b: View of the cliffed coast between Tusan cliffs (center) and Pantai Bungai. The orange line indicates the approximative position of a paleo-coastline 15550 years ago in the early Holocene. The yellow line indicates the contemporaneous outer boundary of the shoreface.

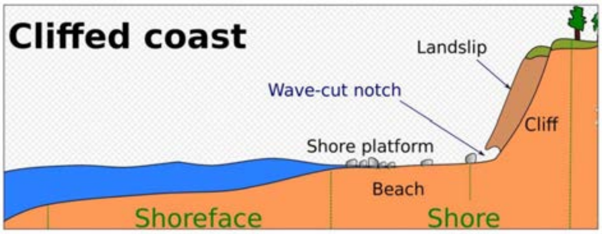

Figure 2: Schematic aspect of a cliffed coast. From Whitthow, John (1984). Dictionary of Physical Geography. London: Penguin, 1984. pg. 97. ISBN 0-14-051094-X.

Figure 3: Picture of the High Terrace on top of the Tusan Cliff, about 22 m above sea level. The Tukau Formation dips at 50° and is cut by a marine abrasion surface, overlain by sands with coaly material/ grains. These carbonaceous materials gave a C-14 age date of 15550 ± 80 years (Kessler & Jong, 2014).

Figure 4: Scoured cliff front of the Tusan Cliff area. The ever deeper grinding sea washes out wave-cut notches. These will destabilize the cliff front until it collapses, layer by layer.

Figure 5: Close-up on a High Terrace outcrop with coaly sands in the Tusan area, above a marked unconformity surface. Picture was taken 2022 at the access road to the now collapsed "Drinking Horse" rock. The uppermost part of the sequence is formed by white, bleached sands. The brown-colored sediments below contain charcoal clasts, charred remnants of roots of mangrove trees, and reworked quartz pebbles originating from the eroded Tukau Fm. beneath. The sands are level-bedded.

Table 1: C-14 age dating of charcoal clasts in sediments of the High Terrace (Kessler & Jong, 2014). The Tusan Cliff is seen as a particularly reliable data point, endowed with well-stratified outcrop sections, and without fluvial incisions.

Sample Index	Northing	Easting	Altitude (m)	Above formation, dip, dip direction	Thickness	Area	C-14 Age (years BP)
1	04° 13.596″	113° 55.149″	18	20° NW, Tukau	>1 m	Sewa Yaya	24,150±170
2	04° 19.757″	113° 59.931″	23	5° NW, Tukau	>1 m	Taman Tunku	25,580±190
3	04° 15.174″	113° 55.758″	14	13° NW, Tukau	>2 m	Bakam Sandpit	18,880±140
4	04° 21.996″	113° 58.160″	38	30° NW, Tukau	>1.5 m	Miri Jalan Tanjung	24,140±170
5	04° 21.107″	113° 59.801″	30	Probably Tukau	>2 m	Riam	28,570±230
6	04° 09.140″	113° 51.169″	23	80° NW, Lambir	2-3 m	Coastal road	8,880±50
7	04° 02.153″	113° 53.555″	17	70° NW, Lambir	2-3 m	Coastal road	16,360±80
8	04° 07.403″	113° 49.289″	22	50° NW, Lambir	1-2 m	Tusan Cliff	15,550±80
9	04° 15.293″	113° 56.955″	21	25° NW, Tukau	1-2 m	Sungai Rait Valley	11,230±60
10	04° 11.376″	113° 52.708″	16	45° NW, Tukau	> 4 m	Beraya Boathouse	8,170±50

Another wave-cut platform, called the Low Terrace (Figures 6 and 7) occurs at only some 2 m above the present sea level and is almost completely destroyed by marine erosion. The Low Terrace remains undated by the C-14 method.

Today, we note the presence of a contemporaneous marine abrasion platform, which reaches some 1-2 km into the sea (Figure 1b). The steeply dipping cliff section is formed by sandy and clayey deposits of Tukau and Lambir formations. The coastline is constantly pounded by waves and scoured by long-shore currents.

The coaly sands of the High Terrace are located 22 m above sea level in Tusan (Figure 3), and were age-dated by the C-14 method (Kessler & Jong, 2014), and

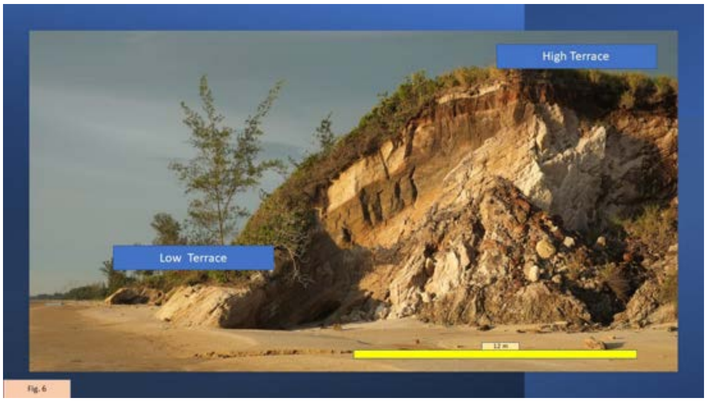

Figure 6: Between Tusan and Beraya Beach, a view of High Terrace and Low Terrace. The High Terrace has started to collapse.

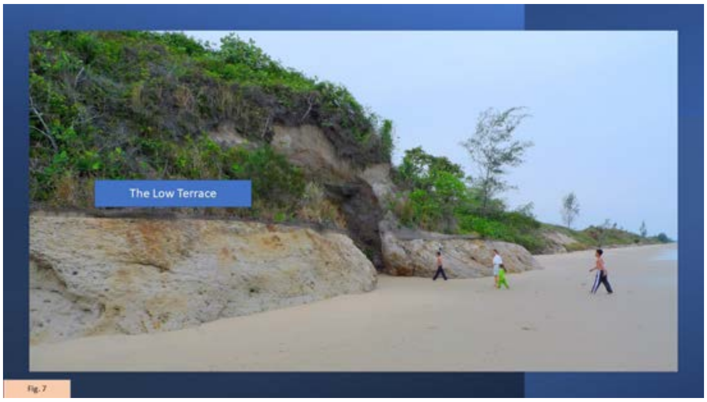

Figure 7: Between the Tusan Cliff section and Kpg. Beraya one can observe remnants of a lower wave-cut platform, 2 m above sea level, which is called the Low Terrace. The sediments above the abrasion platform have not been age-dated yet.

yielded an age of 15550 +/- 80 years. These (char-) coaly sands (Figure 5) are overlying a marked unconformity, which may be inferred to be somewhat older than the dated sediments.

Uplift

Accordingly, it is inferred that the High Terrace rose 132 m since the end of the last Ice Age, in a time span of merely 15550 years. This suggests a rise of 8.5 mm/year. The cause of the uplift remains unknown. The Low Terrace may have formed during a pause in the uplift.

A glance into the future

If tectonic uplift had prevailed over a period of rising sea level, its rise appears to have accelerated during the last hundred years and may have started to outpace the slower rising cliffed coast of Northern Sarawak. What will the future hold for the Tusan Cliff? It will continue to be scoured and damaged by waves and longshore currents. A front of wave-cut notches would gradually grind deeper, until the rock formation above it eroded cliff front collapses. This process would continue, and the cliff front would further recede.

WHICH ARE THE FORCES THAT CAUSED BORNEO TO RISE? A DISCUSSION

Large parts of Borneo Island have undergone a history of uplift and erosion (Kessler & Jong, 2016). A few factors may have contributed to the uplift. These are:

(i) Endogenic factors such as tectonic compression leading to faulting and folding. There is evidence of faulting and thrusting in the Pliocene and Pleistocene.

(ii) Uplift of mountainous regions in the hinterlands. Vast amounts of sediment were eroded and shed into the SCS; on the island, the load on crust and mantle was diminished. The reduced weight on the island may have caused an elastic rebound (see explanation Figure 1a). On the other hand, the sea-covered crust of the SCS was loaded by additional sediment and water, and may have subsided further consequently.

(iii) Diapiric upwelling of mobile clay from the Setap Formation. As shown in Kessler & Jong (2011), diapiric upwelling has occurred in the greater Miri area. The elevation of the High Terrace is not equal level in the entire area of studies and may indeed point to a relatively mobile substratum, which allowed the High Terrace abrasion platform and the coastal mangrove swamps to develop on the paleo-coastline earlier or later.

CONCLUSION

Since the end of the last glaciation, some 15550 years ago, melting ice caused the sea level to rise by some 110 m, or 7 mm/year. During the same time span, the Borneo coastline south of Miri rose by 132 m, and the uplift of the coastline was in the order of 8.5 mm/ year. A prominent cliff section with an abrasion platform on top, called the High Terrace is now exposed at Tusan. The rate of tectonic uplift, averaged over 15550 years, exceeded the average sea level rise by 1.5 mm/ year. The reasons for the uplift that outpaced the rising sea level are not well understood.

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DECLARATION OF COMPETING INTEREST

The author declare that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The author have no conflicts of interest to declare that are relevant to the content of this article.

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Advancing science, technology and innovation for disaster risk reduction: The Kuala Lumpur Consensus on Disaster Risk Reduction

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Abstract: The Kuala Lumpur Consensus on Disaster Risk Reduction was the outcome of the 2020 Asia Pacific Science and Technology Conference for Disaster Risk Reduction (APSTCDRR), documenting renewed commitment to accelerate the implementation of the Sendai Framework for Disaster Risk Reduction in four priority areas, drawing on multi-disciplinary knowledge including geoscience. The 2020 APSTCDRR offered an opportunity for science-policy interfacing to enhance the appropriate role of science, technology and innovation, facilitate the inclusion of empowered young scientists, and accentuate the integration of risk from all perspectives into planning and development at all levels. Highlights of the 2020 APSTCDRR include the status of disaster risk reduction (DRR) in the Asia Pacific, and means of addressing systemic risk including Natural Hazards Triggering Technological Disasters (NATECH) and its associated shortcomings in the region. There was also focus on climate risk and local action spotlighting the Kuala Lumpur Multi-hazard Platform, as well as youth engagement in science and technology through U-INSPIRE Alliance, an alliance of young professionals in DRR. Many of the initiatives showcased in the 2020 APSTCDRR are of relevance to the geoscience community, to strengthen their role in DRR in Malaysia and the region.

Keywords: Disaster risk, Science and Technology, Sendai Framework, science-policy dialogue, Kuala Lumpur, Malaysia

INTRODUCTION

The Sendai Framework for Disaster Risk Reduction, 2015-2030 shifts the focus from responding and managing disaster events to managing the risk of disasters (UNISDR, 2015). The shift is reflected in its four priorities, which covers understanding disaster risk; strengthening disaster risk governance to manage disaster risk; investing in disaster risk reduction for resilience; and enhancing disaster preparedness for effective response, and building back better. It also requires reliable science and technology-based disaster risk reduction (DRR) measures with innovations for a better understanding of risk from all perspectives. Evidence-based disaster risk governance is also required to ensure that risk is integrated into planning and development at all levels. Connecting science to policy is a major challenge in efforts to achieve sustainable development (McConney *et al.*, 2016). Notwithstanding, there is progress in the DRR arena particularly in the Asia Pacific, where science-policy interfaces allow for periodic linkages between scientists and policy-makers.

The Science and Technology Roadmap to Support the Implementation of the Sendai Framework for Disaster Risk Reduction was agreed upon in 2016. The global roadmap emphasizes the four priorities of the Sendai Framework and includes expected outcomes, actions and deliverables for each. Focusing on this, the inaugural 2016 Asia Pacific Science and Technology Conference for Disaster Risk Reduction (APSTCDRR) was held in Thailand, where 12 actions and cooperative mechanisms were identified for implementing the Science and Technology Roadmap 2015-2030 (APSTCDRR, 2016). The actions and mechanisms were further expanded in the Second

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APSTCDRR in 2018 to 14 actions and six cooperative mechanisms in the "Beijing Consensus" (APSTCDRR, 2018). As a continuation, the third APSTCDRR in 2020 focused on how to strengthen science-based DRR policy development for building the resilience of communities and infrastructure. The 2020 APSTCDRR was hosted virtually on 15 October 2020 by the United Nations Office for Disaster Risk Reduction (UNDRR) and the National Disaster Management Agency (NADMA) of Malaysia. Key partners included the UNDRR Asia Pacific Science, Technology and Academia Advisory Group (APSTAAG), International Science Council Regional Office for Asia and the Pacific (ISC-ROAP), Integrated Research on Disaster Risk (IRDR), Asian Network on Climate Science and Technology (ANCST), Academy of Sciences Malaysia (ASM) and Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM).

The 2020 APSTCDRR provided an opportunity to the science, technology, and academia community in Asia and the Pacific to continue the much-needed science-policy dialogue to ensure that implementation of DRR measures is based on reliable science, technology and innovation. A total of 175 participants, comprising academics, policymakers and young professionals from 19 countries in the Asia Pacific were involved. The event also showcased successful applications of science and technology in preventing and mitigating risks for different types of hazards. The highlights of this important science-policy interface are briefly mentioned in the following sections. These include the status of DRR in the region, addressing systemic risk, climate risk and local action, and youth engagement in science and technology. Many are relevant to the geoscience community, and some feature entry points for geoscience information to strengthen DRR in Malaysia and the region.

STATUS OF DRR AND SCIENCE AND TECHNOLOGY IN THE ASIA PACIFIC

Generally, implementation of the Science and Technology Roadmap in the region is good with respect to the four priority areas (Shaw, 2020; UNDRR-APSTAAG, 2020a). The progress under priority area 2 (strengthening disaster risk governance to manage disaster risk) was relatively the best among the four priorities. For this priority area, maximum progress was made in promoting disaster risk assessment in planning and development, while the least progress was made for considering root causes of risk and input from traditional knowledge for decision making. Relatively, priority area 4 (enhancing disaster preparedness for effective response, and building back better) showed the least progress and needs improvement (UNDRR-APSTAAG, 2020a). There are many issues related to integrating science and technology into DRR, particularly in the Pacific Islands of the region. Lack of integration of climate change adaptation and disaster risk management in national policies and development plans is a major challenge. In addition, limited capacity for integration of technologies and lack of appropriate technology amongst practitioners is a barrier. This calls for increased capacity-building and training for integrating science and technology into DRR to build resilience.

The top ten innovations for linking DRR to Sustainable Development Goals (SDGs) in the region have been identified (Izumi, 2020). These include ecosystem-based DRR in the livelihood sector; integrated water resources management in the water sector; earthquake guard - an early warning system; a nexus approach toward climate change, food security, and livelihoods; and a Nationalized Cluster Coordination Mechanism in the emergency response sector. Several recommendations were made to increase the applicability of innovative DRR measures. Among these were the need to reduce the huge gap between the interface of science, technology, innovation, and policymaking. In order to do this, the co-production and collaboration between researchers and practitioners have to be enhanced. Furthermore, the sharing case studies of innovations have to be intensified. It is also suggested that academia takes an additional step to improve their skills in communicating their research and its results to the public (Izumi *et al.*, 2019).

The cumulative effect of COVID-19 has strongly impacted national and local development planning with respect to DRR and the science and technology agenda. As biological hazards have different impacts on the SDGs, it was recommended that multi-sectoral impacts be analysed to understand how sectors exacerbate the transmission of infectious diseases, and identify the health mitigation measures. For example, the information and telecommunication sector can support multiple sectors from different aspects in responding to biological hazards.

ADDRESSING SYSTEMIC RISK

The Asia Pacific Framework for NATECH (Natural Hazards Triggering Technological Disasters) Risk Management is now available to address systemic risk in the region (Chatterjee, 2020). Risks associated with NATECH have not been well documented in the region. There is no baseline available to compare risk trends. This is in part due to its low impacts prior to the large-scale 2011 East Japan Earthquake and Tsunami that triggered the Fukushima nuclear disaster. Despite increasing coverage in academia, government reports and policy documents are relatively sparse in covering NATECH risk (UNDRR-APSTAAG, 2020b). Inclusion of NATECH risks is recommended for policies, transboundary response mechanisms and agreements at the regional level. Similarly, the coverage of this aspect should be enhanced in the implementation of policy, regulation, and combination of risk assessment tools at the national level. In addition, risk assessment, awareness generation, and specialized response teams at the local level should include the risk of NATECH. The conversion of knowledge to local actions should be strengthened for NATECH risks, and this context, geoscientists have a major role to play.

The implementation of the Sendai Framework could be strengthened using a "system of systems approach" drawing on digital solutions for managing systemic risk, using wide-ranging risk analytics. The fundamental aspects of high complexity with the interaction of multiple systems need to be considered in this approach, where stochastic relationships between triggers and effects are involved. In addition, the risk is transboundary and global in nature where the systemic developments are non-linear and include tipping points. There is a need to carefully consider the complexity involved. As a solution, science could offer modelling for scenario analysis and sketching out the stochastic nature of the system. Eight steps for building a scenario of systemic risk were presented. These were (a) Scope the risk, (b) Conduct background research, (c) Frame the scenario, (d) Develop a candidate scenario, (e) Develop a narrative, (f) Assess impacts and materiality, (g) Communicate and alert, and (h) Evaluate and update. Additionally, Big Earth Data platforms for DRR and SDGs can help to fill gaps in scientific knowledge to support the achievement of SDGs. It has great potential as a digital solution for managing systemic risk.

CLIMATE RISK AND LOCAL ACTION

The readiness of ASEAN countries for a 1.5°C world is generally at a low to medium level for many aspects covering extreme events, food security and water availability, among others (Pereira & Shaw, 2022). Disaster prevention, mitigation and preparedness provide opportunities for climate change adaptation with the co-benefits of emission reduction. The integration of climate change adaptation and DRR, specifically in cities is facilitated by a system of systems approach, public-private participation with the involvement of local government stakeholders, participation of knowledge-empowered youth who offer the best potential to fill the knowledge gap, authentic community engagement, and open science communication and engagement, where community members are involved in systematic data collection and storage. The Kuala Lumpur Multi-hazard Platform was presented as a case study, to illustrate the potential for communicating local level risk through forecasting and disaster alerts in the city (Pereira *et al*., 2021). For climate risk-related local action, it was suggested that the challenge is to determine how many local level DRR strategies exist (Perweiz, 2020). In terms of reaching to local level, it was emphasized that "Local-action" should take place instead of localization. This means much must be done at the local level in translating such technologies into decision-making for risk-sensitive investment planning.

The Japanese experience reveals that DRR and environment and development consist of a set of issues that can be explored as scientific questions, but cannot be resolved using scientific actions alone (Koike, 2020). Therefore, the approach of "Science for Humans and Society" should be given priority. The addition of "science for discovery of social wish" was also suggested to discover and resolve social issues. This includes promoting different types of sciences as "consilience", so that science could contribute to resolve social problems as well as develop sustainably for developing "consilience knowledge base". However, there is a critical gap between scientific knowledge and social actions. To minimize that gap, an Online Synthesis System (OSS) was introduced. The functions of OSS are exploration, collection, archival, and search of scientific information in mother tongues; data integration, information fusion, prediction, simulation, and visualization; coordination of various disciplines towards consilience; mutual risk communication between society and the science community. It was recommended that the scientific community should develop the Online Synthesis System (OSS) to promote DRR and sustainable development.

YOUTH ENGAGEMENT IN SCIENCE AND TECHNOLOGY

Countries in the Asia Pacific have prioritized building skilled human capital in the field of disaster risk, as reflected by long-standing investments in national higher education and research institutions (Holloway, 2020). Higher education and research are at the forefront of grounded disaster risk knowledge, policy, and innovation, for fast tracking skilled capacity development and human resource. However, many countries in the region are still lacking in embedded institutional capability to grow their own 'scientific and educational timber'. This calls for a dual-track for strengthening skilled capacities. The first track is advocacy to bridge higher education institutions and disaster risk policy. The second track is technical integration and embedding in higher education by integrating disaster risk across a wider disciplinary and professional range, and promoting such scholarship in vulnerable countries.

The U-INSPIRE Alliance is a platform for youth engagement that was inaugurated in Indonesia in 2018 (Kathiwada, 2020). It is an alliance of young professionals, working to support DRR with the vision of developing a powerful collaboration platform for empowering youth and young professionals in DRR focusing on linking to policy at the local, national, and global levels. The Alliance has chapters in 12 countries with close to 1000 members. The major initiatives of U-INSPIRE include contributing to the status report of the Science and Technology Roadmap, Framework for NATECH Risk Management, conducting surveys on youth participation in managing COVID-19, and developing the COVID-19 Monitor. In Malaysia, U-INSPIRE is coordinated by the Special Topic Group on Young Professionals in DRR & Climate Change of the Asian Network on Climate Science and Technology (ANCST). The group has convened numerous capacity building and outreach programs, including workshops and associated events in partnership with key national and regional partners including the Geological Society of Malaysia (Muhamad, 2020). Student exchanges and information dissemination are also conducted with the support of ANCST.

Members of U-INSPIRE Alliance have developed innovative technologies. In Indonesia, a coping practice for flood disaster called "Kentongan" was introduced, which is fast and usable without electricity to send information by monitoring river water level, and can serve as a traditional early-warning tool in the face of disaster (Findayani, 2020). In Nepal, the conventional paper-based vulnerability and capacity assessment process was digitized while keeping the participatory approach intact at the community level (Gautam, 2020). Geoscience information provided in this process include hazard ranking and its historical timeline. In Sri Lanka, the community relies on kinship, relatives, and religious community to mitigate flood damages (Tsuchida, 2020). A disaster ethnographic study was conducted to identify the missing links where young practitioners and researchers play an important role in interacting with the community. This is important to prepare for future disaster events. U-INSPIRE Malaysia play an important role in providing exposure to young professional geoscientists in multidisciplinary settings (Muhamad, 2020).

CONCLUDING REMARKS

The Kuala Lumpur Consensus on DRR was the outcome of the 2020 APSTCDRR. The Kuala Lumpur Consensus renewed the commitment to accelerate the implementation of the Sendai Framework for Disaster Risk Reduction to achieve the goals of sustainable development and resilience. The Consensus recommends 14 actions and six cooperative mechanisms to the global "Science and Technology Roadmap", and sets the pathway for strengthening the four priority areas of the Sendai Framework drawing on multi-disciplinary inputs including geoscience. A multi-hazard approach is key for improving understanding of disaster risks, specifically emerging climate risks, exposure, vulnerability, and public health threats. This also includes risks of transboundary, cascading, biological, technological, environmental, and NATECH disasters. Enhanced disaster risk governance requires improvement in transdisciplinary engagement between scientists, policymakers, civil society, and businesses at all levels. Other important elements include strengthening science-based decision making, considering future risk, and promoting local and traditional knowledge, including land-based solutions.

Priority actions to increase investment DRR for Resilience covers knowledge, education, research, innovation, technology transfers, and the empowerment of youths and young professionals, to advance multi-disciplinary disaster risk reduction and build resilience. In order to enhance disaster preparedness for effective response and to build back better, the priority is to develop and disseminate information on multi-disciplinary science, technology, and innovations for effective pre-disaster planning, preparedness, response. The element of regular outreach programmes to connect with the most vulnerable groups in exposed areas is critical in this context. Implementation of the Kuala Lumpur Consensus requires cooperation on strengthening transdisciplinary action-oriented research and education, and engagement in disaster risk science, technology, and policy. Non-government organisations also have a role in advancing science and technology drawing on Local and Indigenous knowledge to support decision-making. Enhancing the inclusion of science and technology groups, including youths and young professionals, and stakeholder groups in DRR activities and policy platforms is also important. Efforts are required for increasing investment from governments, societies, businesses and other stakeholders in research, capacity building and development of DRR science and technology. In Malaysia, the Geological Society of Malaysia (GSM) can play a leading role in garnering support from universities, government, businesses and other stakeholders, around innovation, partnership development, international cooperation and exchanges on science and technology-based DRR. There is also much to be done in translating into actions the "whole of Government" and "whole of Society" approaches in DRR, and the GSM is well positioned to support this endeavour.

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AUTHORS CONTRIBUTION

JJP – conceptualisation, writing and editing; TRB – writing and editing; NM – information curation, review and editing; SY – review and editing; and SY and RS – review and editing.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the effort reported in this paper.

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CERAMAH TEKNIK TECHNICAL TALK

Electrical imaging and geophysical method for subsurface mapping

Mohd Nawawi Mohd Nordin
Date: 9 November 2022
Platform: Microsoft Teams

Kejadian tanah runtuh sering berkaitan dengan keadaan cerun, kewujudan batu-batu dan jumlah hujan. Tanah runtuh sering berlaku di Malaysia di mana keadaan cuaca yang panas dan hujan. Oleh itu proses luluhawa adalah lebih cepat dan tidak sekata. Sesar akan terbentuk dalam batuan. Hakisan lanjut dan luluhawa akan menyebabkan batu besar memecah menjadi batu bundar. Hujan akan melonggarkan tanah dan tanah runtuh dikatakan berlaku apabila batu bundar dan tanah bergerak. Batu bundar disubpermukaan pula boleh mengganggu projek kejuruteraan awam terutamanya cerucuk dan semasa pemotongan bukit untuk pembangunan setempat.

Dua tanah runtuh utama di Malaysia pernah berlaku di Bukit Antarabangsa, Kuala Lumpur dan Paya Terubong, Pulau Pinang. Kedua-duanya berlaku semasa atau selepas hujan dan terlibat dengan batu bundar yang besar. Tanah runtuh sering mengakibatkan kehilangan nyawa, tanaman dan harta benda. Bencana ini biasanya melibatkan hujan dan kehadiran batu di subpermukkan yang dikenali sebagai batu bundar. Kewujudan lubang benam, rongga dan sesar adalah ciri-ciri biasa di kawasan batu kapur. Ciri-ciri ini dapat dielakkan jika dapat dilihat dengan jelas dan jika ianya terdedah tetapi amat sukar untuk dikesan jika ia berlaku di subpermukaan. Rongga yang tidak dapat dikesan dan sesar di bawah permukaan boleh mewujudkan masalah yang serius di kawasan yang akan dibangunkan. Ini adalah antara masalah utama dalam bidang kejuruteraan awam.

Pencemaran, pencemaran air bawah tanah dan pencerobohan air masin adalah beberapa masalah persekitaran di Malaysia. Perubahan dalam kestabilan tanah sering disertai oleh perubahan dalam sifat-sifat fizikal tanah yang boleh diukur dengan menggunakan kaedah geofizik. Parameter fizikal yang boleh digunakan termasuk sifat-sifat mekanik dan elektrik. Sifat-sifat mekanikal boleh diukur menggunakan kaedah seismik yang mengukur kelajuan gelombang bunyi di dalam tanah. Sifat-sifat elektrik boleh diukur menggunakan kaedah resistiviti dan induced polarization (IP). Parameter graviti dan magnet boleh dikesan menggunakan kaedah graviti dan magnet. Kaedah-kaedah ini juga akan memberikan gambaran subpermukaan geologi secara dua dimensi (2-D) dan tiga dimensi (3-D) di tapak kajian. Kaedah geofizik seperti pengimejan elektrik, seismik dan graviti dan magnet adalah kaedah tak membinasakan yang telah digunakan secara rutin untuk menyelesaikan beberapa masalah kejuruteraan dan persekitaran. Kaedah pengimejan elektrik 2-D digunakan untuk mengesan batu bundar subpermukaan dan batu hampar (bedrocks), rongga di subpermukaan dan untuk mencari air bawah tanah dan pemantauan pencemaran. Kaedah Transient Electromagnet (TEM) boleh disepadukan dengan kaedah geofizik lain untuk kajian air bawah tanah. Kaedah graviti juga boleh digunakan untuk mengesan rongga di subpermukaan dan kaedah magnet digunakan untuk mengesan paip dan cerucuk yang tertanam. Beberapa kajian kes pemetaan subpermukaan menggunakan kaedah pengimejan elektrik dan kaedah geofizik yang lain samada secara sendiri atau sepadu akan dibincangkan dalam kertas kerja ini.

Organized by:
Geophysics Working Group
Geological Society of Malaysia

CERAMAH TEKNIK TECHNICAL TALK

Hydrothermal fluid and significant in exploration and ore genesis

Charles Makoundi
Date: 2 December 2022
Platform: Google meet

Hydrothermal fluid can be found trapped in microscopic cavities within minerals. They are thought to be closed systems and provide important information in characterizing the composition in volatiles, origin, and chemical make-up of fluids. Additionally, density, pressure, and the physical and chemical processes of fluid evolution such as mixing, boiling and conductive cooling can be investigated. Most fluid inclusions range is size between <5μm and 50μm and those that are approximately 10μm in size are excellent candidates for micro thermometric analysis and Laser Raman Spectrometry. Fluid inclusion studies can help discriminate the type of ore system and therefore understand ore genesis. Fluid inclusion data (homogenization temperature and salinity) can serve as vectoring tools in the search for gold and base metal mineralization.

Organized by:
Economic Geology & Mineral Resources Working Group
Geological Society of Malaysia

Radio-echo Sounding (RES) profiling and numerical modelling

Muhammad Hafeez Jeofry
Date: 7 December 2022
Platform: Microsoft Teams

Ice sheet stability and contribution to sea level are regulated by high-pressure water that lubricates the ice floor and promotes rapid flow to the sea. In Antarctica, subglacial processes are poorly characterized, limiting our understanding of ice sheet flows and their susceptibility to climate change. Satellite imagery shows streaks of the Foundation ice flow parallel to the ice flow and meandering features of the ice shelf intersecting the ice flow, thought to be formed by water exiting a well-organized subglacial system. Here, ice-penetrating radar data show flow-parallel hard-bed landforms beneath the grounded ice, and channels incised upwards into the ice shelf beneath meandering surface channels. As the ice transitions to flotation, the ice shelf incorporates a corrugation resulting from the landforms. Radar reveals the presence of subglacial water alongside the landforms, indicating a well-organised drainage system in which water exits the ice sheet as a point source, mixes with cavity water and incises upwards into a corrugation peak, accentuating the corrugation downstream. Here, using numerical modelling and geophysical data, we provide evidence of extensive, up to 460 km long, dendritically organized subglacial hydrological systems that stretch from the ice-sheet interior to the grounded margin. We show that these channels transport large fluxes (~24 m^3s^{-1}) of freshwater at high pressure, potentially facilitating enhanced ice flow above. The water exits the ice sheet at specific locations, appearing to drive ice-shelf melting in these areas critical for the ice-sheet stability. Changes in subglacial channel size can affect the water depth and pressure of the surrounding drainage system up to 100 km on either side of the primary channel. Hard-bedded landforms influence both subglacial hydrology and ice-shelf structure and, as they are known to be widespread on formerly glaciated terrain, their influence on the ice-sheet-shelf transition could be more widespread than thought previously. Our results demonstrate the importance of incorporating catchment-scale basal hydrology in calculations of ice-sheet flow and in assessments of ice-shelf melt at grounding zones. Thus, understanding how marginal regions of Antarctica operate and may change in the future requires knowledge of processes acting within and initiating from, the ice-sheet interior.

Organized by:
Geophysics Working Group
Geological Society of Malaysia

CERAMAH TEKNIK TECHNICAL TALK

UKM Geophysics: Past, present and future

Mohd Hariri Arifin
Date: 14 December 2022
Platform: Microsoft Teams

The field of geophysics is one of the main sub-fields under the Geology program, Universiti Kebangsaan Malaysia (UKM). Since UKM was established in 1970, undergraduate level geophysics has been taught by Dr. Ismail Mohd Noor and several contract lecturers from renowned Indonesian universities. This geophysics course was then taught by Dr. Abdul Rahim Samsudin who is a geology graduate from UKM who successfully obtained a Master of Science (Geophysics) degree from the University of Leeds United Kingdom in 1975. Also joining forces to teach this geophysics course is Dr. Umar Hamzah who obtained a Master's degree in Science (Geophysics) from the University of Birmingham (UK). Now the legacy is continued by Dr. Mohd Hariri Arifin and other academic colleagues in the geology program. The pairing of academic staff for this course has yet to be filled as there are no candidates with suitable qualifications based on the university's current requirements. At the undergraduate level, the engineering and environmental geophysics program has been introduced as coursework since 2010. This geophysics master's program is more focused on exploration and applied aspects and focuses heavily on the four main geophysical methods, namely the geoelectrical resistivity method, the seismic method, and the gravity and magnetic method. The use of geophysical methods in various fields, especially engineering and the environment, including the exploration of earth resources, underground water (cold/hot/saltwater intrusion), pollution (landfills and oil spills), archaeology, site investigation (development and engineering problems) and meteorites impacts. In the future, UKM geophysics is determined to continue contributing especially in the development of geothermal resources and the exploration of rare earth resources.

Organized by:
Geophysics Working Group
Geological Society of Malaysia

Geological aspects in earthquake engineering

Azlan bin Adnan
Date: 11 January 2023
Platform: Microsoft Teams

Geological aspects play important roles in determining seismic hazard of a region. Seismic hazard in Malaysia is associated with the geological conditions of faults movement and seismicity originating from seismically active faults in neighboring countries such as Indonesia and Philippines. Being situated on the stable Sunda plate, most people perceive that Malaysia is free from the life-threatening seismic crisis. The Malaysian Network of Seismological Stations have been recording distant ground motions from the two most active plate tectonic margins in the world, which are the 1650 km long Sumatran fault and the Philippines plate. In addition, several earthquakes due to local active faults with the maximum moment magnitude of 4.4 have also been observed within Peninsular Malaysia since 2007. Even though the local earthquakes were small, the epicenters were as close as 20 km to Kuala Lumpur, which a slightly higher value of magnitude could have remarkable effects on seismic hazard of the region. The big earthquake of 6.0 Magnitude occurred on 5th June 2015 at a depth of approximately 10 km, with its epicentre

CERAMAH TEKNIK TECHNICAL TALK

approximately 15 km north of Ranau, Sabah. The fact that the earthquakes have not yet inflicted any serious damage or collapse of buildings, historically, it should not be taken as an excuse for not considering the effects of earthquakes on the existing and future structures. Current design code for building structures in Malaysia widely adopts the British Standard (BS) 8110 code (BS 8110-1:1997) which has no provisions for earthquake-induced forces. In the interest of public safety, it is reasonable to comprehensively assess the seismic hazard and design of the region. Thus, the seismic hazard assessment provides Peak Ground Acceleration (PGA) values to all regions in Malaysia for Malaysia National Annex of EC8 (NA-MS EN1998), and developes seismic zoning map for Malaysia so that zones with non-seismic regions can be identified and zones with no special steel reinforcement detailing requirement can be specified. In EC8, zone 0 is specified for ground accelerations of 0.0g to 0.04 g and 0.04 g to 0.08 g for seismic zone 1. It can be concluded that about 90% of Peninsular and Sarawak fall into zone 0 and 1, without any special requirement for steel detailing, and generally about 40% of the regions is not required to design for seismic. In comparison among the 3 regions, the ratio of zone 0, zone 1 and zone 2 and higher, are as follows; Peninsular (45:45:10), Sabah (30:40:30), and Sarawak (70:20:10). The highest Peak Ground Acceleration (PGA) values covering sizeable regional areas of Peninsular, Sabah and Sarawak are 9%g, 16%g, and 9.5%g, respectively.

Organized by:
Geophysics Working Group
Geological Society of Malaysia

New ocean bottom seismometer exploration for crustal imaging in Arctic Ocean

Xiongwei Niu (Second Institute of Oceanography, MNR, China)
Date: 8 February 2023
Platform: Microsoft Teams

Due to the presence of ice floes, few studies have reported the velocity of crustal structures beneath the ultra-slow spreading ridge of Gakkel Ridge in the Arctic Ocean. In 2021, the “Joint Arctic Scientific Mid-Ocean Ridge Insight Expedition (JASMInE)” was conducted with international participation, utilizing the recently released Icebreaker “Xuelong 2” and innovative technology to adapt to concentrated sea ice. The expedition used 43 ocean bottom seismometer (OBS) deployments (42 recovered) at two profiles intersected at 85°E along and across the ridge axis, and a travel-time raytracing modeling method to derive P wave crustal velocity structures. The results show significant variations in crust thickness, from approximately 7.0 km beneath the 85°E volcanic spreading center to approximately 3.0 km beneath the surrounding non-volcanic zones.

Organized by:
Geophysics Working Group
Geological Society of Malaysia

CERAMAH TEKNIK TECHNICAL TALK

Engineering geological challenges in urban development : From conventional to unconventional approach

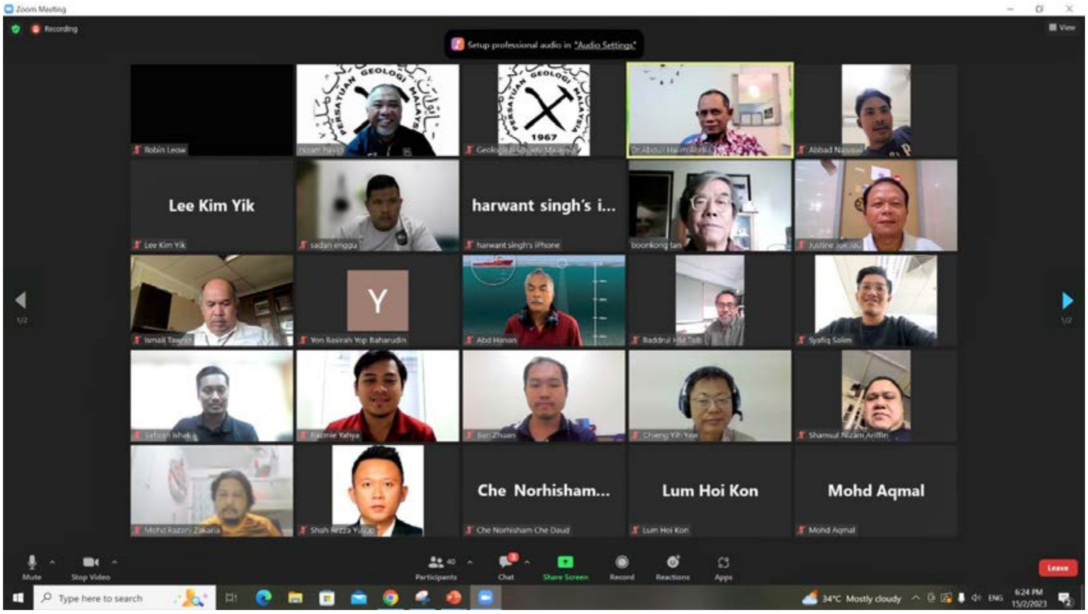
Ahmad Nizam Hasan
Date: 15 February 2023
Platform: Zoom

The above talk was delivered by P.Geol. Tuan Haji Ahmad Nizam Hasan (President, GSM; Geosolution Resources) on 15th February, 2023 via Zoom. Some 100 members participated. An abstract of the talk is given below:

Abstract: Engineering geology is the application of geology to engineering studies pertaining to the geological factors related to the location, design, construction, operation and maintenance of engineering works are recognized and taken into account. The engineering geologist's realm is essentially about earth-structure interactions or investigating how earth or earth processes impact human-made structures and human activities. Conventionally, one of the most important roles as an engineering geologist is the study of geomorphological and geological processes to identify potential geological and associated human-made hazards that may have a significant impact on civil structures and human development. Hence, most of the geological hazard forensic studies required significant of technical skills, strong fundamental and creative minds to solve such more problematic and complicated geological and geomorphological issue ahead. Therefore, transition from conventional to unconventional method or approach is essential to assist the engineering geologist to solve more complex geological riddle.

We thank Sdr Nizam for his support and contribution to the Society's activities.

Tan Boon Kong
Chairman, Working Group on Engineering Geology
16th February 2023



CERAMAH TEKNIK TECHNICAL TALK

Groundwater investigation: Fundamental and application

Stefan Herwig GÖdeke (Universiti Brunei Darussalam)
Date: 1 March 2023
Platform: Microsoft Teams

Accounting for approximately 99% of all liquid freshwater on Earth, groundwater has the potential to provide societies with tremendous social, economic and environmental benefits and opportunities. Excessive groundwater withdrawal has led to land subsidence or seawater intrusion in many areas of the world. However approximately around four billion people live in areas that suffer from severe physical water scarcity for at least one month per year. Increasing water demand has led to an increase in groundwater investigation and exploration and a strong increase in groundwater withdrawal. In this regard the field of hydrogeophysics has emerged in the late 1990 demonstrating the benefits hydrogeophysical studies can bring for subsurface investigation. This presentation will discuss the importance of groundwater and go through fundamentals of groundwater investigation, defining key properties before presenting case studies in Brunei Darussalam using geophysical techniques.

Organized by:
Geophysics Working Group
Geological Society of Malaysia

Characterizing weathering profiles in Peninsular Malaysia

Dr John Kuna Raj
Date: 15 March 2023
Platform: Zoom

The above talk was delivered by P. Geol. Dr John Kuna Raj (Consultant) on 15th March, 2023, via Zoom. Some 65 members participated. An abstract of the talk is given below:

Characterization of weathering profiles has usually involved their differentiation into weathering zones based on morphological criteria, akin to descriptions of pedological soil profiles. Several criteria have been employed and include colour, degree of preservation of original bedrock minerals, textures and structures, and the shape and percentage occurrence of litho-relicts (core-stones and core-boulders). The weathering zones can serve as engineering geological mapping units and can also assist site investigations through the assignment of engineering characteristics to each zone and the possibility of reducing the number of boreholes and in situ and laboratory tests.

The use of weathering zones for geotechnical purposes, however, has been criticized on the grounds that their recognition is based on qualitative or pedological criteria, criteria that are not quantitative nor related to mechanical properties or engineering behavior of material. It was thus proposed that different grades of weathered rock be recognized; each grade representing a different stage, or combination of stages of weathering of both rock material and rock mass. Recognition of distinct weathering grades in the rock mass was to be based on the degree of discoloration, the rock/soil ratio and the presence or absence of original rock texture.

A review of several classifications of weathering profiles pointed out that core-boulders were not present in all profiles and was critical of the way in which the term ‘grade’ was used both to describe a stage of weathering of rock material as well as classify a zone of weathered heterogeneous rock mass. It was thus proposed that the term “weathering zone” be used to distinguish the character of material en-masse, while the term “weathering grade” is used to describe material from which the mass is formed.

CERAMAH TEKNIK TECHNICAL TALK

Recent work in Soil Science has advocated application of the pedo-weathering profile; a synthetic paradigm melding pedological and geological profile concepts. The pedo-weathering profile is defined as being the vertical section that extends downward through the zone affected by sub-aerial weathering, including the soil profile, to the unweathered, unconsolidated or consolidated rock.

In Peninsular Malaysia, deep weathering profiles are found over different bedrock and have developed as a result of prolonged sub-aerial exposure throughout a larger part of the Cenozoic era. Weathering profiles in acidic and intermediate igneous bedrock areas can be differentiated into three broad zones i.e., an upper pedological soil (zone I), an intermediate saprock (zone II) and the lower bedrock (zone III). The upper zone I comprises A, B and C soil horizons and is up to some 15 m thick, whilst the intermediate zone II is up to about 50 m thick and consists of medium to very dense, gravelly silty sands with distinct relict bedrock minerals, textures and structures. Core-boulders are often found towards the bottom of zone II, whilst zone III consists of continuous bedrock with effects of weathering along and between discontinuity planes. Rock mass weathering grades can be assigned to the weathering zones; the pedological soil being Grade VI, and the bedrock, Grades I and II, whilst the saprock comprises Grades III, IV and V.

Weathering profiles over other bedrock types in the Peninsula are quite distinct from those over acidic and intermediate igneous bedrock in view of two main factors i.e., differences in mineral composition and texture, and differences in genesis. Differences in mineral composition and texture give rise to different rates and extents of alteration of bedrock minerals in view of their varying stability under atmospheric conditions. Minerals in ultrabasic and basic igneous bedrock for instance, are altered more completely than those in acidic and intermediate igneous bedrock. Mineral grains in sedimentary and meta-sedimentary bedrock, however, are relatively stable under atmospheric conditions and do not completely alter as those in basic and ultrabasic igneous bedrock. Differences in bedrock genesis influence the processes of weathering that occur as in the case of igneous rocks whose decomposition mainly involves chemical processes due to their constituent minerals that crystalize out at high temperatures. In the case of sedimentary and meta-sedimentary bedrock, however, processes of physical weathering are more important in their disintegration in view of the stability of their constituent minerals and their formation through the compaction, consolidation and cementation of sediments as well as directed stresses.

Weathering profiles over ultrabasic and basic igneous bedrock can be differentiated into three broad zones i.e., an upper pedological soil (zone I), an intermediate saprock (zone II) and the lower bedrock (zone III). Zone I can be separated into A, B and C soil horizons and is up to 4 m thick, consisting mainly of brown, soft to stiff, clays. Zone II is some 2 to 5 m thick and consists of brown, very stiff, sandy silt with many lateritic concretions. Zone III is an outcrop of bedrock with effects of weathering along discontinuities. Rock Mass Weathering Grades cannot be applied to these profiles in view of the absence of their defining criteria, including the absence of discoloration, relict textures and core-boulders as well as inability to apply rock/soil ratios (due to a distinct rock-soil boundary.

Weathering profiles in meta-sedimentary bedrock areas show a great deal of vertical and lateral variability in weathered materials due to their inter-layered nature and inherent lithological, mineral. textural and structural differences. Weathering profiles over quartz-mica schists (and interbedded phyllites and quartzites) can be separated into two broad zones; an upper pedological soil (zone I), some 2 to 6 m thick and the lower saprock (zone II) that is more than 15 m thick. Zone I mainly consists of firm to stiff, silty to sandy clays, often containing lateritic concretions, and can be separated into A, B and C soil horizons. Zone II consists of in situ, moderately to highly weathered quartz-mica schists (or phyllites and quartzites) with distinct relict minerals, textures and structures and marked by alternating bands ofvariously colored, stiff to hard, clayey to sandy silts, and medium dense to very dense, sands. Rock Mass Weathering Grades cannot be applied to these profiles in view of the heterogeneity of the weathered materials and absence of their defining criteria, particularly the inability to apply rock/soil ratios (due to non-existent fresh bedrock outcrops) and lack of core-stones.

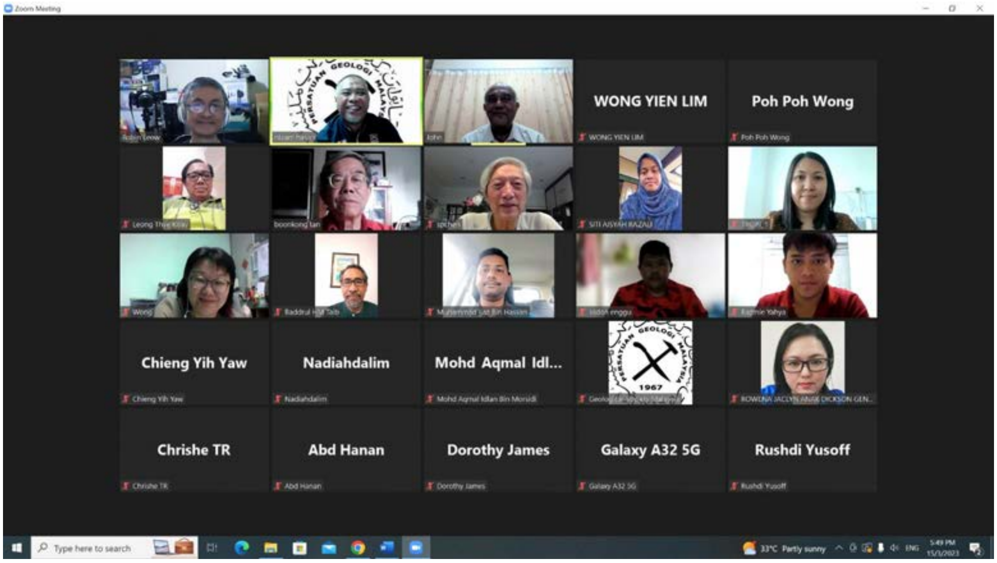
Weathering profiles in sedimentary bedrock areas show a great deal of vertical and lateral variability in weathered materials due to their inter-bedded nature and inherent lithological, mineral, textural and structural differences. Weathering profiles over inter-bedded sandstones, siltstones and shales can be separated into two broad zones; an upper pedological soil (zone I), some 2 to 6 m thick and the lower saprock (zone II) that is more than 15 m thick. Zone I mainly consists of firm to stiff, silty to sandy clays, often containing lateritic concretions, and can be separated into A, B and C soil horizons. Zone II consists of in situ, slightly to moderately and highly weathered strata with distinct relict textures and structures and marked by alternating bands of variously colored, firm to stiff and hard, clays and clayey silts, and loose to very dense, sands. Rock Mass Weathering Grades cannot be applied to these profiles in view of the heterogeneity of the weathered materials and absence of their defining criteria, in particular the lack of core-stones and inability to apply rock/soil ratios (due to non-existent fresh bedrock outcrops).

In conclusion, it is recommended that discussions on, and characterizations of, weathering profiles in Peninsular Malaysia take into consideration the following points:

1. weathering grades must strictly only be applied to weathering of rock masses,
2. differentiate between weathering of rock material and weathering of rock mass,
3. recognize differences in genesis of bedrock - igneous, metamorphic and sedimentary,
4. recognize differences in bedrock mineral compositions and textures,
5. grades can only be applied to weathering profiles over acidic and intermediate igneous bedrock,
6. grades cannot be applied to weathering profiles over other bedrock as their defining criteria are not present (especially inability to apply rock/soil ratios and absence of core-stones), and
7. better to characterize weathering profiles in terms of the pedo-weathering profile concept for sub-divisions can be based on geological processes with bedrock applied in a geological sense.

We thank Sdr Dr JK Raj for his support and contribution to the Society's activities.

Tan Boon Kong
Chairman, Working Group on Engineering Geology
16th March, 2023



Acknowledgement to Peer Reviewers (2022)

In appreciation of the enormous contribution they make to the Society's publications, we would like to thank the scholars and experts below who have participated in the peer review process of manuscripts submitted for consideration for publication in the Bulletin of the Geological Society of Malaysia and Warta Geologi in 2022:

Abdul Halim Abdul Latiff

Adi Susilo

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Aiad Ali Hussien Al-Zaidy

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Azman Bin Abd Ghani

Douglas Kirwin

Elvaene James

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Suhaina Ismail

Sukonmeth Jitmahantaku

Tan Boon Kong

Thamer Mahdi

Yasir Bashir

Zamzarina Sulaiman

Zuliskandar Ramli

THANK YOU

LAPORAN PERSIDANGAN GEOSEA 2022

Pada 17 hingga 21 Disember 2022, Persidangan GEOSEA telah dijalankan serentak bersama beberapa acara lain termasuk *17th Regional Geoscience Conference of Southeast Asia*, *34th National Geoscience Conference*, *Sustainable Earth Resources Engineering* (SERIES 2022) dan *Regional Course* on *UNESCO Global Geopark* di Bayview Hotel, Langkawi. Tema persidangan kali ini adalah Advance Geoscience Advance ASEAN.

Pihak Persatuan Geologi Malaysia (GSM) ingin mengucapkan jutaan terima kasih kepada semua pihak yang terlibat dalam menjayakan persidangan kali ini terutama rakan koloberasi penganjur bersama iaitu Lembaga Pembangunan Langkawi (LADA), Jabatan Mineral dan Geosains Malaysia (JMG) dan Institut Geologi Malaysia (IGM). Tidak dilupakan juga rakan-rakan universiti yang tampil sebagai rakan urusetia dan juga rakan industri yang menyertai ruang pameran sepanjang persidangan berlangsung.

Setinggi-tinggi penghargaan kepada rakan koloberasi persatuan geologi dari negara-negara ASEAN.

Antara rakan industri yang telah memeriahkan persidangan sebagai rakan pempamer dan penyumbang.

Berikut adalah antara foto-foto yang sempat dirakam sepanjang persidangan dan aktiviti susulan yang berlangsung selama hampir seminggu di Langkawi.

Foto 1: Antara tunjang utama jawatankuasa yang telah menjayakan penganjuran persidangan GEOSEA 2022.

Foto 2: Malam jaringan (networking night) yang dimeriahkan dengan tema pakaian pahlawan.

Foto 3: Jabatan Mineral dan Geosains Malaysia (JMG) antara rakan yang turut menyertai sebagai pempamer.

Foto 4: Pemimpin-pemimpin utama dan wakil setiap persatuan geologi dari negara ASEAN turut bersidang membincangkan halatuju kerjasama setiap persatuan.

Foto 5: Tetamu khas dan peserta persidangan bergambar kenangan selepas majlis perasmian.

Foto 6: Peserta turut berpeluang menyertai kerja lapangan yang telah diaturkan di sekitar Pulau Langkawi

LAPORAN REPORT

Perbincangan Intelek: Perspektif geologi kejuruteraan terhadap kejadian terkini tanah runtuh Batang Kali

Satu ceramah teknik bertajuk **Perbincangan Intelek: Perspektif Geologi Kejuruteraan Terhadap Kejadian Terkini Tanah Runtuh Batang Kali** telah diadakan pada 26 Januari 2023 di Bilik Mesyuarat Program Geologi UKM. Majlis tersebut telah berlangsung dari jam 9.00 pagi sehingga 1.00 tengahari.

Ceramah ini telah dipengerusikan oleh tuan presiden Persatuan Geologi Malaysia sendiri iaitu En. Ahmad Nizam bin Hasan. Panel Jemputan pula dibarisi oleh:

1) Tuan Rusli bin Tuan Mohamed
   Pengarah Jabatan Mineral dan Geosains
   Selangor/Wilayah Persekutuan
2) En. Abdul Rasid bin Jaapar
   Presiden
   Institut Geologi Malaysia (IGM)
3) Dr. Nor Shahidah binti Mohd. Nazer
   Pensyarah
   Jabatan Sains Bumi dan Alam Sekitar, FST

Kupasan menarik dan pelbagai soalan yang dilontarkan semasa ceramah ini boleh dilihat kembali dalam rakaman live di Facebook rasmi Fakulti Sains & Teknologi, Universiti Kebangsaan Malaysia (Official) menggunakan pautan berikut: https://fb.watch/iJ12kZ8F2o/.

*Laporan disediakan oleh:
Prof. Madya Dr. Mohd Hariri Arifin
Timbalan Presiden Persatuan Geologi Malaysia/
Penganjur ceramah teknik Tanah runtuh Batang Kali

Poster ceramah yang berjaya mengumpulkan 3 panel utama bagi mengupas perspektif mereka dalam isu tanah runtuh di Batang Kali.


Panel dan antara tetamu yang sempat meluangkan masa bersama selepas ceramah tamat namun diteruskan dengan diskusi secara santai.

Antara tetamu yang sempat hadir dan bergambar kenangan di lobi utama Bangunan Geologi UKM. (Dari kiri: Dr. Goh, Dr. Zuhar, En. Wan Nizam, En. Tuan Rusli, Dr. Rozi, Dato Amran, En. Nizam, Dr. Hariri, En. Safarudin dan En Rasid).

LAPORAN REPORT

Geological Society of Malaysia Karst Working Group and Malaysian Cave and Karst Conservancy educational excursion to Batu Caves

On March, 11 2023, the Geological Society of Malaysia Karst Working Group in collaboration with Malaysian Cave and Karst Conservancy has organised an educational half-day trip to Batu Caves. This fieldtrip was designed to introduce karst in the aspects of geology, palaeontology and biodiversity particularly for Batu Caves which is being threatened by the development within the hill and its immediate surrounding. The excursion was participated by 25 attendees including 4 members of GSM and 7 children. The two caves visited in this tour are managed by Gua Damai Extreme Park who also provided insurance and helmets for rent by the participants.

Participants arrived at GDEP site office to register, be prepared with proper gears and had a short briefing at 8.30 am. All participants gathered at the entrance of Gua Itchibawa at 9.00 am. Dr Ros Fatihah Muhammad made an introduction to karst by describing the fundamental karst processes, the distribution of karst in Malaysia and karst in Batu Caves. She also described the importance of Batu Caves as a Quaternary fossil site by showing some fossils orang-utan teeth, previously collected from a few caves in the hill.

Dr Nur Atiqah Abd Rahman explained the rich biodiversity in Batu Caves, describing bats as important pollinators, butterflies and herpetofauna. Threats such as encroachment happen close to up to the foothill of Batu Caves and encroachments are rampant. Participants were also briefed of the ethics in cave exploration.

At about 10 am, all participants were ushered into the underground zig-zag narrow passage of Gua Itchibawa where participants were shown various karst features, speleothems, fossil-bearing sediments and cave-dwellers such as gnat larva and cave insects. Participants were exposed to the cave troglofauna ecology, adaptation and the uniqueness of food web in the cave. Participants also experienced total darkness, to imitate the adaptation of the fauna, by switching off the headlamps for a few seconds. Despite its decreasing population, we had the opportunity to catch glimpses of bats.

We trekked up the cliff into Gua Cilipadi, a high level cave not far from Gua Itchibawa at 11.15 am, while observing the fauna along it. This cave is a different morphology, being the older cave with more spacious chamber. More description of cave processes was conveyed to the participants. It was not as dark here as the Sun shined through the skylight above, all due to the collapse of the ceiling that further enlarges the chamber.

All participants returned to the open area on the ground for end of tour briefing and group photography. This field trip hopefully disseminates the understanding on the complexity of karst, its rich biodiversity and cultivate appreciation towards its conservation and protection.

The fieldtrip ended at 12.30 pm.

NEW MEMBERSHIP

Student Membership

1. Adam Daniel Rosliza
2. Adzreeq Rifqi Azman
3. Afdlina Hazwa Rodzuan
4. Afrina A Husaini
5. Ahmad Luqman Haqeem Mohd Rashid Azuari
6. Ahmad Lutfi Abd Mutalib
7. Ahmad Mu'az Iskandar Rosly
8. Ahmad Shauqi Affandi
9. Aiman Hazim Azman
10. Aiman Haziq Hamzan
11. Ainul Najah Mohd Jafri
12. Aishah Irdhina Kamarul 'Arif
13. Ajmal Hakim Razmin
14. Alia Farisha Muhammad
15. Amin Zuhairi Alimi
16. Anis Farzana Adam Malek
17. Anis Shafiqah Zamri
18. Anisha Maisara Shahrul Nizam
19. Auni Hazirah Jamal
20. Ayu Afrina Awfiyah Kamarudin
21. Azalea Safiar Ashraf
22. Azaleya Nurfatin Najwa A Karim
23. Azra Noor Athira Ramlee
24. Bahij Iqram Othman
25. Batrisyia Azmi
26. Batrisyia Qistina Hasmeejohn
27. Beatriz Vanelly Lumpoh
28. Bibi Aisyah Amir
29. Carlz Stann El Kain
30. Esmyra Edriyana Zulkhibri
31. Fan Jun Xiang
32. Faqihah Fatnin Mohammad Effendi
33. Farhana Alia Faisal
34. Fatin Nurhanani Shahiran
35. Fatini Nabilah Faizal
36. Hanis Karina Mohamed Amin
37. Hanisah Hazlie
38. Harie R Kannan
39. Hazim Hakim Z Yussery Effendy
40. Helmy Ariffarhan Hairudin Ruzaili
41. Herda Misya Rusli
42. Intan Izzati Rezal
43. Intan Safiyyah Lokman Al-Hakim
44. Isa Idris
45. Izni Sufiah Rosly
46. Izzati Khairina Zulkpli @ Zulkeffli
47. Janani Mukuntan
48. Jazlynn Januarius
49. Jufry Haikal Juaidy
50. Maliq Adzhim Norhishamuddin
51. Melissa Heslina Md Radhi
52. Mohamad Aminudin Zawawi
53. Mohamad Firdau Mohd Azmi
54. Mohammad Aiman Syafeeq Azly
55. Mohammad Haikal Azmi
56. Mohammad Syahmi A Rahim Musly
57. Mohmmad Haziq Abd Sawarun
58. Mu'adz Mirza Farizul Hafiz
59. Muhamad Zaim Azkaf Mohamed Saidi
60. Muhammad Aiman Haqiemi Zabri
61. Muhammad Amien Idha Yuri
62. Muhammad Asyraf Damal Mohamed Romli
63. Muhammad Asyraf Danial Osman
64. Muhammad Danish Irfan Ahmad Hisham
65. Muhammad Faheem Nafiz Saberi
66. Muhammad Fayyadh Muhamad Rohani
67. Muhammad Firdaus Abd Razak
68. Muhammad Hafiy Ikhwan Khairur Rizal
69. Muhammad Hafiz Abdullah
70. Muhammad Hafizzuddin Hamzah
71. Muhammad Imran Syafi Ahmad Rosdi
72. Muhammad Irfan Busrah
73. Muhammad Ismail Rosani
74. Muhammad Luthfi Iman
75. Muhammad Mahathir Roslan
76. Muhammad Mu'az Aryusry
77. Muhammad Norfirzaie Ambing
78. Muhammad Rasyid Redha Mohamad Ridzwan
79. Muhammad Zulhaziq Mat Zamzol
80. Nabilah Ahmad
81. Najihah Ahmad Termimi
82. Neil Haqeeminn Hailmy
83. Noor Balqis Mohd Nordin
84. Noor Fatihatul Izyan Kamarul Ariffin
85. Noorul Rizma Deenie Rizal Hamidi
86. Nopporn Khongphakdee
87. Nor Athirah Aqilah Mat Sukri
88. Nue Ebryna Ellysha Muhamad Harzly
89. Nur Aaliah Syazlina Mohd Nazman
90. Nur Adliyana Hasriman
91. Nur Adryana Azrynizam
92. Nur Aina Mardhiah Mohammad Shukri
93. Nur Aisyah Mohd Norhusairi
94. Nur Anis Batrisyia Shaiful Hamidi

95. Nur Atikah Idzwan
96. Nur Ayuni Nabihah Azni
97. Nur Diyana Mohd Akbar
98. Nur Farhana Mohamad Asril
99. Nur Fatihah Mohd Yusof
100. Nur Fatin Farhana Muhamad Zubit
101. Nur Halili Mohd Huzirizal
102. Nur Hanis Ayunni Muhamad Ajos
103. Nur Husnina Mustafa Kamal
104. Nur Irdina Sheikh Azree
105. Nur Khaleeda Safiah Hamzah
106. Nur Munirah Mohd Rozmi
107. Nur Nabila Mohd Nasir
108. Nur Rahidatul Hani Ab Rahman
109. Nur Syaheerah Syazwani Mohd Shahrizal
110. Nur Syahirah Salleh
111. Nur Syam Sinar Samsol Kamal
112. Nur Syarah Ana Idris
113. Nur Wazinie Mohd Shafie
114. Nur Zarith Sofea Norazam
115. Nuralia Ayuni Rosli
116. Nur'aliah Nadhirah Ibrahim
117. Nuraqylah Sabrina Noor Azlan
118. Nureen Husna Izzatie Mohd Shahid
119. Nurliyana Mustafa
120. Nurul Ain Abdull Halim
121. Nurul Aini Sharidan
122. Nurul Anith Ayuni Talib
123. Nurul Athirah Ahmad
124. Nurul Farisha Mohamed Faisal
125. Nurul Hanisah Badi
126. Nurul Hazwani Izzati Mohd Hasaha
127. Nurul Iman Nor Azhar
128. Nurul Sabrina Yustri
129. Nuryasmin Zaimi
130. Rani Claire Alexandra Gara Jadaone
131. Shah Alvin Jabak
132. Shakti Kumara Shanmuga Kumaraiah
133. Shalyssa Aiylia Shamsudin
134. Sharmila Ismail
135. Siti Aida Nasuha Mahmud Fauzi
136. Siti Aisyah Mohd Firdus
137. Siti Fatimah Shuhaimi
138. Siti Nur Khaizunisa Khairul Anuar
139. Siti Nurhazwani Harun
140. Siti Zahra Aqila
141. Tengku Amalin Tengku Zainal Abidin
142. Tengku Abdullah Ayub Tengku Hussin
143. Titin Ria Ramadani Mansur
144. Ummi Mausarah Nazar
145. Wan Ainil Naim Wan Maizulkhar
146. Wan Amira Syafiqah Wan Ahmad Munawar
147. Wan Nadzrul Hasif Wan Abdul Rahman
148. Wan Nurul Ain Wan Abdul Aziz
149. Yadzmeen Suraya Rosli
150. Yogahnisha Manohar
151. Zhao Tong

Full Membership

1. Nizarulikram Abdul Rahim
2. Muhammad Syazwan Mohd Rohani

From Student To Full Membership

1. 'Afifah Ishak
2. Muhammad Khairul Hakim Helmi

From Full To Life Membership

1. Afifi Fahmi Ahmadol
2. Hareyani Zabidi
3. Khoong Tai Wai
4. Mohd Shafiq Firdauz Abdul Razak
5. Rabieahtul Abu Bakar

GSM-UMS Geology Club program December 2022 report

KOTA KINABALU – The GSM-UMS Geology Club has hosted 'Jalinan Mesra Kemasyarakatan' from 3 December to 4 December 2022 that took place in Kampung Nandal, Tambunan. This programme was held at the invitation of the Malaysian Red Crescent Society (BSMM) to collaborate with BSMM Tambunan, Ministry of Health Malaysia (MOH), MASWings and 4WD G6 Club Ranau to raise awareness of women's healthcare especially for the community in Kg. Nandal that does not have easy access to health services. At the same time, this programme has nourished the relationship between the students and the local community which also encourages the students for volunteerism.

In addition, on December 16, 2022, the GSM-UMS Geology Club has also organized an online talk, entitled 'Geotalk 11.0: Get to Know Seismic!'. This programme was participated by the students with geology background from University Malaysia Sabah (UMS). The invited speaker was the technical advisor at Halliburton Landmark Tokyo, Kian Wei Tan. This programme was held to educate the students on the opportunities and job-scope of a geologist in the geophysics industry.

Not to mention, the GSM-UMS Geology Club has also successfully conducted 'ArcGIS Workshop' on December 18, 2022. This workshop was participated by Year 1 to Year 4 Geology students from University Malaysia Sabah (UMS). The speakers were invited from the Minerals and Geoscience Department Malaysia (JMG), Sabah. This programme was conducted to provide early exposure to the students regarding ArcGIS skills that has huge potential to dominate the job market in the future. Besides, social network can be built between the students and representatives from the Geology field.

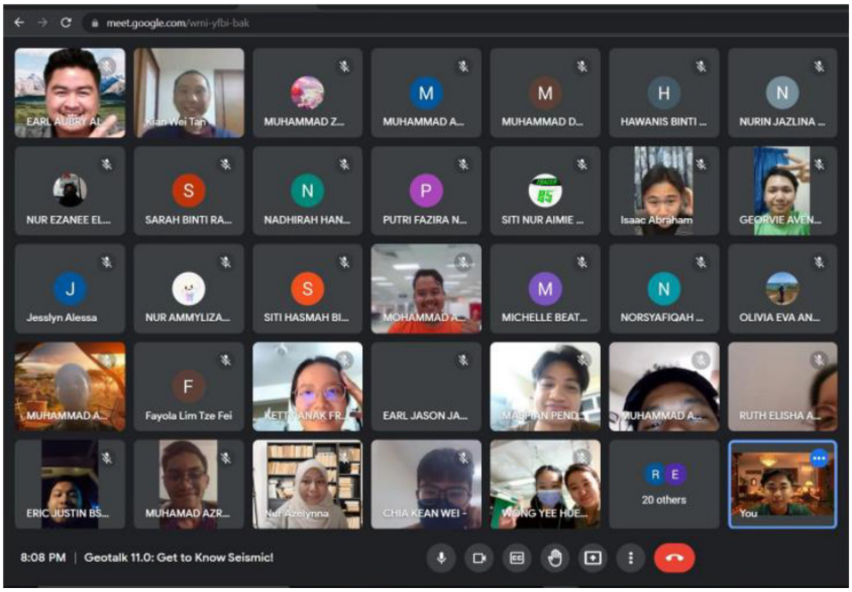
Lastly, all of the programmes were carried out smoothly, with positive feedback from the participants. We truly want to host more interactive and beneficial geology-related programmes in the future in conjunction with GSM and GSM-UMS Geology Club. Thank you very much.

B. Maha Letchummy,
Vice Secretary

Photographs taken during the Jalinan Mesra Kemasyarakatan programme. Photo by: Malaysian Red Crescent Society (BSMM).

Poster of Geotalk 11.0: Get to Know Seismic! Photo by: Publicity Unit of Geotalk 11.0: Get to Know Seismic!

Poster of ArcGIS Workshop 2022. Photo by: Publicity Unit of ArcGIS Workshop 2022.



Screenshot images of the participants of the programme on December 16, 2022. Photo by: Publicity Unit of Geotalk 11.0: Get to Know Seismic!

Participants of ArcGIS Workshop 2022. Photo by: Publicity Unit of ArcGIS Workshop 2022.

GSM-UMS Geology Club program January 2023 report

KOTA KINABALU – The GSM-UMS Geology Club has organized ‘Geology Family Day’ or also known as GeoFam Day on 2nd of January 2023 that took place in Faculty of Science and Natural Resources (FSSA). This programme includes both GeoMesra and GeoFamily Day and was held to strengthen the relationship between the new intake students with Year 2, Year 3 and Year 4 Geology students through many beneficial activities. At the same time, this programme encourages the senior students to share their experiences and knowledges as a Geology student in Universiti Malaysia Sabah.

Not to mention, the GSM-UMS Geology Club has also successfully conducted ‘Geotalk PLUS’ on January 16, 2023 at Seminar Room 1, Faculty of Science and Natural Resources (FSSA). This workshop was participated by Year 1 to Year 4 Geology students from University Malaysia Sabah (UMS). The invited speaker was one of the alumni of geology programme and also a reservoir geologist at PETRONAS, Mohammad Syafiq Ridzwan Bin Jamaluddin. Geotalk PLUS is a new programme and was conducted for the very first time as a platform for geology alumni to share their experiences other than the typical sharing of what a geologist would do in their career. This platform highlights more on the leadership qualities, student affairs and also their involvement in community.

Poster of Geology Family Day @ GeoFam Day. Photo by: Publicity Unit of Geology Family Day 22/23.

In addition, on January 28, 2023, the GSM-UMS Geology Club has also hosted ‘GeoNight’, the most anticipated night by each and every Geology student. This event was hosted to celebrate the 4th year students who will be graduating soon with the theme of Gala Night. Apart from that, this event also provided the opportunity for Geology students to bond among each other and also with Geology lecturers.

Lastly, all of the programmes were carried out smoothly, with positive feedback from the participants. We truly want to host more interactive and beneficial geology-related programmes in the future in conjunction with GSM and GSM-UMS Geology Club. Thank you very much.

B. Maha Letchummy,
Vice Secretary

Photographs taken during the Geology Family Day programme.
Photo by: Publicity Unit of Geology Family Day 22/23.

Poster of Geotalk PLUS 2023.
Photo by: Publicity Unit of Geotalk PLUS 2023.

Participants of Geotalk PLUS 2023.
Photo by: Publicity Unit of Geotalk PLUS 2023.

Photographs taken during the GeoNight event, and the Poster of GeoNight 2023 (right).
Photo by: Publicity Unit of GeoNight 2023.

Laporan Ceramah Teknik

Pembangunan ciri geoteknik CPT menggunakan kaedah pemodelan geoteknik SSPT 2D

Date: 27 July 2022
Platform: Zoom / Facebook

The above talk was delivered by Dr Abdull Halim on 27 July 2022, via Zoom/Facebook Live of Faculty Science and Technology, UKM. The total attendees were 25 persons.

Below is the synopsis of the presentation:

A Cone Penetration Test (CPT) is a geotechnical testing method that examines a soil parameter that influences the soil layer's cone resistance (Qc) and skin friction (fs). Current evaluation methods do not provide a better solution for predicting several geotechnical parameters such as strain, shear strain, poison rotation, shear modulus, stress, shear stress, elastic modulus, modulus, and the rates of soil consolidation or subduction for each layer. Each of their methods properly measures the soil's cone resistance and skin friction. In this study, a new approach model is proposed in which a single value of Qc or fs is used to forecast numerous geotechnical parameters of a soil layer. The research technique centered on the creation of elastic consolidation and Mohr circle geotechnical properties using 2D SSPT Geotechnical Modelling. As a significant outcome, the holistic geotechnical parameters of the soil layer were discovered.

1) Hypogenic karst in Peninsular Malaysia – implications for active tectonics
2) Seashells on the mountaintop – Holocene waterspout sediments located at high elevation (Langkawi Islands, Malaysia)

Date: 26 July 2022
Platform: Zoom / Facebook

The above talk was delivered by Prof. Dr. Miklós Kázmér on 26 July 2022, via Zoom/Facebook Live of Faculty Science and Technology, UKM. The total attendees were 38 persons.

Below is the synopsis of the presentation:

Hypogenic karst in Peninsular Malaysia – implications for active tectonics

- Tectonically stable Thai-Malay Peninsula?
- Karst features and associated hydrogeological regime are being studied.
- Features of hypogenic karst (scallops, lateral and ceiling niches, cupolas, ledges, pendants, windows, discharge slots, dykes, rift conduits, corrosion tables, notches) are identified.
- Sulphurous thermal springs in a narrow NW-SE zone.
- 24°C ground temperature + 35°C/km geothermal gradient = 2-3 km depth of hydrothermal reservoir.
- Fossil hypogenic karst is the surface evidence for ongoing hypogenic processes in depth.
- The linear arrangement of high-temperature springs in 750 km length along the west coast suggests that open, therefore, active faults exist.

Seashells on the mountaintop – Holocene waterspout sediments located at high elevation (Langkawi Islands, Malaysia)

- Holocene mollusc sand with well-preserved shells up to 65 m above sea level at Langkawi.
- Coral reef, mangrove, and shallow sea fauna.
- Double valves indicate transport and entombment while still alive.
- Unabraded shells – low energy versus convex side up – high energy
- Waterspouts: repeatedly siphoned sediment from nearby shallow sea and deposited it on land.
- Deposit survived under overhanging cliffs, within cave openings, overgrown by speleothems.
- Shell assemblaged are unreliable sea level markers.

Air panas di Malaysia: Status perkembangan kajian terkini dan halatuju

Date: 24 August 2022
Platform: Zoom / Facebook

The above talk was delivered by Associate Professor Ts. Dr. Mohd. Hariri bin Arifin on 24 August 2022, via Zoom/Facebook Live of Faculty Science and Technology, UKM. The total attendees were 38 persons.

Below is the synopsis of the presentation:

Sebanyak 101 lokasi mata air panas telah direkodkan di Malaysia. Air panas yang dijumpai di Semenanjung Malaysia berjumlah 85 lokasi. Negeri Sabah mencatatkan 7 lokasi manakala Sarawak sebanyak 9 lokasi. Negeri yang paling tinggi penemuan mata air panas adalah negeri Perak sebanyak 27 lokasi. Hanya negeri Perlis sahaja yang tidak ditemui mata air panas. Pembahagian taburan mata air panas di Semenanjung Malaysia dapat dikelaskan mengikut jalur granit. Majoriti lokasi air panas terletak dalam Granit Jalur Barat. Hanya 5 lokasi yang ditemui dalam Granit Jalur Timur dan 4 dalam Granit Jalur Tengah. Kesemua mata air panas di Semenanjung dikelaskan sebagai berasalan bukan volkanik. Hanya di bahagian Tawau-Semporna, Sabah sahaja yang berasalan volkanik. Pelbagai bidang kajian telah dilaksanakan untuk memahami pembentukan sistem air panas di Malaysia. Kajian geologi meliputi jenis batuan, perkaitan sesar penyumbang kepada aliran air panas dan lineament dilakukan. Taburan mata air panas turut dipetakan menggunakan kamera peka suhu iaitu FLIR. Merekod bacaan suhu dan pH air adalah perkara asas yang dilakukan semasa persampelan air. Aktiviti untuk menentukan asalan air, pengiraan suhu geotermometri (suhu takungan) dan analisis geokimia seperti kation dan anion merupakan analisis lanjutan. Kawasan terpilih yang mewakili keunikan geologi mata air panas juga turut dianalisis dari aspek isotop. Penelitian geofizik banyak tertumpu pada kedalaman bawah 500 m. Pendekatan kaedah magnetotalurik masih terlalu asing dalam mendapatkan kedalaman yang lebih bermakna bagi kajian sistem geoterma di Malaysia. Manakala aktiviti penggerudian lebih banyak tertumpu kepada pembinaan telaga cetek dengan kedalaman bawah 150 m. Halatuju penggunaan sumber mata air panas memerlukan lebih banyak komitmen daripada semua pihak. Bukan sekadar tempat berendam kaki malah tersimpan tenaga hijau di bawahnya tunggu untuk digali.

Pembangunan bahan komposit nano valensi sifar (nZVI) dan potensi rawatan terhadap pewarna sintetik dan logam berat di persekitaran

Date: 09 November 2022
Platform: Zoom / Facebook

The above talk was delivered by Dr. Nur 'Aishah Zarime on 09 November 2022, via Zoom/Facebook Live of Faculty Science and Technology, UKM. The total attendees were 26 persons.

Below is the synopsis of the presentation:

Pewarna sintetik dan logam berat daripada air sisa buangan industri merupakan permasalahan utama di seluruh dunia. Kini, banyak teknologi baru telah dicipta untuk menangani isu ini. Sebagai contoh teknologi komposit nano yang mampu merawat pewarna sintetik dan logam berat yang berasal daripada air tercemar. Kajian ini juga mengetengahkan (i) penghasilan bahan komposit besi nano valensi sifar (nZVI) dan mengenalpasti sifat-sifat fiziko-kimia, mineralogi dan morfologi bahan komposit yang dihasilkan, (ii) keupayaan penjerapan bahan komposit nZVI dan (iii) penentuan sifat dan tingkah laku pengangkutan bahan pencemar dalam kolum turasan serta menentukan keupayaan bahan komposit (nZVI) dengan mengira nilai pemalar penjerapan (Kd). Berdasarkan kesemua analisis yang terlibat, bahan karbon aktif-nano valensi sifar (AC-nZVI) merupakan bahan komposit nZVI yang terbaik dalam menjerap bahan pencemar tanpa sabarang syarat. Bahan penjerap nano seperti nZVI, Bentonite-nZVI dan Granit-nZVI juga terbaik dalam merawat larutan pencemar berbanding bahan penjerap B, AC dan Gr. Walaubagaimanapun, ia mempunyai kapasiti penjerapan yang berlainan kerana setiap bahan penjerap mempunyai ciri-ciri fiziko-kimia, mineralogi dan morfologi yang berlainan.

Slope hydrogeology

Date: 19 January 2023
Venue: Bilik Mesyuarat Program Geologi, FST, UKM and Zoom / Facebook (Hybrid Session)

The above talk was delivered by Professor Jimmy Jiao on 19 January 2023, at Bilik Mesyuarat Geologi, Faculty Science and Technology, Universiti Kebangsaan Malaysia and also via Zoom/Facebook Live of Faculty Science and Technology, UKM. The total attendees were 103 persons.

Below is the synopsis of the presentation:

This informal presentation will cover various aspects of slope hydrogeology based on our understanding of groundwater flow in hillslopes with special reference to case studies in Hong Kong.
1) Hillslope groundwater should be viewed from the system perspective because it exists in a regional system and has its recharge, by-pass, and discharge areas. Traditional geotechnical slope stability studies focus only on a small area near the failure, which may be just a part of the by-pass area.
2) Groundwater may circulate in a system much deeper and larger than most engineers expect. The deep circulation suggests that the bedrock groundwater is an important and dynamic component of the hillslope hydrogeology but is commonly ignored in current slope stability study. The bedrock groundwater, however, can be studied without much additional cost based on the current drilling practice for site investigation.
3) Confined groundwater may commonly exist in the slopes but can be easily overlooked as a result of shallow piezometers and inappropriate estimation of hydraulic conductivity.
4) Human activities often modify natural groundwater flow system and may play an important role in triggering some deep-seated landslides but the human impact may be ignored in site investigation.

Professor Jimmy with Professor Dr Fredolin Tangang, Head of Department of Earth Sciences & Environment, UKM.

Sudut geseran dalam mekanik batuan

Date: 23 February 2022
Platform: Zoom / Facebook

The above talk was delivered by Dr Abdul Ghani Md Rafek on 23 February 2022, via Zoom/Facebook Live of Faculty Science and Technology, UKM. The total attendees were 121 persons.

Below is the synopsis of the presentation:

> The roughness parameter is normally reported as the friction angle and plays an important role in the assessment of the stability of rock. Rock itself is a discontinuous system composed of rock material and discontinuity planes and is referred to as rock mass. Due to this situation, at least three different friction angles can be defined for rock material and rock mass. Rock material is characterised by the internal friction angle, (φ) which can be determined by triaxial testing or direct shear testing in the laboratory. The values that are obtained are the internal friction angle, (φ) together with cohesion (c) of the rock material. Discontinuity planes have variable surface roughness resulting in different friction angles. Furthermore, the stress conditions and sample size can also affect the results of direct shear testing of discontinuities. Normally for a complete direct shear test, the peak friction angle, (φ_p) and the residual friction angle, (φ_r) are determined. For discontinuities, another friction angle is the basic friction angle, (φ_b) which is to be understood as the friction angle of the surface without roughness. Interaction of different size blocks with variable surface roughness influences the friction angle of the rock mass. It has been stated that the rock mass is one of the most complex engineering material used by man. The different rock mass classification systems are used to determine the friction angle of the rock mass. This presentation summarises the results of 10 years of research in the determination of friction angle at Geologi Department, UKM.

We thank the speakers for their support and contribution to the UKM and Society's activities.

Dr Norsyafina Roslan
Moderator of the technical talk sessions (UKM)

UPCOMING EVENTS

May 17-18, 2023: Trenchless Asia 2023 Conference and Exhibition; Kuala Lumpur Convention Centre. Please find details of the conference programme and list of confirmed participating exhibitors on the website https://www.trenchlessasia.com/.

May 24-27, 2023: 14th International Symposium on Pseudokarst; Sudetes, Poland. Visit website: https://14pseudokarst.wonders4you.com/ for more information.

June 13-15, 2023: Unconventional Resources Technology Conference (URTeC); Denver, Colorado. Further details can be obtained at: https://urtec.org/2023/.

August 23-24, 2023: International Conference on Exploration Seismology and Geophysical Signal Processing; Kuala Lumpur, Malaysia. Website URL: https://waset.org/exploration-seismology-and-geophysical-signal-processing-conference-in-august-2023-in-kuala-lumpur.

August 28-September 1, 2023: The International Meeting for Applied Geoscience & Energy; Houston, Texas. More details aboutthe event at https://www.imageevent.org/.

September 4-6, 2023: APPEC 2023 (39th Annual Asia Pacific Petroleum Conference); Singapore. Website: https://plattsinfo.spglobal.com/appec2023.html.

October 2-3, 2023: AAPG/EAGE New Discoveries in Mature Basins; Kuala Lumpur. Further details will be available soon, at https://www.aapg.org/events.

October 7-10, 2023: AAPG Midcontinent Sectional-"Finding New Oil and Gas the Old-Fashioned Way"; Oklahoma City Convention Center, Oklahoma. Event website: https://www.aapgmcs2023.org/.

October 9-11, 2023: World Geothermal Congress 2023; Beijing, China. Please visit www.wgc2023.com to learn more about the event.

October 24-26, 2023: Offshore Technology Conference; Rio de Jeneiro, Brazil. Details about the event is available at https://otcbrasil.org/.

October 25-27, 2023: 21st Southeast Asian Geotechnical Conference and 4th AGSSEA Conference (SEAGC-AGSSEA 2023); Bangkok, Thailand. Contact Information: Contact person: Apiniti Jotisankasa, Address: Department of Civil Engineering, Kasetsart University, Email: fengatj@ku.ac.th, Website: https://seagcagssea2023.com/, Email: seagc2023@gmail.com.

October 30-November 2, 2023: International Geomechanics Symposium; Al Khobar, the Kingdom of Saudi Arabia. Event website: https://www.igsevent.org/.

November 6-8, 2023: 2023 International Conference and Exhibition (ICE); Madrid, Spain. Visit https://madrid2023.iceevent.org/ for further details.

December 3-7, 2023: AAPG/EAGE/SEG Digitalization and IR 4.0 Applications in Geosciences Symposium; Al Khobar, Saudi Arabia. More information is available at https://www.aapg.org/global/middleeast/events/announcement/articleid/65046.

December 4-6, 2023: Latin America URTeC 2023; Buenos Aires, Argentina. Contact latinamerica@urtec.org for additional information.

February 12-14, 2024: International Petroleum Technology Conference; Dhahran Expo, Kingdom of Saudi Arabia. Visit event website for further details, https://www.iptcnet.org/.

Link : https://gsm.org.my/articles/xvii-geosea-2022/

Geological Society of Malaysia Publications

Instruction to Authors

General Policy

Papers should be as concise as possible. They may include original results of basic, applied and policy research of national or international significance, current reviews, or discussions on techniques, research programs, organisations, information, or national and international policies in geoscience.

Submission of Papers

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