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# Warta Geologi

Newsletter of the Geological Society of Malaysia

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*Cover photo: Photomicrograph of liptinite-rich coal of Bintulu, Sarawak. Wan Hasiah Abdullah*

# A brief review of gravity and magnetic data for Malaysia

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**Abstract:** Gravity and magnetic surveys have been carried out in Malaysia for exploration of natural resources, especially minerals and hydrocarbons since the 1930s. Most land-based point measurements were collected by the Minerals and Geoscience Department (JMG) and its predecessor, the Geological Survey of Malaysia, whereas most ship-based offshore surveys up to the 1970s and 1980s were undertaken by research institutions from abroad. Offshore gravity and magnetic data continued to be acquired by the petroleum industry since the early 1970s but rarely made available to the public. In addition, country-wide airborne gravity surveys were conducted in 2002/2003 by the Department of Survey and Mapping (JUPEM) for geodetic purposes. Despite the abundance of gravity and magnetic data collected throughout the years, the data are not publicly available and we still do not have a unified gravity and magnetic database for the whole country. This article is a brief review of the main sources of public domain gravity and magnetic data available for Malaysia and its surrounding region. Interested geologists may find this information useful, especially for regional studies.

## INTRODUCTION

Potential field methods, especially gravity and magnetic, are important reconnaissance tools for delineating sedimentary basin geometry during the early stage of exploration. They are used for investigating deep crustal structures, especially in regions with thick sedimentary cover. Understanding the tectonic framework of a region is the first step in the search for petroleum in a sedimentary basin, through detailed analysis of the basin framework and reconstructing of crustal geometry. Gravity and magnetic data are normally used for qualitative interpretation of regional geology and structural features in offshore sedimentary basins but, in Malaysia, they are often neglected by petroleum geologists despite having been acquired at great expense. Gravity interpretation supplements the seismic evidence of stratigraphy and crustal structure and may indicate potential hydrocarbon-bearing structural anomalies. Similarly, magnetic surveys are particularly useful in the early stages of exploration to determine the depth to magnetic basement. This paper is a brief review of the gravity and magnetic data available in the Malaysian region, both on land and at sea, for regional geological and tectonic interpretation.

## GRAVITY AND MAGNETIC SURVEYS IN MALAYSIA

In regional basin analysis, gravity and magnetic data provide the initial information about basin type, geometry, and crustal structure. A wealth of gravity and magnetic data is available in the public domain for such studies (Figure 1). A single archive of gravity and magnetic data for Malaysia, however, is lacking. Such

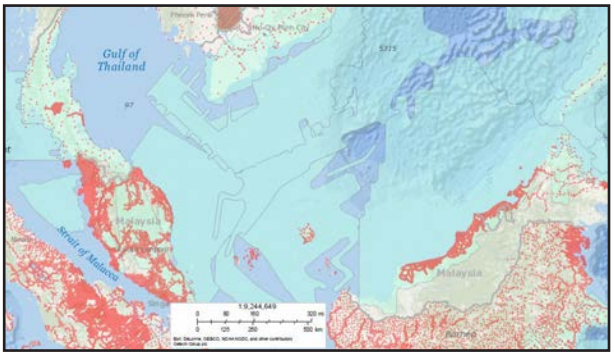


**Figure 1:** Gravity and magnetic coverage of Malaysia and surrounding areas (based on Getech database, www.getech.com, accessed 25 March 2015). Red dots are the gravity point measurements on land, shaded light blue areas offshore are magnetic grids. During 2002 and 2003 the entire land area of Malaysia was covered by airborne gravity surveys by JUPEM (Figure 2). In addition, but not shown, the whole of offshore area is covered by satellite altimeter-derived gravity data.

a database, and preferably an open one, that include all the data acquired in Malaysia should be accessible for the interested geoscientists for research purposes. In the past, regional gravity and magnetic surveys were carried out by the Geological Survey Department, now known as the Minerals and Geoscience Department (Jabatan Mineral dan Geosains, JMG). An extensive coverage of land gravity measurementsis therefore held by JMG (red dots in Figure 1) but the data are not available publicly.

A number of gravity surveys in Peninsular Malaysia have been reported. They include an east-west traverses across different parts of the peninsula; northern (van

Klinken & Ho, 1982), central from Kuala Selangor to Kuantan (Ryall, 1982), and southern (Loke *et al*., 1983). The surveys were able to show the overall crustal structure of the peninsula: a major gravity low over the granitic Main Range and a major gravity high over the Central Belt. Other surveys are smaller, sub-regional scale, e.g. Foss (1986a, b; Arafin *et al*., 1989; Burley & Othman, 1990; Vijayan, 1990). Tjia (1999) showed an unpublished gravity map of the Kelang delta area from the Geological Survey of Malaysia which indicated the presence of a sedimentary basin between Telok Datok and Tg. Sepat.

An extensive gravity and magnetic coverage of Sabah and Sarawak is also known to exist, but the data are not freely available. Data acquired by oil companies were mentioned in the PETRONAS 1999 publication and presumably are still kept by PETRONAS. Gravity surveys by oil companies in the onshore areas apparently date back to the British colonial era of the early 1920s after the First World War. During the 1920-1950 period, land gravity along with seismic data in the coastal areas of central Sarawak (Balingian) were acquired by the Anglo-Saxon Petroleum Company (the predecessor of Sarawak Shell Berhad). Aeromagnetic surveys for the entire offshore Sarawak area were extended into onshore Balingian and Tinjar provinces in 1965. In 1989 OPIC acquired gravity and magnetic data together with Synthetic Aperture Radar (SAR) in the onshore Balingian and Tatau areas of Sarawak (Chiu & Abd Kadir, 1990). More recently in onshore Baram Delta area, an airborne gravity and magnetic survey was also acquired by JX Nippon flown by Sander Geophysics Limited during the month of December 2008 (John Jong, pers. comm.). In western Sabah, early surveys were carried out sporadically during the late 1930s in and around the Klias Peninsula, and later extended into eastern Sabah. In 1963 gravity surveys in eastern Sabah on the Sebatik and Simandalan islands by Sabah Teiseki Oil Ltd, had moved gradually offshore into NW Sabah basin by the early 1970s.

The most comprehensive land gravity archive in the country is held by the Department of Survey and Mapping (Jabatan Ukur dan Pemetaan Malaysia, JUPEM) and includes more than 7447 ground measurements (Vella, 2003). In addition, under the Eighth Malaysia Plan (RMK8) Airborne Gravity and Geoid Determination Project, JUPEM in 2002-03 acquired airborne gravity data over the entire country to complement the terrestrial gravity data. The airborne gravity data were acquired in 2002 for Sabah and Sarawak and in 2003 for Peninsular Malaysia using the Danish National Space Center (DNSC)/ University of Bergen system, which is based on differential GPS for positioning, velocity and vertical accelerations. A modified marine Lacoste-Romberg gravimeter system was installed in an AN-38 aircraft flown at 5 km line spacing at different altitudes of between 1600 m and 4500 m according to topography (Figure 2). The total survey area covering the whole country is approximately 350,000 km$^2$. According to JUPEM, cross-over analysis indicates that the derived gravity anomalies are better than 2 mGal accuracy while the computed geoid has a relative accuracy of 2 to 5 cm. Details of the geoid computation were published by JUPEM (2005) on their website (jupem.gov.my). JUPEM's gravity database also includes ship-borne and satellite-derived data from various sources.

The acquisition of airborne gravity was significant, as it enabled the collection of data over the inaccessible areas, especially the deep forests of the interior. As a result the entire land area of country is now covered by gravity measurements. Coupled with all the available gravity data offshore (including ship-based and satellite-derived data) a complete gravity anomaly map for the whole country can and should be compiled.

The first regionally extensive aeromagnetic survey onshore Peninsular Malaysia was undertaken during the mid-1950s for mineral exploration (Agocs, 1958). This survey remains to this day the largest magnetic coverage of the peninsula and has been analysed by various workers (e.g., van Klinken, 1981; Loke *et al*., 1983). Another regional aeromagnetic survey on the peninsula was carried out by CGG (1980) for the Geological Survey Department, also for mineral exploration. Subsequently, more magnetic surveys were carried out over the onshore and offshore areas, both in the peninsular region and Sabah/Sarawak, mainly through oil exploration. These include the first regional aeromagnetic survey offshore Sarawak and Sabah by Shell in 1965, and later over the Malay and Penyu basins by Esso Production Malaysia Inc. (EPMI) in 1969. Since then, oil companies, including PETRONAS, have acquired gravity and magnetic data

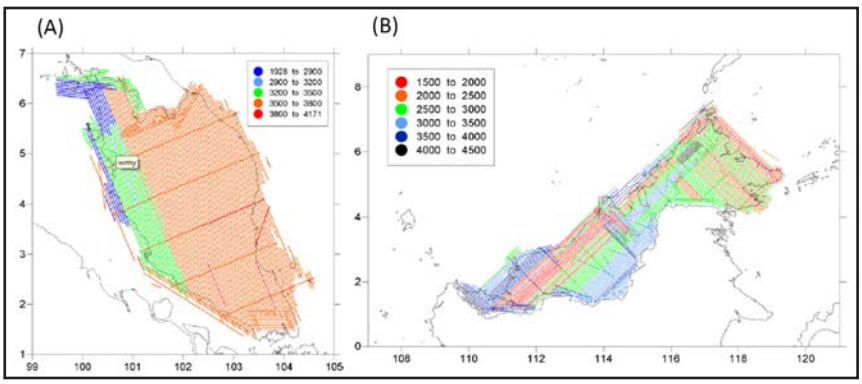


**Figure 2:** Airborne gravity of Malaysia acquired by JUPEM. (A) Peninsular Malaysia (2003), (B) Sarawak and Sabah (2002). Colour codes represent flight elevation in metres. Maps from Forsberg (2016).

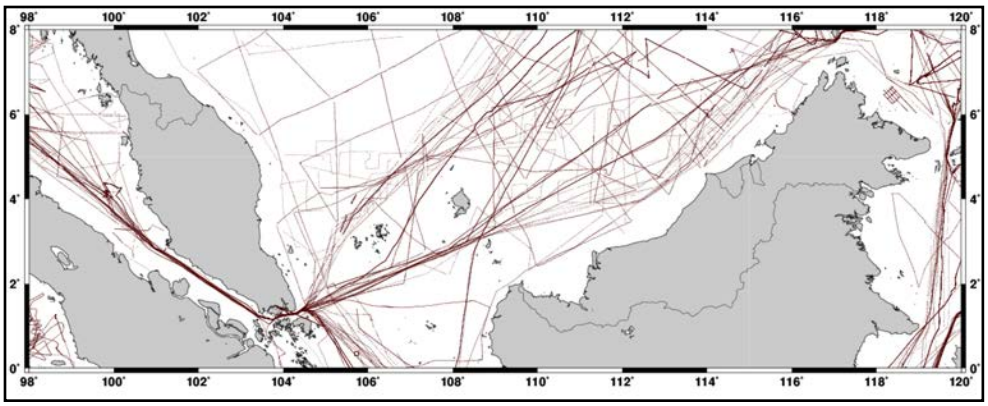


**Figure 3:** Gravity and magnetic ship-track data in the Malaysian offshore and adjacent regions obtained from NGDC (NCEI) database.

sporadically, often along with seismic acquisition, but have made little use of those data. Gravity and magnetic studies are rarely published.

Gravity and magnetic data have also been acquired in Malaysian waters during various marine scientific research projects in the South China Sea. For example, gravity and magnetic data were acquired, along with seismic reflection data, by the German Federal Institute for Geosciences and Natural Resources (BGR) during a cruise of its vessel, RV Explora in 1986 within Malaysian waters off northwestern Sabah. Interpretations of those data were published by in a landmark paper by Hinz *et al*. (1989), which contains the first detailed geological/ geophysical description of the Sabah Trough. BGR carried out another cruise, BGR01 in 2001, the results of which were described by Franke *et al*. (2008).

A useful resource for public domain marine gravity and magnetic data is the Marine Trackline Geophysical database (also commonly referred to as "GEODAS", short for Geophysical Data Access System), which is held at the US National Centers for Environmental Information, NCEI (formerly, the National Geophysical Data Center or NGDC). The database contains all the bathymetry, gravity and magnetic data collected by the numerous research cruises that have plied the regions since the 1950s. A subset of the database for the Malaysian region, including trackline bathymetric data, is shown in Figure 3.

In 2007, as part of the Malaysia Marine Research Study (MyMRS) under the Continental Shelf Project by the Malaysian government, gravity and magnetic data were acquired together with reflection seismic, single-beam and multi-beam echo sounding data. This dataset complements existing data towards a better understanding of the crustal structure of the Sarawak and Sabah margin. Gravity modelling of selected MyMRS profiles were published by Vijayan *et al*. (2013), who showed the Sabah Trough underlain by a thinned continental crust (20-25 km thick) that is a continuation of the Dangerous Grounds rifted continental terrane.

## CCOP MAGNETIC COMPILATION

A comprehensive global digital compilation of magnetic data is available on the World Digital Magnetic Anomaly Map hosted by the NGDC. The database incorporates various sources of data, from land and marine measurements to satellite data. For Southeast Asia, the most comprehensive magnetic database was compiled by the Geological Survey of Japan and the Coordinating Committee for Coastal and Offshore Geoscience Programs in East and Southeast Asia (CCOP, 1996). The compilation includes shipboard measurements, aeromagnetic surveys and some land data processed into a single 1x1 arc-minute grid. This database includes the 1969 offshore aeromagnetic survey by EPMI east of Peninsular Malaysia and the 1965 survey by Shell in offshore Sarawak and Sabah. Figure 4 shows a map of total magnetic intensity from the CCOP compilation. Since the region is near the equator, the strength of the geomagnetic field in areas above strongly magnetized bodies is reduced and resulted in local minima. This contrasts with high latitude regions where steeper geomagnetic inclinations produce magnetic highs over magnetized bodies. In general, basins with thick sedimentary fill, such as the Malay Basin and NW Borneo margin, show a smooth magnetic signal due to a deeper magnetic basement as compared to the strong

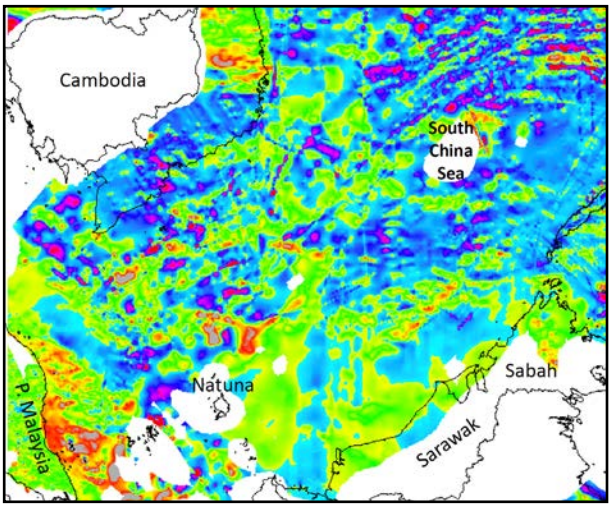


**Figure 4:** Total magnetic intensity map of Malaysia, Sunda Shelf and South China Sea region based on the compilation by CCOP (1996). Blue/purple areas represent relatively low values, green intermediate, and yellow/red high total magnetic intensities.

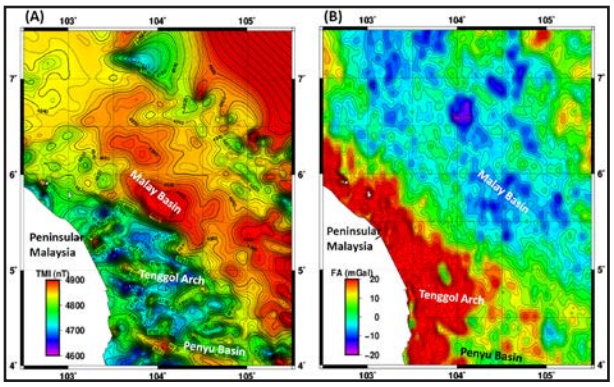


**Figure 5:** Maps of offshore Peninsular Malaysia over the Malay and Penyu basins: (A) Total Magnetic intensity (TMI). (B) Free air (FA) anomaly. Note the strong WNW-ESE lineaments in the Tenggol Arch and Penyu Basin areas where basement is shallower. The strong fabric is similar to major fault trends offshore Peninsular Malaysia. Magnetic data from CCOP (1996); gravity data from Sandwell and Smith global grid v.23.1 at topex.ucsd.edu (Sandwell *et al.*, 2013).

and sharp magnetic lineaments above oceanic crust in the South China Sea (Figure 4).

The magnetic field over the Malay Basin shows a predominantly positive anomaly with amplitude of over 300 nT. This variation is mostly due to the negative magnetic susceptibility contrast between the non-magnetic Tertiary sediments and the magnetic basement, whose average magnetic susceptibility is 0.03 to 0.05 SI. Across much of the southern part, elongate NW-SE magnetic anomalies (lineaments) probably represent strong basement fabric. The magnetic highs lie above the grabens whereas the lows correspond with the intervening horst blocks. Unlike in the Malay and Penyu basins, the magnetic field over Sarawak and Sabah basins appear smooth, which suggests a much deeper magnetic basement. Only in the NW Sabah Platform (Dangerous Grounds) are the magnetic intensities higher, probably due to the shallow depths of magnetic (volcanic or plutonic) rocks that form the basement highs. Onshore Sabah, a high magnetic signature in the Central Sabah (Telupidarea) is likely to be associated with the Mesozoic ophiolitic basement (Figure 4).

A smaller scale magnetic map over the Malay and Penyu basins is shown in Figure 5. There is a strong magnetic WNW-ESE fabric in the shallow basement areas of the Tenggol Arch and the western flank of the Malay Basin. This appears to be related to major Tertiary fault/fracture zones on Peninsular Malaysia (Ngah *et al.*, 1996). Strong lineaments with similar orientation were also recognized from aeromagnetic data onshore Johor (van Klinken *et al.*, 1980).

## GRAVITY ANOMALIES FROM SATELLITE ALTIMETRY

Where ship-borne gravity measurements are lacking, gravity anomalies derived from satellite radar altimetry are used to provide a complete gravity coverage of the

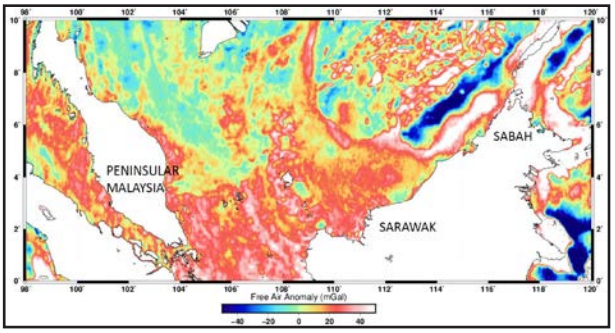


**Figure 6:** Free air gravity anomaly map of offshore Malaysia and surrounding region based on satellite-derived global grid data v. 23.1 (topex.ucsd.edu; Sandwell *et al.*, 2013).

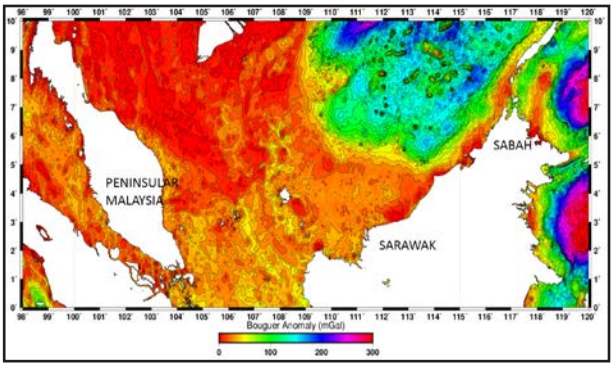


**Figure 7:** Bouguer gravity anomaly map for Malaysia and surrounding region based on satellite-derived global grid data v. 23.1 (topex.ucsd.edu; Sandwell *et al.*, 2013).

oceans. Gravity anomalies from satellite radar altimetry are basically derived from sea-surface heights. There are now several global models of gravity anomalies derived from satellite altimetry that are publicly available. Depending on the source of the data (different satellite missions, e.g., Geosat, ERS-1, Topex/Poseidon) the satellite tracks have spacing that ranges from 5 to 8 km (Green *et al.*, 1998). The most commonly used is the "Sandwell & Smith" global gravity grid (Sandwell & Smith, 2009; Sandwell *et al.*, 2013; Garcia *et al.*, 2014). Figures 6 and 7 shows free-air and Bouguer gravity anomaly maps for Malaysia based on this grid. Since it is based on sea-surface altimetry, satellite-derived gravity is available only over marine areas as free-air anomalies. In Figure 7, Bouguer correction is applied to the free-air anomaly using a density of 2.67 for rock in place of the water column (1.03 g/cc) filling the bathymetry. In gravity interpretation it is also a common practice to combine Bouguer anomaly (BA) offshore and free-air (FA) offshore in areas that straddle the coastline.

The free-air and Bouguer gravity anomaly maps reveal interesting features. For instance, the Thai, Malay and Natuna rift basin system is clearly identified, characterized by a low amplitude negative anomaly, which represents a negative density contrast due to the presence of a deep sedimentary basin. The Malay Basin is characterized by a long-wavelength low-amplitude negative anomaly of about -10 mGal caused by crustal thinning under the basin (Madon & Watts, 1998). A strong north-south fabric

which characterizes the Sundaland continental landmass continues offshore onto the shallow basement of the Sunda Shelf between Malaya and Borneo. The north-south grain in the gravity anomalies swings eastwards into SW Borneo and appears to bend sharply to continue into northern Borneo along strike with the oroclinal Rajang/Crocker fold and thrust belt.

The strong lineaments in the Sunda Shelf area between Malaya and Borneo may be attributed to the pre-existing Indosinian fabric of the granitic terrane that extends from the Schwaner Mountains northwards through Natunato Indochina. Cretaceous granites have been penetrated by wells in this area and are being pursued as fractured basement reservoirs for hydrocarbons.

## FULL-TENSOR GRADIOMETRY (FTG) DATA

Besides conventional airborne and ship-based gravity data acquisition, there is also recently acquired gravity data using the full-tensor gradiometry (FTG) technique. While conventional gravimeters measure a single component (vertical, Gz) of gravity force at a point on Earth, the FTG uses a number of gravimeters to measure the gravity gradients in all three components (x, y, z). As in conventional gravity acquisition, FTG acquisition can be done on board an aircraft or ship for marine survey.

Since the gravity field is a tensor with 9 orthogonal components (Figure 8), the FTG technique aims to measure all those nine components. In practice, depending on the configuration of different instruments, between three

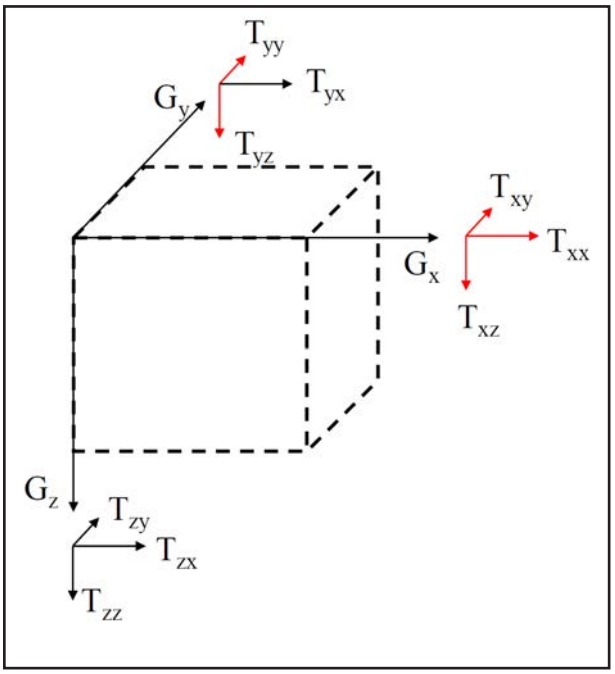


**Figure 8:** The gravity tensor field consists of nine components, five of which are measured in the FTG technique: Txx, Txy, Txz, Tyy and Tyz . Conventional gravity measures only the Gz component of gravity (modified from Murphy, 2012).

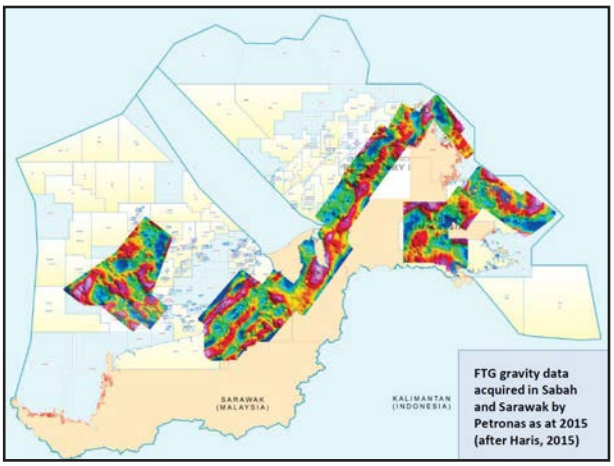


**Figure 9:** FTG gravity data in Sabah and Sarawak acquired by Petronas as at 2015. Map from Haris *et al*. (2015).

and five components are measured, e.g. Txx, Txy, Txz, Tyy and Tyz (Murphy, 2012).The main advantages of FTG over conventional scalar gravity are in its higher resolution (for defining local subsurface structures) and minimized effects from aircraft motion or air turbulence (accelerometer pairs measure differences in acceleration between them, i.e. relative, instead of absolute, value of gravitational acceleration). These detailed measurements of the gravity field therefore may provide crucial supplementary information related to shape, size and orientation of density anomalies in the subsurface and aid in structural and geological interpretation.

Since 2012, Petronas has acquired extensive FTG gravity and magnetic data in Malaysia, particularly in the Sarawak and Sabah regions (Figure 9, Haris *et al.*, 2015). In 2017, Petronas announced with its partners that a multi-client FTG data in Malaysia, which would complement the already existing158,000 km$^2$ of FTG data[1]. The new FTG data would be a significant addition to the entire Malaysian gravity and magnetic data coverage. Although at the time of writing this paper, the FTG data is proprietary to Petronas, it is hoped that the data could be made available to the public in the near future.

## GRAVITY/MAGNETIC DATABASES AND MAPPING SOFTWARE

Without access to the data held by JUPEM, JMG and PETRONAS, geologists rely on public domain databases for regional work. Topography and bathymetry data are also available from these websites. Below are some of the major public domain databases commonly used by geoscientists (summarized in Table 1).

### 1. National Centers for Environmental Information (NCEI)

(Formerly known as National Geophysical Data Centre, NGDC, which are now merged together with National Climate Data Centre and National Oceanography

1. World Oil, 13 February 2017, "Bell Geospace introduces Malaysian multi-client FTG program".

**Table 1:** Summary of the commonly used public domain digital databases for gravity and magnetic data.

| Host Organisation | Database and features | Website url |
|---|---|---|
| US National Centers for Environmental Information (NCEI), formerly known as National Geophysical Data Centre (NGDC) | Marine Geology and Geophysics Trackline data, which contains gravity, magnetic and bathymetry measurements along ship tracks of marine surveys.<br><br>Also include land-based DEMs such as ETOPO models and satellite-derived sea-floor bathymetry<br><br>High-resolution digital coastline data. | https://www.ngdc.noaa.gov/mgg / mggd.html<br><br>https://www.ngdc.noaa.gov/mgg/bathymetry/relief.html |
| Marine Geoscience Data Systems (MGDS), hosted by Lamont Doherty Earth Observatory, Columbia University | Digital database called "Global Multi-Resolution Topography Data Synthesis" (GMRT) which merges al multi-resolution multi-sourced topography and bathymetry data into a single continuous global elevation data. Easy web-based or app (GeomapApp) extraction facility. | http://www.marine-geo.org/index.php |
| Satellite Geodesy website (Scripps Institution of Oceanography, University of California San Diego, California) | Global topography and satellite-altimetry by Sandwell and Smith at UCSD. ASCII xyz files of free-air anomaly and topography may be downloaded off a gridded global dataset. | http://topex.ucsd.edu/ |
| Bureau Gravimetrique International (BGI) (France-based institution for gravity data) | Global compilation of land and marine gravity data, reference stations and absolute gravity measurements. Different databases based on different models are available for download (WGM2012, EGM2008, GGMplus2013 etc) as well as maps of global gravity in pdf formats | http://bgi.omp.obs-mip.fr/) |
| World Digital Magnetic Anomaly Map (WDMAM) website (hosted by Stephen Maus, University of Colorado, Boulder) | Global compilation of magnetic data in various downloadable formats, including .kmz(GoogleEarth™) format | geomag.org/models/wdmam.html |
| Generic Mapping Tool (GMT) website. Hosted by Paul Wessel at University of Hawaii | Open-source mapping software for Unix and Windows platform, widely used by academics and students; for manipulating geographic and Cartesian data sets (including filtering, trend fitting, gridding, projecting, etc. Software distribution includes basic data such as topography, gravity, magnetic, and coastline data | http://gmt.soest.hawaii.edu/ |

Data Centre), under the administration of the National Oceanic and Atmospheric Administration (NOAA).

The main sites under this centre are:

Marine Geology and Geophysics Tracklinedata, https://www.ngdc.noaa.gov/mgg /mggd.html, which contains gravity, magnetic and bathymetry measurements along ship tracks of marine surveys (example shown in Figure 3).

Bathymetry and Global Relief, https://www.ngdc.noaa.gov/mgg/bathymetry/relief.html, which contains global digital elevation models (DEM) for topography (land), bathymetry (ocean) and combine topography-bathymetry. The databases include land-based DEMs such as ETOPO1, ETOPO2, and ETOPO5, as well as satellite-derived sea-floor bathymetry (Smith & Sandwell, 1997).

Digital Coastline Data, which can also be downloaded from the NCEI for plotting the geophysical maps using any common geospatial/mapping software, such as GMT or ArcGIS. NCEI also provides the widely used display and data extraction software, GEODAS Desktop (which has a new 'next-generation' version, GEODAS-NG).

The data can be downloaded either as pre-plotted maps in common image format (jpeg or tiff) or in ASCII (xyz) format for further processing, manipulating and plotting.

## 2. Marine Geoscience Data Systems (MGDS) http://www.marine-geo.org/index.php

This website was set up with funding from the US National Science Foundation to provide data management services for the U.S. Antarctic Program (USAP), the Ridge 2000 and MARGINS programs, and for active source seismic data, and since 2010, the global bathymetry data. The website is hosted as part of the International Earth Data Alliance (IEDA) at Lamont-Doherty Earth Observatory of Columbia University.

A very useful product of the MGDS is the Global Multi-Resolution Topography Data Synthesis (GMRT) which is a compilation of multi-resolution multi-sourced topography and bathymetry data that have been merged into a single continuous global elevation data. Data from within a user-defined geographical area (specified by coordinates) can be downloaded in xyz or jpeg/tiff format.

The website has a web-based tool for specifying and downloading the data. It also provides a handy app called "GeoMapApp" (www.geomapapp.org) which is freely

downloadable as a desktop app to browse, search and download data from the MGDS database. A screenshot of GeoMapApp is shown below (Figure 10).

### 3. Satellite Geodesy website(http://topex.ucsd.edu/)

This site is hosted by Scripps Institution of Oceanography, University of California San Diego, California, and has a database on global topography and satellite-altimetry; the latter includes the often-quoted marine gravity data derived from satellite altimetry by Smith & Sandwell (1997), which has been updated and improved a number of times. ASCII xyz files of free-air anomaly and topography may be downloaded off a gridded global dataset from http://topex.ucsd.edu/cgi-bin/get_data.

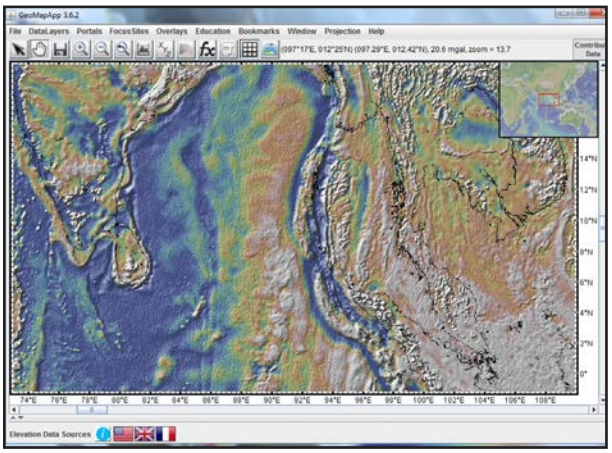

**Figure 10:** Screen shot of GeoMapApp showing a portion of the GMRT global bathymetry grid.

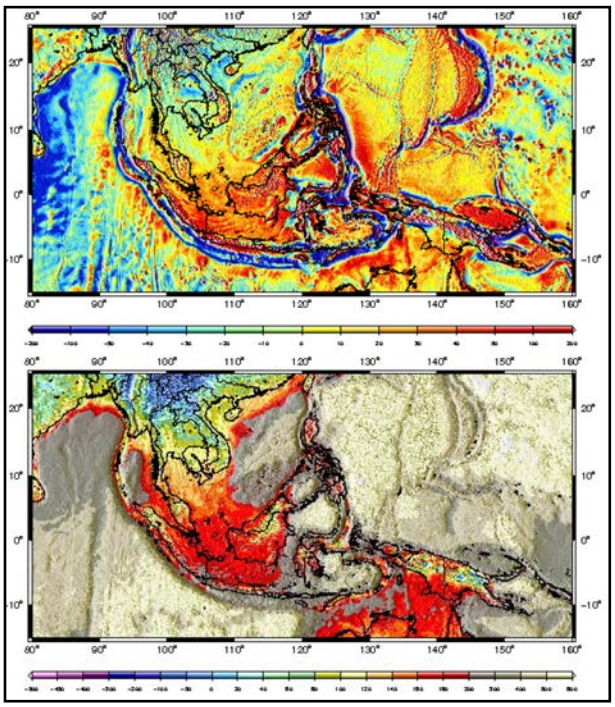

**Figure 11:** Gravity anomaly maps downloaded from the BGI website. Top – free air, bottom – bouguer anomalies.

cgi by specifying a rectangular region defined by latitutes and longitudes. At the time of writing, the topography grid is version 18.1 and the gravity grid is V23.1. Useful references relating to the databases are also available on the website. Some examples of gravity maps plotted from this grid are shown in Figures 6 and 7.

### 4. Bureau Gravimetrique International (BGI) (http://bgi.omp.obs-mip.fr/)

This France-based organization, International Gravimetric Database, contains a global compilation of land and marine gravity data, reference stations and absolute gravity measurements. Different databases based on different models are available for download (WGM2012, EGM2008, GGMplus2013 etc) as well as maps of global gravity in pdf formats. Examples of downloaded gravity maps for Southeast Asia are shown in Figure 11 below.

### 5. Global geomagnetic database of the World Digital Magnetic Anomaly Map

The World Digital Magnetic Anomaly Map (WDMAM) website (geomag.org/models/wdmam.html), hosted by Stephen Maus at University of Colorado, Boulder, holds a global compilation of magnetic data in various downloadable formats, including .kmz format which can be displayed with GoogleEarth™. Figure 12 is a map of total magnetic anomaly for Southeast Asian region obtained from the WDMAM website.

### 6. GMT mapping software

GMT stands for “Generic Mapping Tools”, and is probably the most commonly used open-source mapping software used by academics and students. Most of the maps shown in the figures in this paper (Figures 3, 5, 6, and 7) were plotted using GMT. The official website (http://gmt.soest.hawaii.edu/) describes GMT as an open source collection of about 80 command-line tools (for Unix or Windows platforms) for manipulating geographic and Cartesian data sets (including filtering, trend fitting, gridding, projecting, etc.). GMT is therefore the most

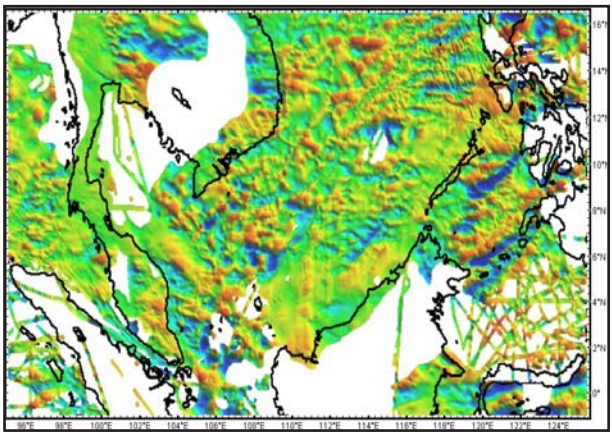

**Figure 12:** Total magnetic intensity map (TMI) for the SE Asian region from the World Digital Magnetic Anomaly Map website.

economical way (without the need to invest a lot of money in commercial mapping packages) to any plot xyz ASCII data in various geographic map projections. Maps are plotted in postscript which is easily exported as jpeg to be incorporated in presentations or publications. The only setback for potential users is the tools are not 'user friendly' in the sense that there is no graphical user interface (GUI) like a standard windows software, and that users need to be familiar with command-line applications by typing the commands or pre-written script either in Unix or Windows environment.

Besides to command-line mapping tools, the distribution includes supplementary data such as coastlines, rivers, political boundaries etc. GMT was developed and maintained by Paul Wessel, Walter Smith and a few others with support from the US National Science Foundation. The relevant references are Wessel & Smith (1991; 1995; 1998) and Wessel *et al.* (2013).

## CONCLUSIONS

Although an extensive coverage of gravity and magnetic data exists over Malaysia, both onshore and offshore, the data have been underutilized due to general inaccessibility. A gravity map of Malaysia has yet to be compiled based on the available data, onshore and offshore, most of which are held by different organisations. In the petroleum industry gravity and magnetic data were acquired routinely but are used mainly during the initial stages of exploration or totally ignored. Detailed analysis of gravity and magnetic data are generally lacking and more work on regional geology and tectonics should include gravity and magnetic data.The main importance of gravity and magnetic data is in the interpretation of crustal structure, basin-scale fault trends, and identification of structural highs and lows. Renewed interest in gravity and magnetics as an exploration tool has been spurred by the marked improvements in acquisition technologies and data quality, as well as the need to explore frontier areas including onshore regions. Some common gravity and magnetic databases and softwares are listed for the interested geoscientists.

## ACKNOWLEDGEMENTS

This review is based on available public domain data and is intended to create awareness and interest in gravity and magnetic studies in Malaysia. Reviews by Dr. John Jong (Nippon Oil) and Dr. Mohd Akhmal M. Sidek (UKM) improved the article and are greatly appreciated.

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# Provenance of the Neogene sedimentary rocks from the Tukau and Belait Formations, Northwestern Borneo by mineralogy and geochemistry

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**Abstract:** Results of mineralogy and geochemistry of the Neogene siliciclastic deposits of the Tukau and Belait formations were studied with the objectives to identify the provenance, estimate the intensity of continental weathering and infer the influence of climate and tectonism. These results were compared with contemporaneous studies of tectonic uplift and erosion. Arguably, episodic periods of rapid uplift of the parent rocks during Miocene may have led to strong physical erosion. Poorly crystallised illites are formed due to intense hydrolysis in the hinterland source area under warm and humid climatic conditions prevailing at the time. Moderate illite crystallinity, however, indicates a mixture of illite and muscovite from different continental sources for both the formations. In the sedimentary rocks of the Tukau Formation, minor content of smectite and higher ratios of illite, quartz and feldspar indicate that the sediments were supplied from a moderately-weathered continental hinterland composed of acidic igneous and/or metamorphic lithologies, and pre-existing common sedimentary rocks present throughout the northwestern Borneo. Samples of the Belait Formation seem to have undergone a stronger weathering (e.g. oxidization of pyrite) compared to samples from the Tukau Formation. Despite the difference in the amount of weathering related to climate and tectonism, there is a chemical and mineralogical similarity between the two datasets, which strongly suggests that the sediment delivery occurred from an area of comparable, or identical to the Rajang-Crocker mountain belt in Borneo hinterland. Higher chlorite and magnesium contents in the sedimentary rocks of Belait Formation, however indicates a significant input of mafic minerals (i.e. biotite and Mg-chromites).

**Keywords:** geochemistry, mineralogy, Belait Formation, Tukau Formation, Borneo

## INTRODUCTION

Mineralogy and geochemistry of fine-grained sediment fractions have been used over the last six decades to identify sediment source (Turekian & Wedepohl, 1961; Klages & Hsieh, 1975; McLennan *et al*., 1993; Sageman *et al*., 2014). This approach has been globally applied to marine sediments (from continental margins, slopes and abyssal plains) (Alt-Epping *et al*., 2009; Armstrong-Altrin *et al*. 2015; Liu *et al*., 2016; Tapia-Fernandez *et al*., 2017; Ramos-Vázquez *et al*., 2017; Ben-Awuah *et al*., 2017) and clastic sediments from different sedimentary formations (Armstrong-Altrin *et al*., 2013; Nagarajan *et al*., 2007; 2014; 2015; 2017a,b). Heavy minerals are widely used as an important tool to interpret the provenance (i.e. source rocks), and transportation history of the sediments which can be applied to fluvial, beach, dune, shallow marine sediments and deep marine deposits. Clay minerals are secondary altered product of feldspar, pyroxene, amphibole, and mica (Chamley, 1989). They are phyllosilicates, predominantly produced by chemical weathering processes and their assemblages are mainly the function of climate and tectonism, essentially controlled by the length of time of weathering, slope, water-rock ratio and water chemistry (e.g. Nesbitt *et al*., 1997). Clay mineralogy is an effective tool to constrain the provenance of fine-grained terrigenous sediments, intensity of continental weathering in the source area, and the impact of climatic variations (e.g. Sheldon & Tabor, 2009).

## STUDY OBJECTIVES, SAMPLE LOCATIONS AND METHODOLOGIES

Our study was part of a circum-South China Sea sediment study sponsored by JX Nippon, with the main objective to align the Neogene sedimentary rocks of the Tukau and Belait formations (Figure 1) with their respective source areas, and to detail the impact of continental weathering and climatic influence. Given the good exposures, the outcrops in Sarawak (Miocene-Pliocene Tukau Formation near Miri, Figure 1b) and in the Labuan Island (Miocene Belait Formation, Figure 1c) were chosen. A total of thirty-eight (38) samples were collected from the Tukau Formation (n=20) and Belait Formation (n=18). The samples were analysed with the

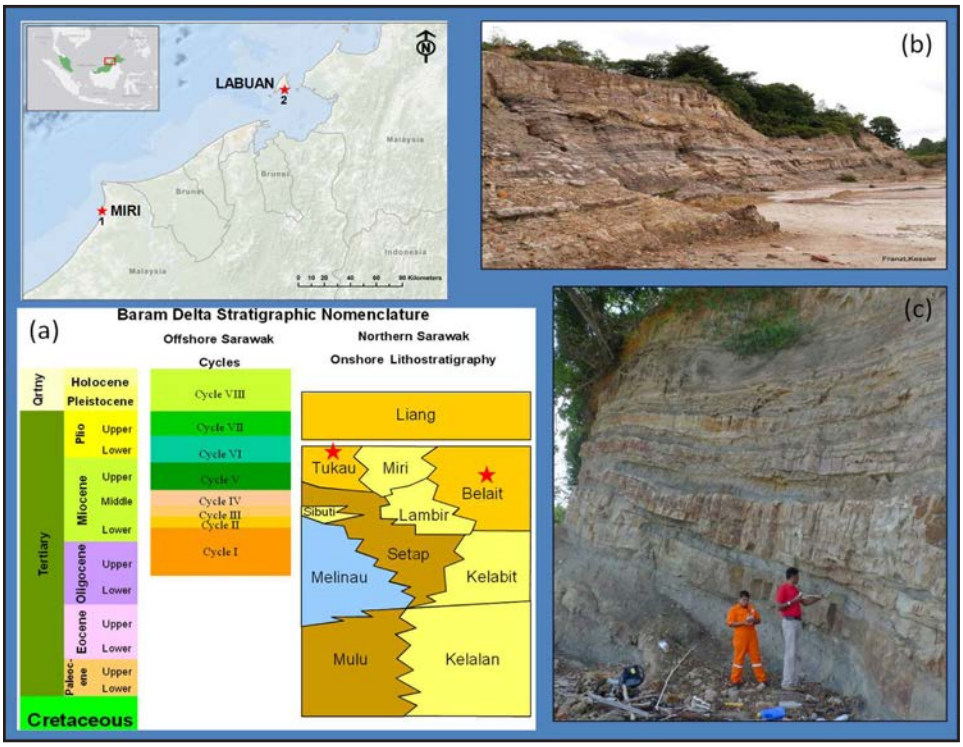


**Figure 1**: (a) Simplified stratigraphy of the northern Sarawak with illustrated nomenclature for onshore formations and equivalent offshore Cycle terminology, with the red stars highlighting locations of the investigated Tukau and Belait formations, (b) Photo of the section near Miri where samples were collected from the Tukau Formation (see Location 1), and (c) Photo of a section at Labuan Island where samples were collected from the Belait Formation (see Location 2).

help of QEMSCAN, X-ray Diffraction (XRD) of whole rock as well as for clay fractions and heavy mineral identification, while mineral chemistry and bulk major oxides were analysed with SEM-EDS (Scanning Electron Microscope/Energy Dispersive X-ray Spectrometry) to trace their provenance characters (Nagarajan, 2013). In addition, the samples were imaged under high vacuum using a combination of the secondary electron signal (primarily for topographic/morphological analysis) and backscattered electron signal (primarily for compositional analysis). Grain types were identified on the basis of backscatter electron brightness and qualitative EDS spot chemical analysis. Detailed, quantitative EDS spot analyses of selected grains, typically chromite, tourmaline and garnet were also undertaken. A range of accelerating voltages (from 15 kV to 25 kV; typically 25 kV) and beam currents were used during imaging in order to maximise image quality and optimise EDS spot analysis.

## RESULTS AND DISCUSSION

### Mineralogical composition

1. Tukau Formation (Table 1): These samples are composed of quartz, illitic clay, and minor kaolinite. Chlorite, K-feldspar, mica, muscovite, and pyrite were recorded as traces. Heavy mineral assemblages comprise of abundant zircon and rutile/anatase, and trace amounts of chromite, ilmenite, monazite, tourmaline and garnet (Nagarajan *et al*., 2017a). Chlorite content is 0.02-9.06% mass (an average of 0.72%). Based on mineralogy, the Tukau Formation sedimentary rocks exhibit a range of rock types and textures such as kaolinitic sandstone, laminated siltstone, sandy siltstones and mudstones. Clay cements are common within the sandstone samples. The siltstones comprise of medium to fine silt grade quartz and abundant illite matrix clays. Kaolinite may also be concentrated along siltstone laminae but the textures indicate that much of it is grain replacive. Graded bedding is also observed in a number of samples where thin siltstone laminae show fining-upward characters grading into claystone and the adjacent lithology is more porous and sandy laminae. Pore-filled siderite is also common, where siderite occurs as scattered pore-filling crystals, more porous laminae and also form a more pervasive (albeit patchy) cement. The predominance of illite with chlorite being largely absent indicates a weak hydrolysis and/or strong physical erosion of the parent rocks. The clay fraction of the Tukau Formation sediments is dominated by the illite, followed by kaolinite with absence of chlorite and illite-smectite type layered clays.
2. Belait Formation (Table 1): These samples consist of quartz, illite and illite-smectite, chlorite, albite, kaolinite, and some Fe-clay (illite and illite-smectite); minor contents of Fe-oxide and siderite are also recorded. Heavy mineral assemblages of the Belait Formation sediments are formed by zircon, rutile/anatase and garnet. Amphibole/clinopyroxene is observed in only one sample. One sample is enriched in mafic minerals and lesser in quartz and feldspar and eight out of the 18 studied samples show more chlorite (>10% up to 28.1% mass) than any other samples. The samples with more chlorite and siderite also have higher density as 3.275 g/cm$^3$. Chlorite is relatively higher in abundance in the Belait Formation

Table 1: Mineralogical composition of clastic sedimentary rocks of Tukau and Belait formations.

| Component | Tukau Formation (n=20) in mass % | Belait Formation (n=18) in mass % | Comments |
|---|---|---|---|
| Quartz | 46-97 | 11-98 | Abundant mineral |
| Illitic clay | 0-40 | 0.2-23 | With smectite in Belait Formation |
| Kaolinite | 1.5-9.2 | 0.8-7 | |
| Chlorite | 0.02-9.2 | 0.01-28 | |
| K-Feldspar | 0.01-0.91 | 0.01-1.19 | |
| Albite | None | 0.01-6.2 | |
| Biotite | 0.01-3.76 | 0.004-5.02 | |
| Muscovite | 0.04-0.86 | 0.02-0.77 | |
| Pyrite | 0-2.25 | Possibly oxidized 0.001-3.98 | To Fe-clay and siderite |
| Rutile/ Anatase | 0.07-0.29 | 0.03-0.41 | + Ti Silicates |
| Tourmaline | 0.0004-0.16 | 0.001-0.75 | |
| Zircon | 0.004-0.06 | 0.002-0.13 | |
| Chromite | Traces | None-0.02 | |
| Ilmenite | Traces | None | |
| Monazite | Traces | None | |
| Garnet | Traces | Common | Almandine Spessartine |
| Amphibole/ Clinopyroxene | None | 1 sample only | |
| Fe-oxides, Siderite | Traces | Common | Likely product of weathering and diagenesis |

compared to the Tukau Formation. Traces of apatites are common in the Belait Formation but very rarely observed in the Tukau Formation. Two lithotypes are identified for the Belait Formation samples based on mineralogical characters. One is sandstones dominated by quartz with minor to trace kaolinite; the second is feldspathic mudstones and sandstones contain abundant chlorite. Clay mineral distribution studies on the present-day oceanic sediments suggest that most chlorites may be of detrital origin (Griffin *et al*., 1968; Curtis *et al*., 1985; Abdullayev & Leroy, 2016). Thus, detrital chlorite can be derived from physical weathering of plutonic rocks, and by hydrolysis of metamorphic rocks such as schist and gneiss (Chamley, 1989; Abdullayev & Leroy, 2016). The clay fractions of the Belait Formation sedimentary rocks are dominated by illite-smectite type layered clays, chlorite with significance amount of either illite and/or kaolinite. Also, some samples show halite and origin of this mineral will be studied in the near future.

## Mineralogical indices

The ZTR (Zircon-Tourmaline-Rutile) maturity index in samples of the Tukau and Belait formations represents values higher than 95 (99-100 for Tukau Formation and 98-100 for Belait Formation) and it indicates that these sediments are texturally and highly matured. High values of RuZi (Rutile- Zircon) in the Tukau Formation (38.6-87.2), as well as the Belait Formation (27.6-56.4) may indicate acidic igneous rocks as the dominant source. These sediments show similarities, with a limited variation in GZi (Garnet-Zircon = 0.4-7.9 and 1.2-2 for Tukau and Belait formations, respectively), and low to moderate CZi (Chromite-Zircon = 5.5-24.7 and 12.1-32.9 for Tukau and Belait formations, respectively) ratios. The data suggest that the clastic sediments of both the formations are most likely derived from the same provenance, with minor supply from mafic/ultramafic sources. Noted also garnets (the almandine-spessartine varieties) are more common in the Belait Formation, while only traces are seen in the Tukau Formation.

## Heavy mineral chemistry

The chemistry of chromites extracted from the Tukau and Belait formations show similar characteristics with higher concentration of $Cr_2O_3$ (31-56 Wt.% and 24-59 Wt.%), $Al_2O_3$ (12-51 Wt.% and 10-41 Wt.%) and FeO (12-35 Wt.% and 13-47 Wt.%), moderate content of MgO (5-17 Wt.% and 2-15 Wt.%), and lower content of $SiO_2$ (BDL-3 Wt.% and BDL-6 Wt.%) and $TiO_2$ (0.4-3 Wt.% and BDL-3.5 Wt.%). Similarly, tourmalines are rich in $Al_2O_3$ and $SiO_2$ content and low to moderate content of $TiO_2$ and FeO, respectively. The clastic sediments appear to be mainly derived from meta-sedimentary source, intermediate to felsic igneous rock sources, and a minor input from ultramafic rocks is also noted (ophiolites, particularly chromites are derived from stratiform and

podiform type deposits). Overall, heavy mineral chemistry indicates sedimentary to meta-sedimentary sources for both formations with a minor input from fresh felsic igneous rocks and metamorphosed ophiolite group of rocks.

## Heavy mineral morphology

Heavy minerals show euhedral to rounded shapes indicating possibly more than one source rock and/or region. In comparison to the Tukau Formation, the Belait Formation shows more siderite in the selected samples (Table 1), which also show the highest average grain density (3.275 g/cm$^3$). At the same time quartz enriched samples show the average density as 2.65 g/cm$^3$. In addition, oxidized pyrite grains are recorded up to 4% in the Belait Formation compared to the Tukau Formation (recorded up to 2.15%, Table 1). The euhedral grains of both zircon and chromite in the Belait Formation indicate nearest source and less transportation in addition to the recycled provenance from the source area (Crocker-Rajang Group of sediments).

## Kaolinite and illite crystallinity

'Crystallinity' is a measure of the lattice ordering. Poorly crystalline illites are formed due to intense hydrolysis in the hinterland source area under warm humid climatic conditions (Das *et al*., 2013). In the Tukau Formation samples, the illite crystallinity varies between moderate to poor, whereas kaolinite crystallinity is mostly poor and only 3 samples show moderate crystallinity. In the Belait Formation samples, illite and chlorite are primary minerals (74 to 98%, n=5), formed through weak hydrolysis and/or strong physical erosion of parent rocks, which are tectonically active since the Mesozoic. The studied samples have low to moderate illite crystallinity, indicating that they have experienced less post-depositional thermal alteration (Krissek & Horner, 1991). Poor crystallinity illites are Al-rich illites (muscovites) formed by strong hydrolysis. But moderate crystallinity indicates a mixture of illite and muscovite from different continental sources. The illite in the Belait Formation shows moderate illite crystallinity and well kaolinite crystallinity. Crystallinity of kaolinites have shown a good correlation with base exchange capacity, which indicates that well crystallised kaolinites have very low base exchange capacity than the poor crystallinity kaolinites (Murray & Lyons, 1959). Similarly, illite-smectite mixed clay interlayers display a more ordered structure in Belait Formation than the Tukau Formation where it is not recognized.

Table 1 summarises the bulk rock mineralogical composition of the studied sample.

## Geochemistry

Based on major oxide geochemistry (Figure 2), the Belait Formation sedimentary rocks can be classified into shale (n=1), wacke (n=5), lith-sublitharenite (n=3), subarkose (n=5), Fe-sand (n=1) and quartz arenite (n=3). The Tukau Formation sedimentary rocks can be classified into wacke (n=5), arkose-subarkose (n=8), sublith arenite (n=3) and quartz arenite (n=3) (Figure 2). Chlorite enriched rocks also show higher MgO (2-5.5 wt.%) content indicating input of more mafic minerals. Subsequent alteration of the mafic minerals (dissolution of biotite; 0.004-5.02%) increased the magnesium content in sedimentary rocks of the Belait Formation.

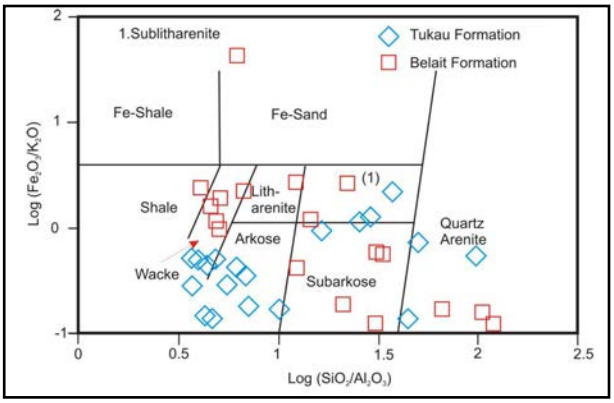


**Figure 2:** Geochemical classification of the sedimentary rocks of the Tukau and Belait formations (after Herron, 1988).

## Studies of tectonic uplift

The tectonic history of Borneo is rather complex and yet to be studied in detail. The Sarawak Orogeny caused a major change in sedimentation, with the transition from flysch to molasse occurred during the Late Eocene in northwestern Borneo (Hutchison, 2007). Accordingly, turbidite flysch of the Rajang-Crocker Group of rocks were intensively folded, thrusted and uplifted (Kessler & Jong, 2015a, 2015b, 2016; Jong *et al*., 2016). Later, during the Early Miocene, both rifting and subduction of Proto South China Sea were slowed-down. This is followed by another major rifting of Proto South China Sea during the Middle Miocene and the Borneo landmass was subsequently uplifted further. This phenomenon leads to transition from the muddy shelf Middle Miocene shale formations (Setap and Sibuti formations) to an unusual sandy formation (Lambir and Tukau formations) during the Middle Miocene to Late Pliocene, which can be attributed to tectonic compression (Kessler & Jong, 2015a). Regional tectonism in addition to climatic influence enhanced the erosion of Rajang/Crocker formations, which helped to deposits sand-rich sedimentary rocks. The influence of paleoclimate on the parent rocks during Miocene-Pliocene was assessed by the bivariate plot of Suttner & Dutta (1986) using $SiO_2$ vs $Al_2O_3$+$K_2O$+$Na_2O$ (in wt.%; anhydrous basis), since this plot can discriminate the sandstones of different climatic heritage (e.g. Yassin & Abdullatif, 2016; Tawfik *et al*., 2017). In this diagram, sedimentary rocks of both formations are scattered over humid and arid climate zones indicating a fluctuation of climatic patterns and

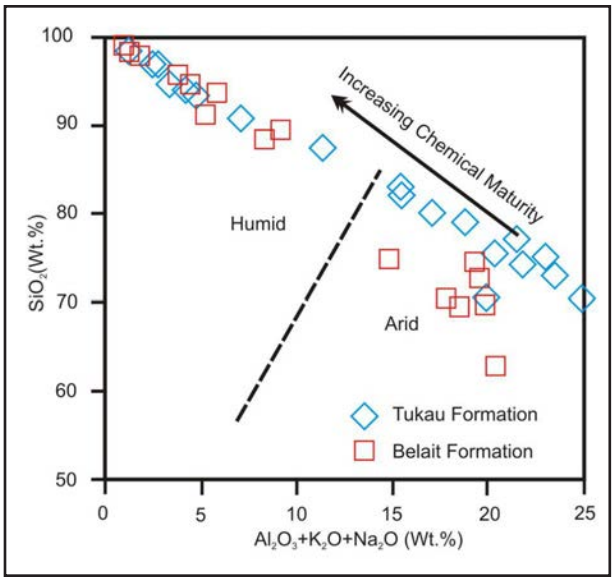


**Figure 3:** Influence of climate on chemical maturity of Tukau and Belait sedimentary rocks (after Suttner & Dutta, 1986).

tectonic setting over the period of the deposition of these sedimentary rocks (Figure 3). During Miocene, northern Borneo experienced upliftment (of different degrees) and that might lead to enhanced erosion and less sediment-water interaction during the transportation phase (hence less chemical weathering). Thus, a further study is required to further investigate the tectonic involvement in addition to the climatic variations during the deposition of the studied formations. The scattered nature of climate may indicate the stratigraphic variations and rates of erosion and transport (e.g. Nagarajan *et al*., 2017a, b). These studies have demonstrated a history of uplift, occurring in pulses dating back at least to the Early Miocene, and the observations are in agreement with geochemical results discussed herein and our on-going research of northwestern Borneo clastic source-to-sink investigations.

## CONCLUSION AND IMPLICATION FOR FURTHER STUDIES

The investigated sedimentary rocks collected from the Tukau and Belait formations formed part of our on-going research of circum-South China Sea clastic systems. The samples were analysed with QEMSCAN bulk mineralogy, X-ray diffraction for whole rock, clay fraction sediments and heavy mineral separation with mineral chemistry and bulk major oxides were analysed using SEM-EDS, and baseline date have been generated. From the study outcomes, we can conclude that:

- Tukau Formation sedimentary rocks consist of more quartz in bulk fraction than clay fraction, while Belait Formation shows more quartz in clay fraction in most of the samples and the dominance of quartz indicates moderate to high maturity.
- Dominance of illite and a significant amount of kaolinite, with less amount of chlorite in the Tukau and Belait sedimentary rocks, and the presence of chlorite and illite-illite smectite are indicating a weak to strong hydrolysis and strong physical erosion (alternatively) under temperate climatic conditions (illite), and warm and humid conditions (kaolinite), respectively. Also, the climates prevailed during the period of these sediment deposition have fluctuated between semi-humid to semi-arid conditions. The clay minerals are mostly derived from acidic igneous rocks and/or metamorphic lithologies and pre-existing sedimentary rocks. The strong physical erosion of parent rock suggests that the parent rock area was tectonically active during the formation of these sediments.
- Overall, the clastic sediments studied are derived from intermediate acidic igneous rocks and metamorphic/metasedimentary sources with a minor input from mafic and ultramafic at certain stratigraphic positions/intervals. This supports the view the South China Sea area is compositionally homogeneous at crustal level.

It is recommending that the results of this study to be integrated and compared with previous source-to-sink investigations conducted (e.g. Nagarajan *et al*., 2017a, b), such that the inter-relationship and provenance of the northwestern Borneo Neogene clastic sediments can be properly established. The study outcomes would have a significant impact for a better understanding on the timing of uplift events at the source areas and sedimentary distributions to the depositional sinks, as these sedimentary rocks formed the main reservoir inputs for the hydrocarbon accumulations offshore.

## ACKNOWLEDGEMENTS

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# Geostatistical analysis using principal component analysis in determining the groundwater quality changes in Kapas Island

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**Abstract:** Groundwater is the main water resource in Kapas Island, especially for drinking water and domestic use. Hence, uncontrolled of groundwater consumption would lead to groundwater pollution. This study aims: (i) to assess the hydrochemistry characteristics of groundwater and (ii) to identify the factors controlling the groundwater chemistry using multivariate statistical tool, namely, principal component analysis (PCA). Groundwater samples from Kapas Island were collected during two different monsoon periods, pre-monsoon (Aug – Oct 2010) and post-monsoon (Feb – Apr 2011), and analyzed for major elements (Ca, Mg, Na, K, $HCO_3$, Cl and $SO_4$) and physical parameters (Temperature, pH, DO, EC, TDS, Salinity and *Eh*). Na-$HCO_3$ and Ca-$HCO_3$ water types were observed during the pre and post-monsoons respectively. The differences in the major ion concentrations found in the two different monsoons have led to dissimilar factors controlling the groundwater chemistry. PCA was applied to the datasets of the different monsoons periods which resulted in four and three effective components explaining 81.6% and 78.9% of the total variance respectively. The components in the pre-monsoon include TDS, EC, Salinity, *Eh*, pH, Cl, and Na indicate a saline process while the components in the post-monsoon represented by Mg, TDS, EC, Salinity, Ca, Na, pH, *Eh* and $HCO_3$suggest a mineralization process. PCA outputs reveal that the natural processes have controlled the groundwater hydrochemistry in Kapas Island. This study portrays the importance of understanding the complex groundwater hydrochemistry by using the powerful statistical tool of PCA.

**Keywords:** hydrochemistry, monsoons, multivariate, water type, small island

## INTRODUCTION

Groundwater is an important water resource in small tropical islands since no other surface water exists and is generally used for drinking and domestic purposes (Praveena *et al*., 2010; Aris *et al*., 2007). The natural characteristics of groundwater depend on the surrounding activities, quantity, surface storage and subsurface recharge (Aris *et al*., 2010). Since most small tropical islands have attracted the attention of tourism, the groundwater consumption has become a major issue. Poor management of ecotourism activities may have a negative impact and lead to the groundwater unhealthy or unfit to consume.

Groundwater quality is affected by a wide range of natural activities such as geological, hydrological and climatic variability (Papaioannou *et al*., 2010). On the other hand, the human influences can be summarized as follow: lixiviation through the soil produced in the surface, leak in septic tanks, dissolution of salts from the up-coning of seawater and excess withdrawal by humans due to high demand of water supply (Kim *et al*., 2012; Servando *et al*., 2010). For a better understanding of such risks, the knowledge of conceptual model gives a better explanation of the groundwater mechanism and explains the effects of the factors mention on the groundwater quality either in saline or freshening status.

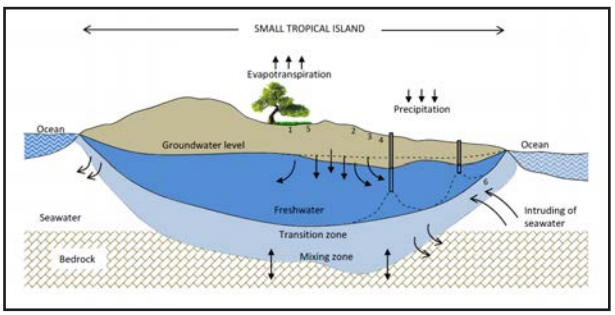


**Figure 1:** The complex geochemical conceptual model for a small island. 1) Redox process in vandose zone, 2) Cation exchange process, 3) Dissolution of mineral by water-rock interaction, 4) Precipitation of secondary minerals such as halite crystalline, 5) Leaching of herbicides and 6) Simple mixing of freshwater-seawater.

In an effort to effectively evaluate and assess the physicochemical parameters of groundwater, multivariate statistical method is widely used with respect to the spatial and temporal scale (Lu *et al*., 2012). Principal component analysis (PCA) is used in the present study to infer the parameters that are related to the groundwater chemistry mechanism. Through the application of PCA, the representative parameters which related to groundwater chemistry and main groups of groundwater quality

can be efficiently presented and categorized. Previous studies have used the multivariate statistical application to determine the groundwater quality assessment (Isa *et al*., 2013; Krishna *et al*., 2009; Bengraïne & Marhaba, 2003 and Helena *et al*., 2000). With this statistical tool, the hydrochemistry characteristics of groundwater and the factor controlling the groundwater chemistry can be revealed.

## Site description

Kapas Island was gazette as Marine Park, with the aims of protecting and conserving various habitats and aquatic marine life. Kapas Island is also well known for its ecotourism activities. Kapas Island was particularly chosen for this study due to the lack of records concerning the hydrochemistry assessment of islands in Peninsular Malaysia (Terengganu, Malaysia) and because it offers the best location for differentiating between the seasonal changes, as the location directly faced the monsoon interchanges. Kapas Island located between 5° 12.6´-5° 14.1´ N, 103° 15.7´-103° 16.3´E with an area of about 2 km² (Abdullah, 1981; Shuib, 2003). The climate is typically tropical with an annual rainfall of between 451 and 1102 mm. Kapas Island experiences a constant mean temperature of 29.88°C varying from 28°C to 31°C and has an average daily relative humidity around 80%.

The Kapas Island topography is 90 % of hilly while the rest is relatively low-lying (Figure 2). Except for the hilly area, about 8 % of the area represents secondary forest and only 2 % of the areas are sandy coastal. The ecotourism activities at Kapas Island have been actively developed in the coastal area, which is regarded as accessible. The boreholes installations were done in the coastal area as the location is high density of population where the abstraction of groundwater is practiced to supply freshwater (Figure 2).

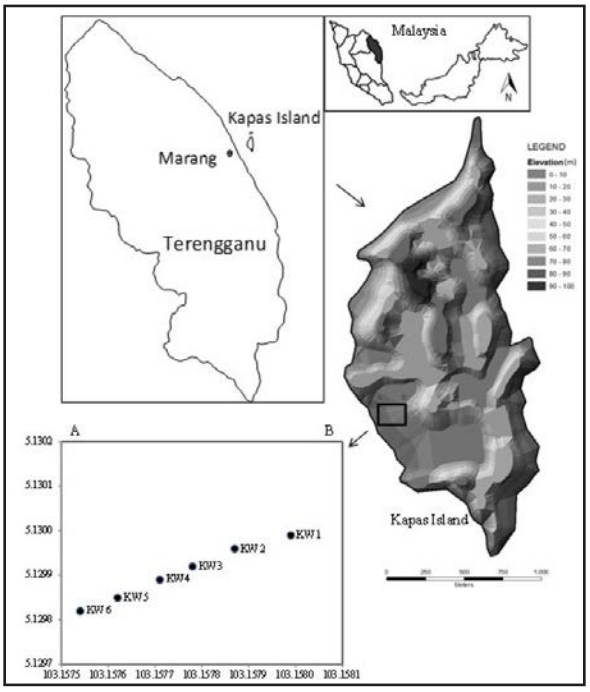


**Figure 2:** Schematic map showing the geographical locality of Kapas Island and the constructed monitoring wells.

## METHODS

A total of 216 groundwater samples were collected from seven constructed boreholes (namely KW 1, KW 2, KW 3, KW 4, KW 5 and KW 6 ) during the pre-monsoon (Aug to Oct, 2010) and post-monsoon (Feb to Apr, 2011) to ascertain the condition of the groundwater hydrochemistry in Kapas Island.

The water level in each monitoring boreholes was measured using a water level meter before collecting the groundwater samples. Subsequently, the groundwater was pumped out for about 10-15 minutes before collecting samples for physicochemical analysis to avoid any stagnant and polluted groundwater. Table 1 shows the location details and the depth of each monitoring boreholes.

## Physicochemical parameter

Groundwater was collected for *in situ* measurement namely pH, redox potential (*Eh*), electrical conductivity (EC), salinity, total dissolved solids (TDS), dissolved oxygen (DO) and temperature, as well as major ions.

Bicarbonate ($HCO_3$) and chloride (Cl) were determined using HCl and the $AgNO_3$ of titration method respectively (APHA, 2005) while the $SO_4$ concentration was determined using a HACH (DR/2000) meter (HACH, Loveland, CO, USA). For cation analyses, groundwater samples were filtered through a 0.45µm Millipore filter and acidified to pH < 2 with $HNO_3$ immediately after the filtration. Pre-treated samples were kept in a cool box before being transported to the laboratory for analysis using a flame atomic absorption spectrophotometer (FAAS, Perkin Elmer, Massachusetts, USA).

The preservation and data collection of samples were done precisely to ensure the quality of data. *In-situ* devices were calibrated with buffer solutions before and after the field sampling to ensure the functionality. The accuracy checks were undertaken to obtain a reliable analytical dataset by checking the procedure of blank measurements and a three point calibration curve while using the FAAS. The results of triplicate analyses and average values are reported to indicate the precision of the measurement.

## Data analyses

Illustration of Piper diagram and Schoeller diagram were used to delineate the groundwater condition as it reveal the concentration and the quality of groundwater. The groundwater type also would be determined based on the data distributions on the diagram used.

Statistical analyses techniques were used to emphasize the meaningful of data such as variability and description of similarities. The descriptive, correlationship and

**Table 1:** Location and depth of the boreholes at Kapas Island.

| Station | Station's Coordinate | | Distance from coastline (m) | Depth of boreholes from surface (m) |
|---|---|---|---|---|
| KW1 | 05° 12.999 N | 103° 15.799 E | 119 | 11.5 |
| KW2 | 05° 12.996 N | 103° 15.787 E | 98 | 9.1 |
| KW3 | 05° 12.992 N | 103° 15.778 E | 83 | 3.5 |
| KW4 | 05° 12.989 N | 103° 15.771 E | 68 | 3.0 |
| KW5 | 05° 12.985 N | 103° 15.762 E | 48 | 2.9 |
| KW6 | 05° 12.982 N | 103° 15.754 E | 31 | 2.5 |

multivariate analysis were obtained using PASW 18. The statistical of *p* and r value were used as significant difference testing in evaluating the dataset where each variable correlated either in positive or negative magnitude. Geostatistical refer to principal component analysis PCA was calculated to evaluate the significant variables controlling the groundwater quality. PCA is a technique used to reduce the unimportant parameters and detect such similarities among the variables or samples (Reghunath *et al*., 2002). The eigenvalues and eigenvectors extracted through PCA were depending on the range of standard deviation, determine whether to use covariance or a correlation matrix (Yongming *et al*., 2006). The main output results in data matrices consisting of the principal component (PC) scores and loadings (Stetzenbach *et al*., 1999).

The number of factors/components score will usually account for approximately the same amount of information as a much larger set of original observations. The factor/component loadings represented by number 1< x < -1 (Kumar *et al*., 2011) were screened and numbers greater than 0.6 were taken into consideration during interpretation of this study. To make the data readable and easily interpretable, the PCA with Varimax rotation was also applied, which can maximize the variances of the factor loading of each variable. When PCA is combined with Varimax rotation, the PC (principal component) score contains information in a single number and the loadings refer to the contribution of each variable to that score (Yongming *et al*. 2006).

## RESULTS AND DISCUSSION

### Descriptive and correlationship analyses

The descriptive and correlation analyses are shown in Table 2 and Table 3. The average temperature and DO values were 29.88 °C and 3.41 mg/L (±1.26) and (±2.26) respectively. EC is in the range of 0.06 to 0.91 mS/cm (±0.14), which shows a positive significant correlationship ($p$<0.01) with salinity and a strong correlation with TDS (Table 3). TDS ranged between 28 to 455 mg/L (±71.62), which represents the significantly correlation of the ions in the groundwater with major ions ($p$<0.01; Table 3). The average salinity value in the groundwater was 0.23 ppt (±0.07). The measured pH and *Eh* showed average values of 7.17 (±0.13) and 1.09 mV (±7.81), respectively, and shows negative correlationship ($p$<0.01; Table 3).

The cation concentration order was Ca>Na>Mg>K while for the anions was $HCO_3$>Cl>$SO_4$. The average concentration of Ca and Na were 64.05 (±28.07) and 13.37 mg/L (±12.04) while Mg and K were 5.72 (±2.69) and 0.77 mg/L (±0.78) respectively. $HCO_3$ is the dominant anion with an average of 326.87 mg/L (±104.82). The mean values for Cl and $SO_4$ are 31.16 (±25.25) and 12.34 mg/L (±6.53) respectively.

The Schoeller diagram (Figure 3) illustrates that the concentration of major ions varies according to the monsoon. The post monsoon shows an increasing concentration of mineral elements, Ca and Mg but a decreasing concentration of seawater elements, Na

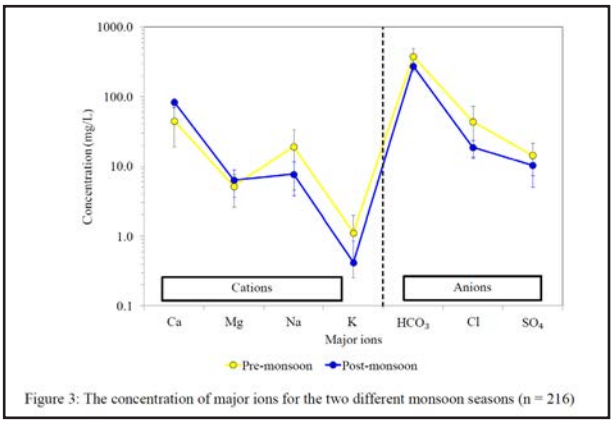


**Figure 3:** The concentration of major ions for the two different monsoon seasons (n = 216).

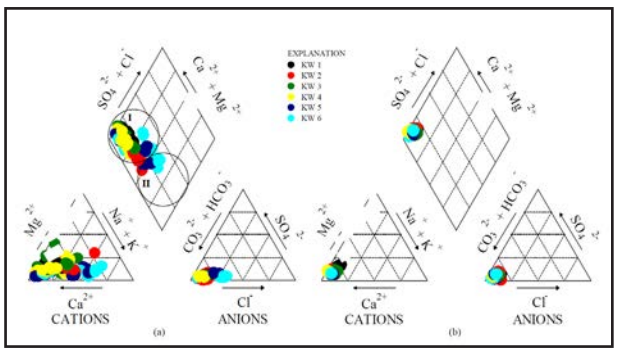


**Figure 4:** Schematic Piper diagram to evaluate the groundwater evolution during two monsoons (pre and post-monsoon) at Kapas Island, Terengganu.

**Table 2:** Descriptive analyses for the *in-situ* and major ions of the groundwater samples (n = 216).

| Station | | Temp | pH | Cond | Sal | DO | TDS | *Eh* | Ca | Mg | Na | K | $HCO_3$ | Cl | $SO_4$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KW 1 | Mean | 29.48 | 7.18 | 0.52 | 0.25 | 2.97 | 258.72 | 1.24 | 75.72 | 8.58 | 13.83 | 0.71 | 326.72 | 30.35 | 17.22 |
| | SD | 0.86 | 0.12 | 0.08 | 0.04 | 2.61 | 38.41 | 5.88 | 28.23 | 4.02 | 4.16 | 0.19 | 36.78 | 7.74 | 2.36 |
| KW 2 | Mean | 29.77 | 7.07 | 0.54 | 0.26 | 2.82 | 270.16 | 7.28 | 60.72 | 6.36 | 12.17 | 1.76 | 344.38 | 31.00 | 8.92 |
| | SD | 1.05 | 0.17 | 0.20 | 0.10 | 2.23 | 99.39 | 10.18 | 23.21 | 2.44 | 6.92 | 1.04 | 108.73 | 12.05 | 8.61 |
| KW 3 | Mean | 29.66 | 7.24 | 0.41 | 0.20 | 4.17 | 202.65 | -3.21 | 54.09 | 5.19 | 9.33 | 0.55 | 273.08 | 22.80 | 11.11 |
| | SD | 0.74 | 0.05 | 0.02 | 0.01 | 2.69 | 12.02 | 2.29 | 26.33 | 1.92 | 3.60 | 0.14 | 19.09 | 4.44 | 2.76 |
| KW 4 | Mean | 30.07 | 7.23 | 0.39 | 0.19 | 4.47 | 197.32 | -2.69 | 62.79 | 4.96 | 7.09 | 0.35 | 293.00 | 17.72 | 9.03 |
| | SD | 1.34 | 0.06 | 0.02 | 0.01 | 2.41 | 11.92 | 3.27 | 29.74 | 1.27 | 5.78 | 0.43 | 26.90 | 6.42 | 3.16 |
| KW 5 | Mean | 30.28 | 7.20 | 0.45 | 0.22 | 3.53 | 227.88 | -0.78 | 67.22 | 4.41 | 15.57 | 0.48 | 361.43 | 31.96 | 15.06 |
| | SD | 1.76 | 0.08 | 0.11 | 0.05 | 1.67 | 55.00 | 5.23 | 29.23 | 1.45 | 13.07 | 0.46 | 179.42 | 19.77 | 8.65 |
| KW 6 | Mean | 30.06 | 7.11 | 0.54 | 0.26 | 2.50 | 269.32 | 4.70 | 63.74 | 4.83 | 22.23 | 0.78 | 362.61 | 53.15 | 12.69 |
| | SD | 1.43 | 0.19 | 0.21 | 0.11 | 0.75 | 105.99 | 12.21 | 28.39 | 1.56 | 21.51 | 0.90 | 118.41 | 50.02 | 5.70 |

Temp = Temperature
All units in mg/L, except for Temperature (°C), EC (mS/cm), salinity (ppt), Eh (mV) and pH (unit less)

and Cl. The monsoon changes affect the groundwater concentration as the results show a positive significant difference ($p<0.01$) between monsoons and the concentration of major ions. The Piper diagram (Figure 4) reflects the types of groundwater in Kapas Island. Insert (a) shows that the water type for pre-monsoon is made up of two main water types: Ca-$HCO_3$ water type (Circle I) and Na-$HCO_3$ water type (Circle II). Insert (b) shows that the water type for the post-monsoon indicates the domination of Ca-$HCO_3$ water type.

## Principle component analysis

The physicochemical parameters in Table 4 were analyzed according to the PCA. From the data for the pre-monsoon, 4 components (81.6 %) were extracted while for the post-monsoon, 3 components (78.9 %) were extracted to delineate the groundwater composition.

During pre-monsoon, the first two PCs explains 57.8 % of total variance which are contributed by TDS, EC, Salinity, Eh, pH, Cl and Na (PC 1) and $SO_4$, K, (PC 2) respectively. While PC 3 and PC 4 with 13.7 % of total variance comprise of Mg, Ca, temp, $HCO_3$ and DO. PC 1 for the post-monsoon has 43.4 % of total variance, which is mainly related to Mg, TDS, EC, Salinity, Ca, Na, pH, Eh, $HCO_3$ while the remaining PCs refer to other variables with 35.6 % of total variance.

Based on PCA the output, the pre-monsoon contain seawater components (Na and Cl) which are believed to be the controlling factors for the groundwater composition. These parameters indicate that as the seawater has evaporates in the coastal area which supposed from inundation events and leaves halite crystalline on the aquifer bedrock that later on dissolve into the groundwater. This mechanism can be explained by Eq. 1 below where X is the aquifer. Na that binds at the bedrock (X) has exchanges with Ca ion in the groundwater which results Na ion in the groundwater. PC 4 shows Ca and Mg represent mineral elements, indicating that the mineralization process has less percentage in controlling the groundwater composition.

$$Na - X + \frac{1}{2}Ca^{+} \leftrightarrow Na^{+} + \frac{1}{2}Ca - X_2 \qquad \text{(Eq. 1)}$$

Vary from pre-monsoon, post-monsoon extract 3 components where PC 1 refers to the classical hydrochemical variables, originating from mineralization of the geological components mainly carbonate. The vice versa of Eq. 1 would be the major hydrochemistry mechanism that controls the groundwater composition during the post monsoon as the heavy rainfall dissolved the Ca back into the groundwater. As water from the heavy rainfall reacts with the aquifer (Eq. 2), the cations exchange once again. This supports the findings on Piper diagram where the post monsoon experienced a shift from the Na-$HCO_3$ into the Ca-$HCO_3$ water type.

$$\underset{\text{Precipitations}}{H_2O} + \underset{\text{Aquifer}}{CaCO_3} \rightarrow Ca^{2+} + HCO_3^{-} + OH^{-} \qquad \text{(Eq. 2)}$$

## CONCLUSIONS

The groundwater data for the different monsoons in Kapas Island describe the groundwater quality based on the hydrochemical mechanism. The Piper and Schoeller diagrams explain that the pre-monsoon experiences slightly saline conditions as seawater components control the groundwater composition. While, the post-monsoon are under freshening conditions where the dominated parameters were minerals element that control the groundwater chemistry. Furthermore, the PCA data revealed the same condition for the groundwater, in that there were seawater elements in Component 1 during

**Table 3:** Correlation coefficient for the groundwater samples for Kapas Island (n = 216).

| | Temp | pH | EC | Salinity | DO | TDS | *Eh* | Ca | Mg | Na | K | $HCO_3$ | Cl | $SO_4$ | Season |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp | 1 | -0.392** | 0.302** | 0.296** | -0.066 | 0.301** | 0.391** | -0.296** | -0.145* | 0.192** | 0.307** | 0.563** | 0.277** | 0.060 | -0.432** |
| pH | | 1 | -0.810** | 0-.804** | 0.250** | -0.807** | -0.965** | 0.080 | -0.309** | -0.531** | -0.644** | -0.547** | -0.573** | 0.012 | 0.372** |
| EC | | | 1 | 0.998** | -0.241** | 0.999** | 0.845** | -0.307** | 0.210** | 0.790** | 0.574** | 0.631** | 0.820** | 0.256** | -0.616** |
| Salinity | | | | 1 | -0.235** | 0.999** | 0.841** | -0.306** | 0.205** | 0.797** | 0.565** | 0.631** | 0.823** | 0.255** | -0.609** |
| DO | | | | | 1 | -0.243** | -0.232** | 0.118 | -0.159* | -0.123 | -0.274** | -0.080 | -0.202** | 0.020 | 0.196** |
| TDS | | | | | | 1 | 0.843** | -0.309** | 0.208** | 0.794** | 0.573** | 0.633** | 0.821** | 0.260** | -0.618** |
| *Eh* | | | | | | | 1 | -0.093 | 0.297** | 0.563** | 0.660** | 0.599** | 0.619** | 0.012 | -0.356** |
| Ca | | | | | | | | 1 | 0.545** | -0.292** | -0.357** | -0.223** | -0.346** | -0.218** | 0.692** |
| Mg | | | | | | | | | 1 | 0.030 | 0.013 | -0.005 | -0.064 | -0.071 | 0.224** |
| Na | | | | | | | | | | 1 | 0.320** | 0.433** | 0.915** | 0.466** | -0.477** |
| K | | | | | | | | | | | 1 | 0.513** | 0.363** | -0.024 | -0.457** |
| $HCO_3$ | | | | | | | | | | | | 1 | 0.518** | 0.193** | -0.500** |
| Cl | | | | | | | | | | | | | 1 | 0.406** | -0.498** |
| $SO_4$ | | | | | | | | | | | | | | 1 | -0.311** |
| Season | | | | | | | | | | | | | | | 1 |

Temp = Temperature
(Upper triangle; $p<0.01^{**}$, $p<0.05^{*}$)

**Table 4:** Principle components of pre (a) and post-monsoon (b) detail.

| **Rotated Component (pre-monsoon)** | | | | | **Rotated Component (post-monsoon)** | | | |
|---|---|---|---|---|---|---|---|---|
| | Component | | | | | Component | | |
| | 1 | 2 | 3 | 4 | | 1 | 2 | 3 |
| TDS | 0.971 | 0.054 | 0.130 | -0.027 | Mg | 0.949 | 0.049 | -0.064 |
| EC | 0.969 | 0.049 | 0.132 | -0.026 | TDS | 0.930 | 0.301 | -0.054 |
| Salinity | 0.968 | 0.059 | 0.124 | -0.026 | EC | 0.928 | 0.308 | -0.062 |
| *Eh* | 0.916 | -0.259 | 0.152 | 0.155 | Salinity | 0.923 | 0.308 | -0.041 |
| pH | -0.860 | 0.305 | -0.193 | -0.118 | Ca | 0.756 | -0.516 | -0.070 |
| Cl | 0.807 | 0.483 | -0.156 | 0.070 | Na | 0.721 | 0.011 | 0.575 |
| Na | 0.763 | 0.525 | -0.079 | 0.015 | pH | -0.581 | -0.506 | 0.472 |
| $SO_4$ | 0.109 | 0.769 | -0.116 | -0.074 | *Eh* | 0.571 | 0.513 | -0.471 |
| K | 0.573 | -0.661 | -0.196 | -0.035 | $HCO_3$ | 0.536 | 0.350 | 0.012 |
| Mg | 0.271 | -0.114 | 0.828 | -0.263 | K | 0.055 | 0.851 | 0.037 |
| Ca | 0.112 | -0.033 | 0.781 | 0.116 | Temperature | 0.187 | 0.808 | -0.309 |
| Temperature | -0.003 | -0.036 | -0.083 | 0.900 | Cl | 0.523 | 0.605 | 0.254 |
| $HCO_3$ | 0.509 | -0.125 | -0.002 | 0.648 | $SO_4$ | 0.169 | -0.001 | 0.842 |
| DO | -0.178 | 0.089 | 0.467 | 0.503 | DO | -0.461 | -0.076 | 0.615 |

the pre-monsoon while the mineral component was dominant in Component 1 during the post-monsoon. Finally, the groundwater in Kapas Island is classified under the category of unpolluted. However, continuous monitoring is necessary to obtain information and to better understand the hydrochemistry mechanism to prevent any risk in the future.

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# Early explorers fatal destiny in the jungle of Sabah

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**Abstract:** Narration of the tragic destiny of Ferencz György Witti, Frank Hatton and other explorers while travelling through the Sabah jungle.

## INTRODUCTION

Borneo's northwest corner has been the last tract of the island to be explored; early explorers venturing into this unknown territory faced all sorts of dangers: fevers, accidents, wild animals, hostile tribes and the risk of getting lost rendered any journey particularly hazardous. Several explorers lost their life while travelling in the jungle and their memory is now largely forgotten. A modest marble monument at the edge of Sandakan's parade ground has the following lines engraved (Powell, 1921):

"*In Memory of Francis Xavier Witti Killed near the Sibuco River May, 1882, of Frank Hatton accidentally shot at Segamah March, 1883, of Dr. D. Manson Fraser and Jemadhar Asa Singh the two latter mortally wounded at Kopang May, 1883 and of Alfred Jones, Adjutant, Shere Singh, Regimental Sergeant-Major of the British North Borneo Constabulary killed at Ranau 1897-98 and of George Graham Warder District Officer, Tindang Batu, Murdered at Marak Parak 28th July 1903, This Monument Is Erected as a Mark of Respect by their Brother Officers*".

Some of these tragic, long-forgotten stories are narrated here again.


**Figure 1:** Ferencz György Witti (1850-1882), portrait by Pollák Zsigmond.

## THE MURDER OF FERENCZ GYÖRGY WITTI

Ferencz György, also called "Francis Xavier" Witti (Figure 1) was an ex-navy officer in the Austro-Hungarian Empire and an explorer at heart. On the advice of Baron Gustav von Overbeck, a German adventurer and diplomat, Witti visited Sabah while on a journey through Southeast Asia. He was so thrilled about the prospects of being the first to explore much of this territory that, on his return to Europe, Witti went to London to seek employment with the British North Borneo Company. In the process, fearing that his nationality may be in the way of securing a job, Witti returned to Borneo on his own account, "*working his passage*" and eventually landing as the mate of a coasting vessel (Hatton, 1886).

Having demonstrated the value of his services through various survey reports in Sabah, Witti gained formal employment with the British North Borneo Company in 1877 and was appointed to carry expeditions of general exploration, whereby tracts of the country could be mapped and their natural resources identified.

In the course of 4-5 years, Witti penetrated into many districts of Sabah never before visited by a European, following major rivers upstream towards their source and venturing through the jungle. He carried out three major expeditions, before meeting with a tragic death while returning from a fourth journey (Posewitz, 1892).

The following is an excerpt from a letter by fellow explorer Frank Hatton to his mother, written in Kudat on October 28th, 1882 (Hatton, 1886).

"*Poor Witti! He was travelling in a Murut country, and having slept in a native's house, left the place next morning with his 11 men. They had a small native-made boat, in which they were going down stream. They came to a shallow place, where everyone had to get out into the water and drag the boat. The rifles and weapons were put in the prahu. Witti waded ashore to make some*

*notes. In the middle of all this, they were attacked by some hundreds of savages, who fell upon Witti and his unfortunate men with spears, sumpitans, swords, etc. Witti, it is said, had a spear thrust right through his body; and even after receiving this awful wound; he turned and fired his revolver six times. Four cartridges were damp and did not explode, with the other two he killed two men. Of the rest of his followers, three escaped to tell the sad tale, the other were killed or died in the ambush.*"

Some gruesome acts followed the killings. From the reports at the time, it was never established which tribe committed these crimes, but it was known that at the time, various tribes were at war with each other. W.H. Treacher, Governor of British North Borneo at the time commented that "*so far as we have been able to ascertain, the sole reason for the attack was the fact that Witti had come to the district from a tribe with whom these people were at war, and he was, therefore, according to native custom, deemed to be also an enemy.*" (Treacher, 1891).

R.C. Mayne (1888) surprisingly mentioned"*…his body and such effects as have been recovered came down the Sibuco, or some river flowing to the east coast in the territory held by the Dutch*". However, no firm evidence is documented that this should have been the case.

These events were widely reported internationally, and the tragic story can even be read in a long article published in the New York Times edition of October 30, 1882, under the heading "*Mr. Witti's Sad Fortunes in the Land of the Head-Hunters*".

## THE FATAL SHOOTING ACCIDENT OF FRANK HATTON

Frank Hatton (Figure 2) was a brilliant, well-educated natural scientist, graduated from the Royal School of Mines in London where he obtained a degree in chemistry and mineralogy. In 1881, aged 20, he accepted a position of mineral explorer and metallurgical chemist with the British North Borneo Company. He was to explore unchartered regions of Sabah in the hope that minerals and metals would be found (Pryer, 1893).

In the course of his expeditions between 1881 and his early death in 1883, Hatton discovered samples of coal, native copper and other minerals. On the Sekuati River, he investigated the occurrence of live petroleum extruding from shales with coal seams, and had a 38 ft deep pit excavated to observe the precise horizons along which the oil was seeping.

In travelling through the interior of Sabah, dangers were always looming. Hatton's diary of February 9th, 1883 tells of a near fatal happening: having walked with his crew to a river bank where several Muruts were building a house, Hatton noticed that one by one, these men slipped away into the jungle, taking their weapons with them. Soon, nearly 50-armed Muruts came down from a nearby hill, menacing with spears and with their blowpipes. This tense situation was diffused at the last moment when one of Hatton's local crew members could talk to the head of the Muruts and explain the peaceful motives of Hatton's presence. The Muruts had interpreted Hatton and his crews' intentions as hostile, which resulted in a near fatal outcome.

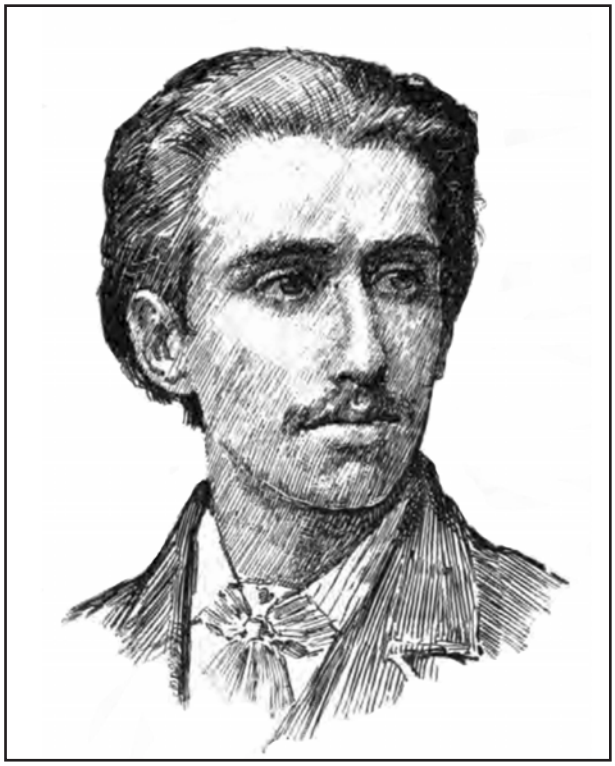

**Figure 2:** Frank Hatton (1861-1883), portrait in Hatton, 1886.

Shortly thereafter, on March 1st, Hutton was exploring the upper reaches of the Segama River for gold when he came unexpectedly upon an elephant. He shot and wounded the animal, but the elephant fled inside the jungle. Hutton and a few of his men immediately followed its tracks but were unable to locate the elephant. As it became late in the day and obscurity was creeping in, the party decided to return to the boats. It was on the way back that Hutton met with his fatal destiny.

The accident that happened is narrated in a letter written on March 7 by W.B. Pryer, the Resident:

"*On the way back (where the elephant had been), he was walking with his rifle (the Winchester) at the shoulder, and stooping down to pass underneath a vine (a creeper), put out his hand, holding the stock of the rifle with it, to lift the vine. The stock was thus from him, the muzzle towards him, the rifle probably being on full cock: at the instant he was in this position, partially stooping, his arm extended from him, the muzzle of the gun must have slid down his shoulder, leaving it pointing at the top of his shoulder, and at this instant it went off, presumably from the trigger having been pulled by some twigs of the creeper. The ball entered the collarbone and came out at the back somewhat lower down. His men were round him in a moment, and seized him before he fell (…). One, if not two of the main arteries were severed, and death ensued very rapidly (…). The body was then placed in a*

*gobang and brought down with all dispatch to Elopura*." (in Hatton, 1886).

The memory of Frank Hatton comes to us through his father Joseph Hatton, who published a biography enriched with Frank's letters and sketches (Hatton, 1886). In concluding the preface to this book, Walter H. Medhurst writes (1885): "*Peace to the young explorer's ashes! As the broad banana leaves and the feathery palms of Sandakan wave over his untimely grave, they whisper anew the old truth, that high aims, a firm purpose, and honest work, ennoble the man, even when fate denies him the fruition of his reward*."

## JUNGLE FATE AND DOOM

In his 1993 paper "*Unheimliche Erlebnisseeines Geologenim Urwald von Borneo*" (Uncanny experiences of a geologist in the jungle of Borneo) Eduard Wenk recalls some particular events with happened in the years 1936-1939, when he was engaged in fieldwork in Sabah on behalf of the Royal Dutch Shell Group.

At the time, Wenk had been given the task to map the Dent Peninsula, an uninhabited territory, consisting of rough, primary rain forest, a refuge for the wild life. Only brave Dayak and Dusun hunters would venture at times into this forbidden land. Rumors had it that from every group entering this jungle, one man would not return!

To support Wenk's mapping, parties of topographers started their work with the establishment of astronomical stations along the coast. These fix-points were due to be connected later by traverses through the rainforest. Along the north-coast, in the mangrove swamps of the Kuala Maruap, a Philippino topographer started work with a couple of people. He quickly became sick and with the bad omen around, he was promptly sent by boat to the Sandakan hospital, where he died of a lung inflammation.

Meanwhile, another group under the direction of Anga, an experienced Malay chieftain, had started with the cutting of a forest track halfway through the peninsula, from the fix point in Maruap, straight in a southerly direction. As it reached about 20km inland, Anga became sick with fever and died in the forest and had to be buried then and there, as the transportation of a cadaver in hot-damp tropical climate back to the coast was impossible. Again, one man did not return from the Dent Peninsula! Who would do any further work in this unfriendly region?

At the time, Wenk was unaware of these tragic happenings, and had assembled a party of local people to start his work. Eventually, while receiving his last briefing in Sandakan, Wenk heard about the disasters that had been befalling on the topographical crews. His first task was to establish a base camp, and in view of the recent dreadful events, a location along the coast, next to the mouth of a river, did not come into consideration. Instead, Wenk selected the nearby coral island Tambisan as his base.

Soon came alarming news: a group of topographers under the command of a Chinese surveyor that for some time had mapped the Togopi River in the south of the Dent Peninsula were in distress. A man in the group, Mandur Sabtu, had disappeared without a trace while working on a straight traverse that followed a strongly meandering stream. Instead of returning to his camp following the unending meanders of the river, he had decided to take a shortcut over a hill. The following day, search parties failed to find him and it was decided to call for help. After 2 days of hard travel, a party arrived in Tambisan to seek Wenk's assistance.

While Wenk was assembling all his men to join in the search and rescue efforts, news came that a fisherman had caught sight of a strangely behaving man by the shore; the fisherman thought it must have been a spirit, and afraid, fled away from the coast. When Wenk's party arrived at the place mentioned by the fisherman, they encountered poor Mandur Sabtu completely exhausted. He was promptly brought to a doctor in Sandakan and slowly recovered.

Later, Mandur Sabtu told his story: that evening he was definitely on the right path over the hill back to the camp. But suddenly he heard calls far away: "*Sabtu, Sabtukomo, OooSabtu...*" from a completely different direction to the one he was following. Then from a completely new direction, he heard again "*Sabtu, Sabtukomo Sabtu, Ooo*". Night was falling, he was tired and without food. Was it his comrades calling or was it an evil spirit, which intended to mislead him? He was now at an unknown, wrong place. On the following day he was wise enough to follow a stream and eventually reached the coast. Once there, he appeared as a ghost to the fisherman!

With the adventure that had happened to Mandur Sabtu, work on the Dent Peninsula was again at risk. His companions assured that they had not called Sabtu on that late afternoon, so all were convinced that an evil spirit did.

Shortly after these bad omens, Wenk decided to investigate the geology of the Togopi River and followed the stream upward with his crew. After some 3 weeks of hard work and no mishaps, the whole party returned to salvation! The spell of the Dent Peninsula was broken!! The first white man in this forest had averted disaster. None of the many Shell groups that worked soon after that on the Dent experienced uncanny situations anymore.

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# Eduard Wenk's jungle adventures in Sabah (1936-1939)

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## INTRODUCTION

On New Year's Day 1936, Eduard Wenk, a 29-year old young Swiss geologist entered employment with the Shell Group. Wenk had strong credentials: as a post-graduate he spent two years at the University of Uppsala (Sweden) and participated in a Greenland excursion. Wenk underwent a three-month training with the Shell Group in The Hague (Netherlands), before being sent as a regional geologist "*in poorly known British North Borneo*" (Wenk, 1994). During the years 1936-1939, Wenk carried out harsh jungle fieldwork in Sabah, before returning to Europe as World War II was just starting.

Wenk had established his headquarters on the island of Tambisan and from there he frequently went to Sandakan for shopping. There, he became acquainted with Henry ("Harry") Keith, a forestry supervisor for the British Government and with his wife Agnes Newton Keith. Agnes was later to write about her time in Sabah in her price-winning book "Land below the Wind" featuring Wenk as one of the characters and describing jungle trips undertaken together.

Among his many journeys, Wenk travelled through the Dent Peninsula and surveyed the Kinabatangan River, getting as far up as Inarad, on the edge of the Maliau Basin (Figure 1).

In travelling through the jungle, a foreign and mysterious environment for an European, Wenk's safety and the successful pursuit of his scientific objectives depended on the native people engaged to accompany him. Wenk says that parting from his loyal team of local staff was hard; "*I really enjoyed the three strenuous years in "Utan" and learned a lot for life: dealing with strangers, scheduling work in difficult terrain and handling administrative duties*".

The geological observations made in Sabah by Wenk and those made earlier by Prof. Max Reinhard were eventually published as Bulletin 1 of the newly established Geological Survey Department of the British Territories in Borneo (Reinhard & Wenk, 1951; Wannier, 2017). Wenk later became ordinary Professor for Mineralogy and Petrography at the University of Basel. He made fundamental contributions to the history of the structure and metamorphosis of the Central Alps that have earned him a place amongst the great Alpine geologists.

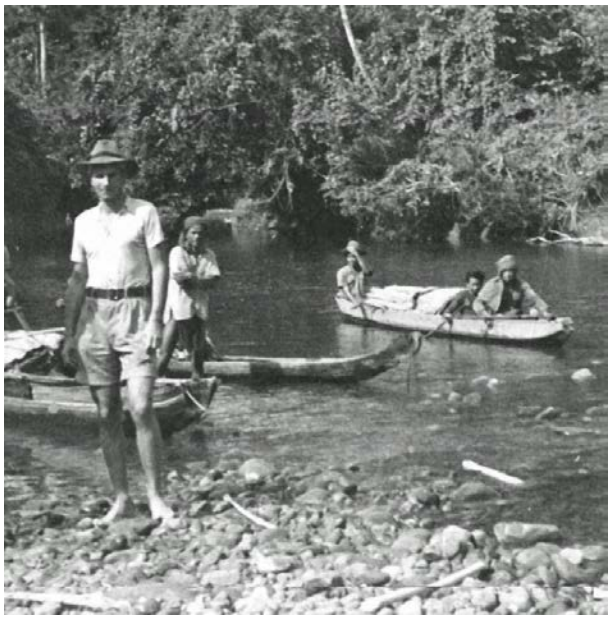

**Figure 1:** Eduard Wenk on Sungai Inarad.

A selection of Wenk's adventurous memories in Sabah is captured here, based on his own descriptions (Wenk, 1938 & 1993).

## NEWS FROM LONDON IN THE LONGHOUSE

In the summer of 1936, newly arrived in Sandakan, Wenk started his geological exploratory work by sailing up the Kinabatangan River accompanied by a team of nine local people, Dusun and Dayak. The journey started by vapor ship, followed by motorboat and in the upper reaches finally by dugout boats. As a geologist, Wenk had to follow up all the major tributaries, first in a dugout boat ("*gobang*"), before progressing on foot with the help of a *parang*. As soon as the party reached the edge of the primary forest, the *gobang* was left behind, and everybody continued on foot. After one week of slow progress through the jungle, Wenk and his men passed the watershed with the Sepulut River; walking down they arrived at a Dayak longhouse where a party was set-up in their honour, Wenk being the first white "*Tuan*" to reach that place. There, in the midst of the Sabah Mountains, Wenk was informed of the latest international news having

reached this longhouse (free translation):

"*Here, far away from telephone and electricity, I learned in December 1936, under the equator, via gong signals relayed from one village to the next, a message which at first I found difficult to understand: the principal chief of the British had left his office and had run away because of a women…*"

It was weeks later, having reached the coast that he learned of King Edward VIII$^{th}$ abdication!

Back from this trip, Wenk spent three months in Miri, to write his report and to get cured from malaria. His next assignment (1937) was to carry out geological mapping of the Dent Peninsula.

## THE DANGERS OF PHOTOGRAPHING WILD ELEPHANTS

While visiting a mud volcano, a clearing in the midst of dense jungle, Wenk and his men met with a five-member elephant herd that he wanted to photograph. There was a long discussion and preparation: the crew retreated to a safe place. Buyung, his trusted Dayak carrying the Winchester rifle and Wenk, camera in hand, crept forward and found a hiding place between the boards of giant trees. Moving two steps forward Wenk activated his camera (Figure 2, a poor shot given the circumstances); the noise alerted the elephants and they came forward. Afraid, Buyung shot the foremost elephant through the eye to the brain; the elephant fell, Wenk retreated quickly to his hiding place and the herd ran past them.

**Figure 2:** The unfortunate pygmy elephant, moments before the shooting (picture by E. Wenk).

As all stories go (see above!) this one became public as well: when Wenk's party later came to a village, people were commenting of this "heroic" deed! Like a wildfire, the news spread immediately to Sandakan, and came to the attention of the Forestry and Hunting-Minister. By law, Buyung would have gone to prison for six months. As the rightful owner of the rifle, Wenk took the full responsibility for the shot; the cost for killing the poor elephant was $ 100. After that sad even, Wenk never again photographed elephants in the jungle.

## WILD ENCOUNTERS ON THE RIVER

In November 1937, Wenk and his crew were making their way up the Kuala Tabin by outboard motor boat and *gobang*. Having left the swamps and reached gently undulating country, the river became plugged with floating logs.

In his 1938 article for the British North Borneo Herald, Wenk recalls the journey: "*The motor, towing two gobangs, had often to be stopped and all three boats had to be unloaded and pulled across half submerged logs; or the boats had to be overloaded and pushed below them. (…) A clever paddler in the bow and an experienced helmsman can evade most of the obstacles, which are almost invisible in the muddy water. Though we had the assistance of both of these specialists, our propeller six times hit sunken logs and once the tail of a crocodile. The latter beast jumped wildly and frightened the men in the towed gobangs*!"

"*Even more excitement was caused by a biawak (monitor lizard) that had been watching fishes from the branch of an overhanging tree and suddenly dropped into the motor prahu. The catching of this snappish varano was no easy task. The only way to deal with him was to cover his head with a tent sheet and tie up the snout. (…) The biawak escaped one week later…*"

## GIANT PYTHONS

On a Sunday afternoon, Wenk's party was leisurely moving up a right-hand branch of Sungai Tabin and noticed a far-away sound. Wenk (1938) writes:

"*As we approached the sound grew louder and louder. One more tanjong and we came face to face with a mighty cataract, a seventy foot high and fifty foot broad solid rock wall, over which the still powerful river leaps in many cascades-rushing down, dashing itself to spray against the naked rocks, until it reached a great circular basin at the foot of the falls.*

*It appeared possible to encircle the lake on the left and then to climb the waterfall. Accordingly my men began to cut a path along the left shore. In the meantime, I climbed a rock on the right, took pictures and hammered at rock samples, as a geologist is supposed to do. Suddenly I heard a piercing cry, followed by a confused chorus: ular, ular sawa! Dia gigit sama Moulud! Luka besar! Suda*

*lari dalam ayer! Bukan main besar dia! – and then: di sana kapala, potong, potong lekas! Lagi! Lagi! ad inf.*

*I was too far away to witness the incident. But when I reached the spot, I elicited the following remarkable facts: a giant python had suddenly emerged from the depth of the lake and rushed towards mandore Moulud, the man in the lead. Moulud, standing three feet above water level, saw his danger and tried to climb the bank, but was bitten on the leg. The cries of the mandore and the shouts of his companions so frightened the snake that he released his grip immediately. But in spite of this the mandore was badly hurt, his ankle bone having been laid bare. The python escaped into the water, was struck by a stone, swam with the current and stopped in a quiet pool, about ten yards broad. This pool was instantly surrounded and all its strategic points occupied by seven men, armed with parangs, stones and sticks.*

*Such was the dramatic situation when I arrived on the scene that I also participated with rock samples and hammer as weapons. I had a Winchester with me, but had only two rounds left and these had to be spared for game and for elephants, which seemed to inspect our camp at 2 a.m. as we had learned the previous night again. What now followed was a wild and thrilling hunt. The snake was invisible at first; but with the help of long poles, the coolies succeeded in prodding it and the snake would now and again thrust up its nasty looking head. The rock sample and some common or garden rock boulders were put to an unexpected use, while sticks and poles thrashed and plashed in the water. The snake endeavored to escape upstream, but then a man, an approved snake specialist indeed, sprang from his perch on a rock boulder into the water and slashed at the head with his parang just at the right moment, whilst another man struck at the middle portion of the body. The snake dived, but a stream of blood betrayed its position. Then a man succeeded in securing the end of the tail, and amidst wild shouting everybody helped, either to pull the reptile on to the gravel bank, or to deal it further blows. And then as the climax, the mandore received the privilege of crushing the monster's head with my honorable two-pound rock hammer, which earlier had crushed so many igneous rocks in Switzerland, Sweden, Greenland and even granodiorite on Mount Kinabalu.*

*With the help of the centimeter scale on the edge of my compass and a rotan, we measured the python and obtained a length of 7.20 meters, i.e. roughly 22 feet. Unfortunately the skin had been badly damaged by the many parang cuts. The coolies, however, managed to recover the bladder, which they later sold to some Chinese for a few dollars.*

*That is another moment which I shall never forget, and which I photographed in all its details* (Figure 3)*: the search for the snake's bladder. Imagine seven men opening and vivisecting the still convulsive body and carefully sorting out the intestines. The question of the sex of the snake, of great moment to the natives on all such occasions, gave rise to heated discussions, as the body had been severely damaged during the struggle. At last, recalling dim memories of early zoological studies, I had to state authoritatively that is was a male, basta!"*


**Figure 3:** Freshly caught giant python, Sungai Tabin (picture by E. Wenk).

*"That was the third giant python I met in B.N.B. In September 1936, I shot one that measured 17 feet. This was in upper S. Bangan (Kinabatangan), on the sandy shores of the basin below the highest of the many waterfalls there. According to my men these giant pythons are typical up-country snakes and frequent the pools or basins below rapids and waterfalls. This one had a wild pig inside it and could only move very sluggishly* (Figure 4)*. Pythons must be exceedingly tenacious of life, as this one, 24 hours after I had smashed its head with a No. 4 cartridge at point blank range, was still alive."*

*"The second one, which also had a newly devoured pig inside it was killed in September 1937 by my coolies in a rentis that runs through the swampy country between Topogi and Maruap. The coolies obtained an excellent meat supper to go with their rice (I mean python not pork!). Unfortunately, when I arrived there some days later the stench was such that I had to refrain from measuring the snake."*

**Figure 4:** Defenseless giant python digesting a wild boar (picture by E. Wenk).

## POST-SCRIPTUM

Eduard Wenk (1907-2001) was one of my professors at Basle University; he was a reserved, most kind person, generally with a Toscani cigar in his mouth. Never in my case, after many excursions in the Alps, when we had ample opportunities to communicate personally with our professors, did the subject of Borneo came up for discussion. I would never have suspected at the time that his was the profile of a true pioneer explorer. How misleading clichés can be!

## ACKNOWLEDGEMENTS

Comments and suggestions made by my colleagues at Petronas Phillip G. Cassidy and Arthur van Vliet as well as by Prof. Hans-Rudolf Wenk (University of California, Berkley), Prof. Felix Tongkul (Universiti Malaysia Sabah) and Franz L. Kessler (Goldbach Geoconsultants) improved the quality of the manuscript. Prof. H.R. Wenk also provided valuable historical pictures and access to rare published documents.

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# The Changing Face of Warta Geologi (1966-2016)

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Throughout the fifty years of the Society's history, the front cover of Warta Geologi has seen several changes to reflect the ever-changing needs of the Society and probably also due to the rapid advancement of computer technology. The accompanying graphic shows the changing faces of Warta in chronological order.

The inaugural issue of the Newsletter in July 1966 had just a simple white cover with black prints without any logo. This was changed to a bright orange cover in July 1970 to have a 'more striking and colourful appearance". It also included the Society's (original) emblem. The Society's name in Malay was initially written as "Kesatuan Geologi Malaysia". "Kesatuan" is Malay for "Union" rather than society, so this was corrected to "Persatuan Geologi Malaysia" in the January 1973 issue. The cover was changed again in January 1975 when the editors introduced a temporary masthead bearing the Malay name of the newsletter "Warta Geologi" (literally, geological news) on a plain white background. In announcing the new name and a new numbering system for Warta, the editors had also sought ideas from members for a new masthead design.

A new masthead design was introduced in the May-June 1975 issue, which reverted to the old gold back cover with a location map of Malaysia and surrounding region as a new feature, essentially for readers who may have not been familiar with Malaysia. This issue was also the start of better quality production of the Warta. However, by early 1976 (March-April issue), the bright orange colour appear to have faded to beige, and eventually to plain white in Jan-Feb 1977!

In January 1978 a slight change to the cover was introduced, with a different font in the masthead, but still on a white background. This design was essentially maintained throughout 1978 to 1995, but with the introduction (from 1980 to 1990) of a coloured background for the masthead as well as the lower portion of the front cover and with a different font for "Warta Geologi" (from 1991 to 1995). In 1996, a slightly new masthead was introduced, with a bit more sophistication (e.g. artistic font style in masthead and a coloured left margin). The location map had also changed somewhat. In 1997, yet another change was made to the font of "Warta Geologi", and the left margin was given a textured instead of a solid colour. This design was maintained until 2002, with a different colour every year.

The use of colour pictures on the cover of Warta started in 2003 with the introduction of a brand new design. This time, the front page had a full-sized cover photograph, usually field photographs of interesting geological features, and included small photo insets in the left column, representing selected contents. The first cover photo was that of iron-oxide infilled fractures by T.F. Ng. Also, the table of contents was placed on the back cover instead of the front. Also, the location map was omitted, presumably because it was deemed no longer necessary as Malaysia was quite well known by then. Unfortunately, this rather attractive cover design did not last very long, for by the 2004 (May-June) issue, the cover was back to old pictureless cover. The reason for this apparent 'regressive' decision is not known.

A pictorial cover design was back again in the January-February 2006 issue, which interestingly, had a photo again by T.F. Ng that won the second prize of the 2005 GSM photo competition. This cover design concept was used for two years until January 2008, when a slightly modified cover was introduced. The photo competition organized by the society (from 2004 to 2011) became a source of beautiful and interesting photographs for use on the covers for both the Warta and the Buletin in the years to come. In 2011, while maintaining the general format, the left margin was omitted and the cover photograph was made to fill the entire page. This format is still being used to this day, and should continue in the foreseeable future. Members should be encouraged to submit interesting photos for the covers of Warta and Buletin. It is for this reason too that the annual photographic competition should be revived and maintained.

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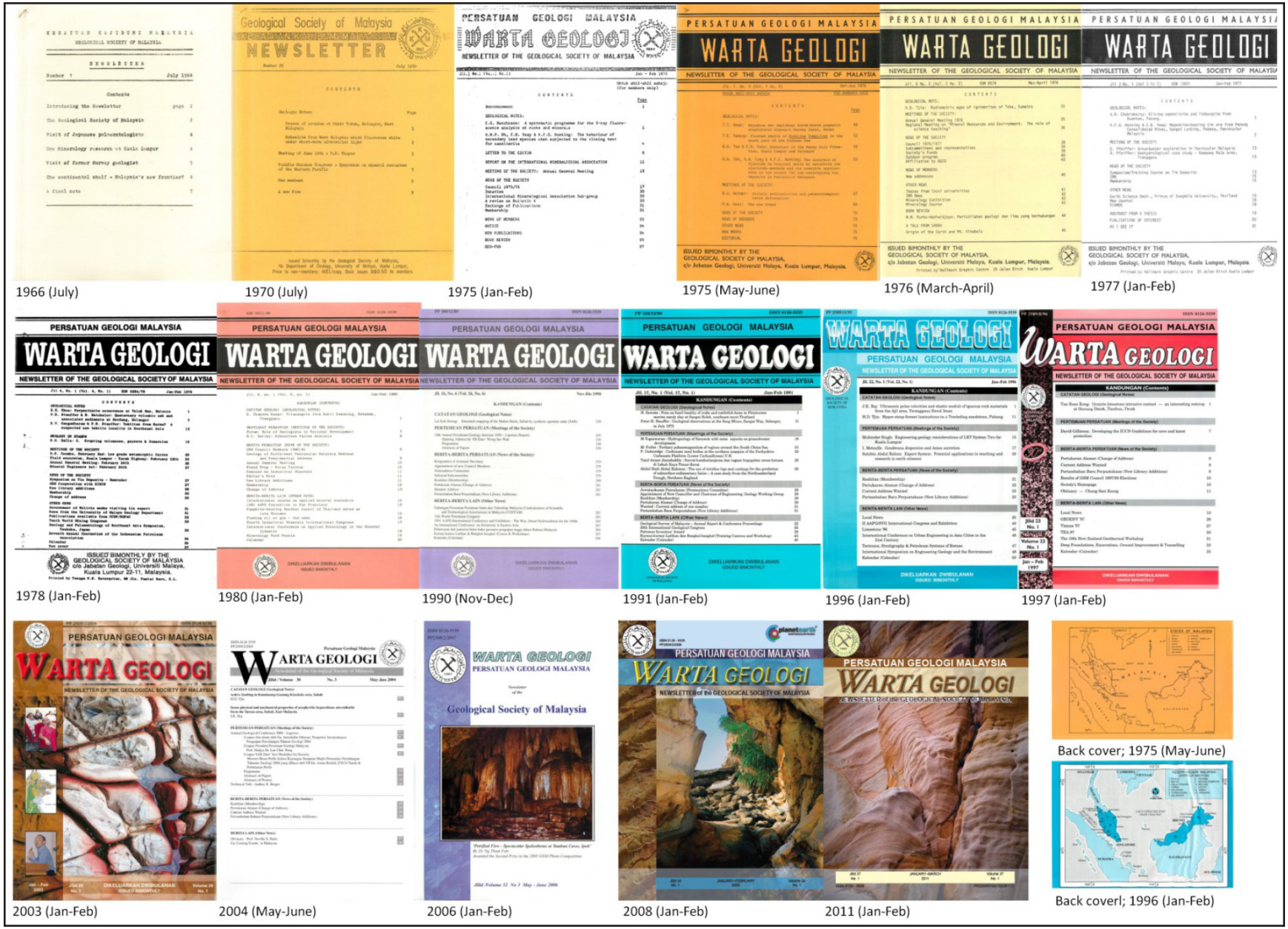
1966 (July)
1970 (July)
1975 (Jan-Feb)
1975 (May-June)
1976 (March-April)
1977 (Jan-Feb)
1978 (Jan-Feb)
1980 (Jan-Feb)
1990 (Nov-Dec)
1991 (Jan-Feb)
1996 (Jan-Feb)
1997 (Jan-Feb)
2003 (Jan-Feb)
2004 (May-June)
2006 (Jan-Feb)
2008 (Jan-Feb)
2011 (Jan-Feb)
Back cover; 1975 (May-June)
Back coverl; 1996 (Jan-Feb)

# PERSATUAN GEOLOGI MALAYSIA
GEOLOGICAL SOCIETY OF MALAYSIA

# 51st ANNUAL GENERAL MEETING & ANNUAL REPORT 2016

21st April 2017
Persatuan Alumni Universiti Malaya (PAUM) Club House,
Kuala Lumpur

## AGENDA

Date: 21st April 2017
Time: 5.30 p.m.
Venue: Persatuan Alumni Universiti Malaya (PAUM) Club House, K. Lumpur

The Agenda for the Annual General Meeting is as follows:

1. Welcoming Address by the President for Session 2016/2017
2. Confirmation of Minutes of the 50th AGM held on the 29th April 2016
3. Matters Arising (50th AGM Minutes)
4. Annual Report for Session 2016/2017
   a. President's Report
   b. Secretary's Report
   c. Editor's Report
   d. Treasurer's Report
   e. Honorary Auditor's Report
   f. Endowment Fund Report
5. GSM Endowment Fund; Board of Trustee - Appointment of a new Chairman and at least 3 independent Full Members
6. Election of Honorary Auditor
7. Other Matters:
   a. PIDM on bank deposits
   b. Note from K.M. Leong, in appreciation of GSM Councils on Sabah Pre-Cretaceous Geology
8. Announcement of New Council for 2017/2018
9. Presidential Address for 2017/2018

# PERSATUAN GEOLOGI MALAYSIA
GEOLOGICAL SOCIETY OF MALAYSIA (GSM)

## MINUTES OF THE 50th ANNUAL GENERAL MEETING

Date: 29th April 2016
Time: 5.30 pm
Venue: Hotel Hilton, Petaling Jaya, Selangor

Member Present:

| | |
|---|---|
| 1. Ahmad Nizam Hasan | 19. Mazlan Madon |
| 2. Ahmad Said | 20. Meor Hakif Amir Hassan |
| 3. Andrew Chan Jon Kit | 21. Ng Tham Fatt |
| 4. Askury Abd Kadir | 22. Nicholas Jacob |
| 5. Azman A Ghani | 23. Nizarulikram Abdul Rahim |
| 6. Cheang Kok Keong | 24. Nur Iskandar Taib |
| 7. Chin Lik Suan | 25. Peter Abolins |
| 8. Fateh Chand | 26. Philip Tiong |
| 9. Gan Lay Chin | 27. S Paramananthan |
| 10. Gopalkrishnan Babu | 28. Tan Boon Kong |
| 11. H.D Tjia | 29. Tanot Unjah |
| 12. Ismail Yusoff | 30. Tay Thye Sun |
| 13. Jasmi Hafiz Abdul Aziz | 31. Wan Hasiah Abdullah |
| 14. Joy J Pereira | 32. Wong Jing Quan |
| 15. Lee Chai Peng | 33. Yip Foo Weng |
| 16. Leong Khee Meng | 34. Youventharan Duraisamy |
| 17. Lim Choun Sian | 35. Yunus Abdul Razak |
| 18. Ling Nan Ley | 36. Yves Cheze |

1. Welcoming Address by the President for Session 2015/2016

Dr Mazlan Madon, the President of Geological Society of Malaysia acted as the Chairperson of the AGM and called the meeting to order at 5.38pm.

**2. Adoption of Agenda**

The Chairperson tabled the following agenda to the AGM for acceptance:
The Agenda for the Annual General Meeting is as follows:

1. Welcoming Address by the President for Session 2015/2016
2. Confirmation of Minutes of the 49th AGM held on the 24th April 2015
3. Matters Arising (49th AGM Minutes)
4. Annual Report for Session 2015/2016
   a. President's Report
   b. Secretary's Report
   c. Editor's Report
   d. Treasurer's Report
   e. Honorary Auditor's Report
   f. Endowment Fund Report
5. Election of Honorary Auditor
6. Other Matters (written notice received by the 21 April 2016):
   a. Matters submitted by honorary member Dr. H.D. Tjia (Received: 30 March 2016)
7. Announcement of New Council for 2016/2017
8. Presidential Address for 2016/2017

The agenda was unanimously accepted.

**2. Confirmation of Minutes of the 49th AGM held on the 24th April 2015**

The Minutes of the 49th AGM was tabled for confirmation.

Joy Pereira proposed that the minutes be confirmed, seconded by Datuk Fateh Chand. The minutes were unanimously confirmed without any amendment.

**3. Matters Arising (49th AGM Minutes)**

a. Promoting Geoscience in School

The AGM was informed that GSM and UM have jointly conducted outreach to schools.

Information

b. GSM Office

The AGM was informed on the new developments in this matter in which a new ruling was imposed by UM Management on office space and facilities in UM Geology Dept., whereby rental charges of up to RM2000 per month will be applied.. A GSM-UM Geology Dept Memorandum of Understanding (MoU) and Memorandum of Agreement (MoA) are being drafted to formalise the collaboration between the two parties, which will include the special rates on rental of office space.

The AGM was also informed that a sum of RM16,000 has been approved by the Council to be disbursed to UM Geology Dept. as a contribution to the cost of renovation of the meeting room, but is yet to be fully claimed by the recipient. Prof H.D Tjia and Dr Paramananthan expressed hopes that the Council can secure a good rate tenancy under the MoA with UM. The idea of buying/renting a new office space was brought up again by some members but besides the anticipated higher rental costs, problems of parking space availability and longer travelling distance to a new venue were some of the main concerns expressed by other members. The AGM agreed for the incoming council to proceed with the new arrangements with UM Geology Dept.

Action: Incoming Council

c. Council Members from outside Klang Valley

The AGM was reminded that the Society should make the effort to ensure that some of its elected council members are from/reside outside the Klang Valley, as per the requirement for a "national society" under the rules of the Registrar of Societies. The Council was requested to look into this matter.

Action: Incoming Council

d. Donation from PGCE

The AGM was informed that the Council had written to Petronas for monetary contributions towards GSM activities, including the National Geoscience Conference (NGC) but as yet no response has been received.

Information

e. 50th GSM Anniversary coffee table book

Members asked about the cost and source of funding for this project The AGM was informed the coffee table book was proposed and agreed to by members at the previous AGM, and therefore was initiated by the current council. The intention was to document the history and achievements of GSM after five decades of existence and the Council will do its best to ensure it is done at minimal cost and may even seek sponsorships for it.

Information

f. Follow-Up on "Elimination of Sabah Pre-Cretaceous in GSM Tate (2002) Geology of Borneo Island Map" by K.M. Leong.

On the above issue raised during the previous AGM, as proposed and agreed by members present, Mr K.M. Leong was invited to contribute a paper on this matter in the GSM publication, either GSM Bulletin and Warta Geologi. The AGM was informed that Mr Leong is preparing a paper for submission to be included in the special 50th anniversary Bulletin.

Information

**4. Annual Report for Session 2015/2016**

**a. President's Report**

Mazlan Madon tabled the President's Report (As in Appendix I of Document in 50th AGM).

Dato' Yunus Abd Razak proposed that the President's Report be accepted, seconded by Datuk Fateh Chand.

**b. Secretary's Report**

Lim Choun Sian tabled the Secretary's Report (As in Appendix IIa of Document in 50th AGM).

The AGM discussed the following matters:

- Full Members – Members in AGM expressed concerns on the low number of full members. The AGM hopes the matter will be addressed by the incoming council.
- Check and update on existing members – The AGM hopes there is some form of exercise to

update information on its members, i.e. address validity.

- Attendance of technical talks very low – Among the proposals given by AGM members to attract more participants was to invite prominent speakers and holding events outside Klang Valley.
- GSM books given away at events – AGM members suggested that GSM books that are given away at its events are to be considered as sponsorship 'in kind'. However, for accounting purposes all sponsorships whether in cash or kind, are considered as expenses, and should be reflected as such in the accounts.

Action: Incoming Council

Dr Paramananthan proposed that the Secretary's Report be accepted, seconded by Datuk Fateh Chand.

**c. Editor's Report**

Ng Tham Fatt tabled the Editor's Report (As in Appendix III of Document in 50th AGM).

Datuk Fateh Chand proposed that the Editor's Report be accepted, seconded by Dr Paramananthan.

**d. Treasurer's and Honorary Auditor's Reports**

Ahmad Nizam Hasan tabled the Treasurer's and Honorary Auditor's Report (As in Appendix IV of Document in 50th AGM).

The AGM discussed the following matters:

Dr Iskandar asked clarification on "subscription revenue fee" under the item "Subscription" in page 30 of 40, or page 5 in Auditor's report. The AGM requested the Incoming Council to respond.

Action: Incoming Council

Prof Joy Pereira proposed that the Treasurer's and Honorary Auditor's Report be accepted, Dato' Yunus Abd Razak seconded.

**e. GSM Endowment Fund Report**

Dato' Yunus Abd Razak, Chairman in Board of Trustees of the GSM Endowment Fund gave a refresher on the background of GSM Endowment Fund, followed by tabling of the Endowment Fund Report and the Recommendations from the Board of Trustees and the Standard Operating Procedure for the GSM Endowment Fund (As in Appendix VI of Document in 50th AGM).

Recommendation from the Board of Trustees was accepted by majority; one person objected to item No. 2 in the section "Responsibilities", on page 38 of 40.

Action: Incoming Council

**5. Election of Honorary Auditor**

Ahmad Nizam Hasan proposed to continue appointing S.F Lee & Co as the Honorary Auditor for the year 2016. The AGM unanimously agreed to the appointment.

Information

**6. Other Matters:**

a. Matters submitted by honorary member Prof H.D. Tjia (Received: 30 March 2016) on "errors and outdated 'expressions' in GSM publications" (as in see Appendix VII of Document in 50th AGM).

The AGM took note of the presentation and is unanimously of the opinion that any disagreements with facts or interpretations contained in GSM publications should be addressed by the concerned parties themselves by submitting a 'reply' or 'discussion' paper to Warta or Bulletin, incorporating any updated information and relevant arguments as necessary. In principle, the council and Editor should not be taking a position on matters relating to scientific interpretation or omission of either data or facts by authors in their publications. Nevertheless, this issue will be considered for discussion by the incoming council.

Action: Incoming Council

**7. Announcement of New Council for 2016/2017**

The result from Election for GSM New Council 2016/2017 by the Election Committee chaired by Prof Joy Pereira was read out by Lim Choun Sian (as in Appendix VIII of Document in 50th AGM).

GSM New Council for the session 2016/2017:

| | |
|---|---|
| President : | Dr. Mazlan Madon |
| Vice-President : | Mr. Abd Rasid Jaapar |
| Immediate Past President : | Prof. Dr. Joy Jacqueline Pereira |

| | |
|---|---|
| Secretary : | Mr. Lim Choun Sian |
| Assistant Secretary : | Mr. Nicholas Jacob |
| Treasurer : | Mr. Ahmad Nizam Hasan |
| Editor : | Prof. Dr. Wan Hasiah Abdullah |
| Council Members : | Dr Jasmi Hafiz Abdul Aziz |
| | Ms. Marelyn Telun Daniel |
| | Dr. Meor Hakif Amir Hassan |
| | Mr. Muhammad Ashahadi Dzulkafli |
| | Dr. Norbert Simon |
| | Dr. Nur Iskandar Taib |
| | Mr. Tan Boon Kong |
| | Dr. Tanot Unjah |

**8. Presidential Address for 2016/2017**

The re-elected President Dr Mazlan Madon expressed that it is a great honour for him to be elected again to serve as the President and thanked the members for their support and confidence. He pledged that he and the new Council would continue to try their best to serve for the good of the Society.

The AGM was adjourned at 8.00 pm.

LIM CHOUN SIAN
Secretary 2015/2016
30 May 2016

**APPENDIX I**

# PRESIDENT'S REPORT 2016/2017

Since the 50th Annual General Meeting (AGM) on 29 April 2016, at the PJ Hilton, the Society continued with its activities by organizing conferences, seminars and talks. Despite the prevailing economic conditions, the Society was able to carry out its normal activities towards advancing the development of the geological sciences and dissemination of geoscience knowledge in the country.

The National Geoscience Conference (NGC) 2016 was successfully held on 14-15 November 2016 with the theme "Geoscience and Environmental Technology for a Better Future" at the MS Garden Hotel, Kuantan, Pahang. It was co-hosted with the Universiti Malaysia Pahang (Faculty of Engineering of Engineering Technology) and Jabatan Mineral dan Geosains (JMG) Pahang.

The event was officiated by the Profesor Dato' Dr. Daing Nasir Ibrahim, Vice Chancellor Universiti Malaysia Pahang. The Society would like to record its appreciation to the Chairman of the Organising Committee, Dr. Mohd Fakhrurrazi Bin Ishak, and Mr Ahmad Nizam Hassan (GSM) for their valuable contributions towards the successful organization of the event. The NGC 2017, in conjunction with the 50th anniversary of GSM, will be held in Kuala Lumpur on 9-10 October 2017.

This year is the Society's 50th Anniversary. The council is happy to report that several initiatives that are planned to celebrate the 50th Anniversary of GSM, are progressing well under the special committee chairperson, Mr Abdul Rasid Jaapar, (as agreed in the last AGM):

1. NGC 2017 in conjunction with GSM 50th Anniversary,
2. 50th Anniversary special issue of the GSM Bulletin; we now have more than 20 papers committed to the issue.
3. Special 50th Anniversary issue of Warta Geologi (this is in lieu of the "Coffee Table Book" that was proposed earlier, due to poor response to appeal for contributions. Will include 'light' articles, anecdotes, news etc).

We expect the special issue of the Bulletin and Warta will be ready in time for the NGC 2017.

During the past term of office, the council has undertaken steps to link up with potential partner organisations to strengthen the GSM brand as well as promote GSM to the younger generation through new channels of communication (e.g. social media). An MOU was signed with a PetroEdge/NrgEdge, a specialist oil and gas training provider with a newly launched professional networking platform for the energy industry. We have entered into this MOU with the purpose of using NrgEdge networking platform to disseminate information about GSM and connecting GSM members with users in the energy industry, thus providing access to knowledge, news, and employment opportunities, especially for students. This effort is in line with our goals to reach out to more young people and connect to the oil/gas industry via the social media platform.

On behalf of the Society, I would like to thank out-going council members and everyone who contributed their time and effort over the past year. My deepest gratitude and appreciation go to the respective organising chairpersons, Working Group leaders and their committee members, as well as partner organisations – University of Malaya, Institute Geologi Malaysia, Universiti Malaysia Pahang, Jabatan Mineral dan Geosains, PETRONAS, Universiti Teknologi PETRONAS, and Universiti Kebangsaan Malaysia.

The Society would also like to thank the University of Malaya for use its facilities at the Department of Geology by the GSM secretariat. Thank you to all the Council Members and secretariat Anna Lee and Wan Aida Wan Zahari for their work and services to the Society during the term 2016/2017.

I wish the incoming council a warm welcome and best of luck for the term 2017/2018.

MAZLAN MADON
President 2016/2017
Geological Society of Malaysia

**APPENDIX IIa**

# SECRETARY'S REPORT 2016/2017

**Introduction**

On behalf of the members of the Council of the Geological Society of Malaysia (GSM), it is my pleasure to present the Secretary's Report for the session 2016/2017.

**Society structure**

The Society's stakeholders are the members of the Society led by an elected Council. The Council's main functions are to set directions to promote the advancement of geosciences, endorse activities and provide guidance for the execution of the activities of the Society.

The Council is supported by 6 Working Groups and 6 Regional Representatives. The Working Group previously known as Stratigraphy, was renamed as **Stratigraphy, Sedimentology & Petroleum Geology** to cover a wider spectrum. The post for Eastern Peninsular Malaysia Representative was vacant because we are unable to find a suitable candidate.

The Council is assisted by the Secretariat. The Secretariat assisted the Society in the administration of day-to-day activities of the Council, Working Groups and Regional Representatives.

A **GSM 50th Anniversary Special Committee** was created in last council to commemorate the Society's 50th Anniversary in 2017 in managing the preparation, organisation, publication and matters relating to the event. This committee is chaired by Vice-President, Mr. Abdul Rasid Jaapar.

An **Editorial Group** chaired by the Editor was created in this year council for the management of journal editing, publication and improving indexing.

**Membership**

As at 31st December 2016, the total number of members in the Society stands at **703**, increased from 613 as of 2015. The drops was mainly from Malaysia's Full and Student categories. However there is quite a big increase in the Life Memberships, largely from Malaysia. The table below presents the breakdown in membership categories and their geographical breakdown.

Breakdowns of Membership

| COUNTRY | Hon. | Life | Full | Assoc. | Student | Inst. | Total 2016 | Total 2015 | Total 2014 |
|---|---|---|---|---|---|---|---|---|---|
| Malaysia | 2 (2) | 330 (287) | 107 (130) | 3 (6) | 192 (120) | 0 (2) | **634** | 544 | 482 |
| Australia | - | 19 (17) | 0 (0) | 1(0) | - | - | **20** | 18 | 17 |
| Bangladesh | - | 1 (0) | - | - | - | - | **1** | - | - |
| Brunei | - | 1 (0) | - | | | | **1** | - | - |
| Canada | - | 1 (3) | - | - | - | - | **1** | 3 | 3 |
| China | - | 1 (1) | - | - | 1(0) | - | **2** | 2 | 1 |
| Europe | - | 11 (13) | - | - | - | 2 (1) | **13** | 15 | 14 |
| Hong Kong | - | 1 (2) | - | - | - | - | **1** | 2 | 2 |
| India | - | 1 (0) | - | - | - | - | **1** | - | - |
| Indonesia | - | 2 (5) | 1 (0) | - | - | - | **3** | 5 | 5 |
| Japan | - | 2 (3) | - | - | - | - | **2** | 3 | 3 |
| Middle East | - | 4 (3) | - | - | - | - | **4** | 3 | 7 |
| Philippines | - | 3 (2) | - | - | - | - | **3** | 2 | 2 |
| Singapore | - | 6 (7) | 0 (1) | 0 (1) | - | 1 (1) | **7** | 7 | 7 |
| Thailand | - | 3 (2) | - | - | - | - | **3** | 2 | 3 |
| USA | - | 7 (7) | 0 (1) | - | - | - | **7** | 7 | 7 |
| **TOTAL 2016** | **2** | **393** | **108** | **4** | **193** | **3** | **703** | - | - |
| **TOTAL 2015** | 2 | 352 | 130 | 4 | 121 | 6 | - | 613 | - |
| **TOTAL 2014** | 2 | 346 | 108 | 7 | 86 | 4 | - | - | 553 |

**Note:** 1. X(Y) --- X=Number for year 2016, Y=Number for year 2015
2. Country – Based on Mailing Address, not Nationality-based

**The Council**

The Council for the Geological Society of Malaysia for 2016/2017 session resumed their office after the 50th AGM on the 29th April 2016.

**COUNCIL FOR 2016/2017**

Upon the closing of nominations, only single nominations were received respectively for the positions of President, Vice President, Secretary, Treasurer, Assistant Secretary and Editor, and there were four nominations for the four 2-year Councillor positions.

**The Council for 2016/2017:**

| | | |
|---|---|---|
| **President** | : | Dr. Mazlan Madon (PETRONAS) |
| **Vice-President** | : | Mr. Abd Rasid Jaapar (Geomapping Technology) |
| **Immdt. Past President** | : | Prof. Dr. Joy Jacqueline Pereira (UKM) |
| **Secretary** | : | Mr. Lim Choun Sian (UKM) |
| **Assistant Secretary** | : | Mr. Nicholas Jacob (JKR) |
| **Treasurer** | : | Mr. Ahmad Nizam Hasan (GeoSolution Resources) |
| **Editor** | : | Prof. Dr. Wan Hasiah Abdullah (UM) |
| | | |
| **Councillors (2 years)** | : | Dr. Meor Hakif Amir Hassan (UM) |
| 2016/2017-2017-2018 | : | Ms. Marelyn Telun Daniel (UM) |
| | : | Mr. Muhammad Ashahadi Dzulkafli (UKM) |
| | : | Dr. Norbert Simon (UKM) |
| | | |
| **Councillors (1 years)** | : | Dr. Jasmi Hafiz Abdul Aziz (UM) |
| 2016/2017 | : | Dr. Nur Iskandar Taib (UM) |
| | : | Mr. Tan Boon Kong (Consultant) |
| | : | Dr. Tanot Unjah (UKM) |

**Council Meetings**

During the 2016/2017 session, the Council met 6 times. The attendance of the council members to the meetings is presented in the table below. All the meetings were conducted at the meeting room of the Department of Geology, University of Malaya, Kuala Lumpur.

*Attendance of Council Members at Council Meetings:*

| NAME | 1 | 2 | 3 | 4 | 5 | 6 | Total |
|---|---|---|---|---|---|---|---|
| Abdul Rasid Jaapar, Mr | / | / | 0 | / | / | / | 5/6 |
| Ahmad Nizam Hasan, Mr | / | / | / | 0 | / | / | 5/6 |
| Jasmi Hafiz Abdul Aziz | 0 | / | 0 | 0 | 0 | 0 | 1/6 |
| Joy J. Pereira, Prof | / | / | / | 0 | / | / | 5/6 |
| Lim Choun Sian, Mr | / | / | / | / | / | / | 6/6 |
| Mazlan Madon, Dr | / | 0 | / | 0 | / | / | 4/6 |
| Meor Hakif Amir Hassan, Dr | 0 | / | 0 | / | / | / | 4/6 |
| Marelyn Telun Daniel | / | / | / | 0 | / | / | 5/6 |
| Muhammad Ashahadi Dzulkafli, Mr | / | 0 | 0 | / | / | 0 | 3/6 |
| Nicholas Jacob, Mr | 0 | 0 | / | / | / | / | 4/6 |
| Norbert Simon, Dr | / | 0 | 0 | / | / | 0 | 3/6 |
| Nur Iskandar Taib, Dr | 0 | / | / | / | / | / | 5/6 |
| Tan Boon Kong, Mr | / | / | / | / | / | / | 6/6 |
| Tanot Unjah, Dr | 0 | / | / | 0 | / | / | 3/6 |
| Wan Hasiah Abdullah, Prof | 0 | 0 | / | 0 | / | / | 3/6 |

**Working Groups**

The Working Groups and the Chairs for Session 2016/2017 are as follows:

| | WORKING GROUP | CHAIRMAN |
|---|---|---|
| 1 | Engineering Geology, Hydrogeology & Environmental Geology | Mr. Tan Boon Kong |
| 2 | Promotion of Geoscience & Young Geologists | Ms. Marelyn Telun Daniel |
| 3 | Economic Geology | Dr. Jasmi Hafiz Abdul Aziz |
| 4 | Regional Geology | Dr. Mohd Rozi Umor |
| 5 | Geophysics | Mr. Mohd Hariri Arifin |
| 6 | Stratigraphy, Sedimentology & Petroleum Geology | Dr. Meor Hakif Amir Hassan |

**Regional Representatives**

The Society is trying to strengthen its delivery mechanism at the sub-national level through the appointment of Regional Representatives to work in conjunction with the local membership to advance geoscience in the respective regions. The Regional Representatives for Session 2016/2017 are as follows:

| | REGION | REPRESENTATIVE 2011/2013 |
|---|---|---|
| 1 | Southern Peninsular Malaysia | Prof. Edy Tonnizam Mohamad (UTM) |
| 2 | Perak | Assoc. Prof. Askury Abd Kadir (UTP) |
| 3 | Northern Peninsular Malaysia | Dr. Kamar Shah Ariffin (USM) |
| 4 | Eastern Peninsular Malaysia | --- |
| 5 | Sarawak | Mr. Dana Badang (JMG) |
| 6 | Sabah | Prof. Felix Tongkul (UMS) |

**Activities, Project and Secretariat**

The Society has successfully organised National Geoscience Conference 2016 (NGC 2016). During the session, the Council with the cooperation of Working Groups, Regional Representatives, and in collaboration with UKM, UM, USM, UMS, IGM, CCOP, AAPG and JMGs were able to organise a total of 20 sessions inclusive of **technical talks, workshops, conferences, and a short course**. GSM also gave secretarial support to the organisation of

GEOSEA 2016 (Bandung, Indonesia).

In the GEOSEA Business Meeting on 12 Oct 2016 in Bandung, Indonesia, GSM was re-elected to serve as **GEOSEA Permanent Secretariat** for another four years (2020).

GSM is one of the partner in the Research Project namely, **Disaster Resilient Cities: Forecasting Local Level Climate Extremes and Physical Hazards for Kuala Lumpur**, led by SEADPRI-UKM in conjunction with associated Partners in UK and Malaysia in securing the grant Newton-UngkuOmar Fund. GSM's role is to benchmark the process and guide knowledge transfer in the research.

Joint Council met two times under GSM-IGM Joint Committee, which is a requirement under the Agreement signed between GSM and IGM on 5 April 2013 and was tasked to set up various subcommittees with the objectives, among others, to promote education, research, and graduate membership, and to oversee and review geoscience curricula in Malaysian universities.

*Summary of Activities*

| No | Date | Activity | Topic | Venue | Collaborators |
|---|---|---|---|---|---|
| 1 | 21 July 2016 | Technical Talk | Fossil sharks from Thailand: Stratigraphical and palaeo-biogeographical implications by Dr. Gilles Cuny | UM KL | UM |
| 2 | 25 July 2016 | Technical Talk | REE Resources Processing Innovation and Challenging by Associate Prof. Dr. Kotaro Yonezo | USM Penang | USM |
| 3 | 29 July 2016 | Technical Talk | Another Glimpse of Engineering Geology and Rock Mechanics in Malaysia by Tan Boon Kong | UM KL | UM |
| 4 | 26th Aug 2016 | Technical Talk | Increasing Needs of Geological Input and Awareness in Civil Work/Construction Development by Qalam A'zad Rosle | UM KL | IGM |
| 5 | 12 Oct 2016 | Workshop | Workshop on Disasters and Climate Change Adaptation: The Role of Geoscience | GEOSEA Bandung, IND | GSM, SEADPRI, ANCST |
| 6 | 12 Oct 2016 | Technical Talk | Discovering hydrocarbon: The role of stratigraphy, by Shamsudin Jirin | UKM | UKM |
| 7 | 11 Nov 2016 | Technical Talk | Diamond - from Gemmology to Geology by Tay Thye Sun | JMG Sarawak | JMG, IGM, GSM |
| 8 | 16 Nov 2016 | Technical Talk | Creep Response in Shear of Clayey Geo-materials under saturated and unsaturated conditions by Dr. Nor Shahidah Mohd Nazer | UKM | UKM |
| 9 | 16 Nov 2016 | Technical Talk | Surface Water Flooding / Sustainable Drainage by Dr. Helen Reeves | UM KL | IGM, GSM, SEADPRI, ANCST |
| 10 | 14-15 Nov 2016 | Conference | National Geoscience Conference 2016 | Pahang | UMP, JMG Pahang |
| 11 | 16 Nov 2016 | Technical Talk | The Proto-South China Sea: Where was it and where is it? By Prof Robert Hall | UM KL | AAPG, UM |
| 12 | 30 Nov 2016 | Technical Talk | Outcrops and geological pictures around the world by Farah Fazulah.<br>Your Personal Branding using Career Passport and NrgEdge by Mohd Anas | UKM | UKM |
| 13 | 21 Dec 2016 | Technical Talk | The Use of Geophysical Principles in the Detection & Characterization of Solution Channels, Voids in Limestone Formation & Rock Slope Discontinuity Survey, by Ir. Liew Shaw Shong | UM KL | IGM, UM |
| 14 | 14 Dec 2016 | Technical Talk | Terrestrial LiDAR sharing session, by Lim Chin Hooi | UKM | UKM |
| 15 | 12 Jan 2017 | Technical Talk | Chairman's Lecture No. 22: Geology vis-à-vis Tunnelling in the Kuala Lumpur Area, by Tan Boon Kong | UM KL | IGM, UM |
| 16 | 22 March 2017 | Technical Talk | Pembangunan Geopark di Malaysia: Cabaran dan masa depan, by Dr Tanot Unjah | UKM | UKM |
| 17 | 17 Feb 2017 | Technical Talk | Geophysics in Tunnelling: the Good, the Bad, and the Ugly, by Devendran Arumugam & Dr Boon Chia Weng | UM KL | UM |
| 18 | 9 & 10 March 2017 | Workshop | GSM-IGM Flagship Workshop on Disaster Resilient Cities: Risk Assessment and Forecasting of Geophysical and Atmospheric Hazards | Hotel Istana, KL | GSM, IGM |
| 19 | 14 April 2017 | Technical Talk | Soil Related Factors Controlling Landslides in Malaysia, by Dr. S. Paramananthan | UM KL | IGM, UM |
| 20 | 17 April 2017 | Short course | Short Course on Geophysics Exploration Technology Dr. Wen J Whan | UKM | UKM |

**GSM Contribution or donation to support student geoscience student activities:**

UM Geology: Sponsorship Application for Geoscience Industrial Week 2017

UKM Geology: Geology Partnership Programme with UPN Veteran and Charity Programme in Yogyakarta

**GSM Awards**

GSM has set up numerous awards for members as follows and their status:

• *Honorary Membership* – No nomination received

• *PGCE Student Excellence Award* - There was no PGCE in 2015/6 onward.

•"Hutchison Best Student Award", previously the "GSM Best Student Award" - The Council yet to receive complete nomination for this award.

• "N.S.Haile Publication Award", previously the "Young Geoscientist Award" - The Council yet to receive complete nomination for this award.

• "DJ Gobbett Award", previously the "Geoscientist Award", - The Council yet to receive complete nomination for this award.

**Linkages and Collaborations**

GSM maintained linkages with national and international institutions such as:

- Institute of Geology Malaysia
- Confederation of Scientific and Technological Association of Malaysia (COSTAM) – represented by two Council members: Mr. Tan Boon Kong and Mr. Nicholas Jacob
- Formation Evaluation Society Malaysia (FESM)
- American Association of Petroleum Geology (AAPG)
  - AAPG House of Delegates: represented by Dr. Mazlan Madon of PETRONAS. Mr. Askury Abd. Kadir of University Teknologi Petronas is the alternative representative
- Newton Ungku Omar Fund and IGM-GSM Flagship since July 2015
- GEOSEA
  - GSM is the present host of the Permanent Secretariat up to 2020
  - GEOSEA 2018 will be in Hanoi, Vietnam. GSP offered to host the next GEOSEA 2020 in the Philippines
- MoU with NrgEdge

For the Student's Geological Club Collaboration, only AAPG Student Chapter of University of Malaya is collaborating with GSM at present.

**Acknowledgement**

The Society would like to record its utmost appreciation to all the individuals and organisations in organising the Society's numerous activities during the session. Special mention must be made of the tremendous support by the Head and staff of the Geology Department, University of Malaya especially in the use of its premises for most of the Society's meetings and activities. The continued co-operation and support extended by JMG, PETRONAS, UKM, UMS, UTP, IGM and ANCST is recorded with gratitude. The unwavering support of Ms. Anna Lee in the administration of GSM is also very much appreciated. Last but not least, the Council also wishes to record its appreciation to all GSM members for their advice, guidance and support throughout the session.

LIM CHOUN SIAN
Secretary 2016/2017
Geological Society of Malaysia

**APPENDIX IIb**

# ASSISTANT SECRETARY'S REPORT 2016/2017

The sales of the Society publications and the list of organizations and institutions that were exchanging publications with GSM are presented in the following tables.

***Sales and stock of publications for 2016***

| Publications | Sales 2016 | Stock remaining by end of 2016 | Stock remaining by end of 2015 |
|---|---|---|---|
| Bulletin 1 | 0 | 0 | 0 |
| Bulletin 2 | 5 | 164 | 169 |
| Bulletin 3 | 5 | 139 | 144 |
| Bulletin 4 | 5 | 53 | 58 |
| Bulletin 6 | 5 | 376 | 381 |
| Bulletin 7 | 5 | 235 | 240 |
| Bulletin 13 | 0 | 0 | 0 |
| Bulletin 17 | 0 | 0 | 0 |
| Bulletin 18 | 0 | 0 | 0 |
| Bulletin 19 | 5 | 356 | 361 |
| Bulletin 20 | 5 | 309 | 314 |
| Bulletin 21 | 5 | 109 | 114 |
| Bulletin 22 | 5 | 185 | 190 |
| Bulletin 23 | 5 | 198 | 203 |
| Bulletin 24 | 5 | 357 | 362 |
| Bulletin 25 | 5 | 65 | 70 |
| Bulletin 26 | 5 | 165 | 170 |
| Bulletin 27 | 5 | 39 | 44 |
| Bulletin 28 | 5 | 74 | 79 |
| Bulletin 29 | 5 | 89 | 94 |
| Bulletin 30 | 5 | 100 | 105 |
| Bulletin 31 | 5 | 91 | 96 |
| Bulletin 32 | 5 | 65 | 70 |
| Bulletin 33 | 5 | 223 | 228 |
| Bulletin 34 | 8 | 44 | 52 |
| Bulletin 35 | 0 | 0 | 0 |
| Bulletin 36 | 8 | 77 | 85 |
| Bulletin 37 | 8 | 129 | 137 |
| Bulletin 38 | 8 | 195 | 203 |
| Bulletin 39 | 0 | 0 | 0 |
| Bulletin 40 | 8 | 79 | 67 |
| Bulletin 42 | 8 | 0 | 8 |
| Bulletin 43 | 7 | 111 | 118 |
| Bulletin 44 | 8 | 29 | 37 |
| Bulletin 45 | 8 | 71 | 79 |
| Bulletin 46 | 0 | 0 | 0 |
| Bulletin 47 | 7 | 25 | 32 |

| Publications | Sales 2016 | Stock remaining by end of 2016 | Stock remaining by end of 2015 |
|---|---|---|---|
| Bulletin 48 | 10 | 21 | 31 |
| Bulletin 49 | 8 | 283 | 291 |
| Bulletin 50 | 9 | 315 | 324 |
| Bulletin 51 | 10 | 193 | 203 |
| Bulletin 52 | 9 | 207 | 216 |
| Bulletin 53 | 9 | 305 | 314 |
| Bulletin 54 | 9 | 255 | 264 |
| Bulletin 55 | 9 | 279 | 288 |
| Bulletin 56 | 11 | 327 | 338 |
| Bulletin 57 | 12 | 38 | 50 |
| Bulletin 58 | 5 | 8 | 13 |
| Bulletin 59 | 10 | 92 | 102 |
| Bulletin 60 | 9 | 93 | 102 |
| Bulletin 61 | 9 | 53 | 62 |
| Abstract (Bull 6) | 0 | 0 | 0 |
| Proceeding AGC 2000 | 10 | 0 | 10 |
| Proceeding AGC 2001 | 9 | 112 | 121 |
| M'sian Stratigraphic guide | 0 | 0 | 0 |
| Lexicon of stratigraphy | 0 | 0 | 0 |
| Stratigraphic correlation | 0 | 0 | 0 |
| Rocks poster | 0 | 0 | 0 |
| Geology of Borneo (CD) | 24 | 0 | 24 |
| Geology of Borneo (Map) | 5 | 690 | 695 |
| Geol. Evolution of SEA | 12 | 442 | 454 |
| Geology of P. Malaysia | 37 | 504 | 541 |

***List of organizations and institutions that are exchanging publications with GSM:***

| Item | Organization | Country |
|---|---|---|
| 1 | New South Wales Dept of Mineral Resources | Australia |
| 2 | Geologica Belgica a.s.b.I | Belgium |
| 3 | University of Geosciences | China |
| 4 | Nanking Institute of Geology | China |
| 5 | National Geological Library | China |
| 6 | Peking College of Geology | China |
| 7 | Suomalaineu Tiedeakatemia | Finland |
| 8 | Freie Universitat Berlin | Germany |
| 9 | National Museum of Natural History | Holland |
| 10 | Geological Society of Japan | Japan |
| 11 | Dept Mineral & Planetary Science, Hiroshima | Japan |
| 12 | Museum of Nature & Human Activities | Japan |
| 13 | National Science Museum | Japan |
| 14 | Natural History Museum and Institute | Japan |
| 15 | Institute of Geosciences | Japan |
| 16 | Geological Society of Korea | Korea |
| 17 | Dewan Bahasa dan Pustaka | Malaysia |
| 18 | Minerals and Geoscience Department Malaysia, Headquarters | Malaysia |
| 19 | Minerals and Geoscience Department Malaysia, Ipoh | Malaysia |
| 20 | Minerals and Geoscience Department Malaysia, Kuching | Malaysia |
| 21 | Minerals and Geoscience Department Malaysia, Kota Kinabalu | Malaysia |
| 22 | Kementerian Dalam Negeri | Malaysia |
| 23 | Perpustakaan Negara Malaysia | Malaysia |
| 24 | Library PETRONAS Berhad | Malaysia |
| 25 | Pusat Sumber Maklumat Negeri Sarawak | Malaysia |
| 26 | Perpustakaan Tun Sri Lanang, UKM | Malaysia |
| 27 | Program Geologi, UKM | Malaysia |
| 28 | Library, UM | Malaysia |
| 29 | Library, USM | Malaysia |
| 30 | Malaysian Institute of Nuclear Technology | Malaysia |
| 31 | Library of Congress, USA Embassy | Malaysia |
| 32 | Institute of Ecological & Nuclear Science | New Zealand |
| 33 | National Library | Singapore |
| 34 | Central Geological Survey | Taiwan |
| 35 | American Museum of Natural History, New York | USA |
| 36 | CIGESE Library | USA |
| 37 | Oklahoma Geological Survey | USA |
| 38 | US Geological Survey | USA |
| 39 | University of Kansas | USA |
| 40 | AAPG Foundation Library | USA |
| 41 | Senckenberg Research Institute and Natural History Museum Frankfurt | Germany |

NICHOLAS JACOB
Assistant Secretary 2016/2017
Geological Society of Malaysia

**APPENDIX III**

# EDITOR'S REPORT 2016/2017

In 2016, two issues of Warta Geologi (Volume 42, Issue 1 & 2 and Issue 3 & 4) and one volume of the GSM Bulletin (Volume 62) were published.

Since its establishment in 2014, the GSM online publication website has been viewed by more than 4,600 visitors from 43 countries, with more than 21,000 views and downloads.

Volumes 46 to 61 of the GSM Bulletin are now abstracted and indexed in MyJurnal (Malaysia Journal Management System); works on depositing the rest are ongoing.

In conjunction with GSM's 50th anniversary this year, the council is planning to publish a special issue of Warta Geologi on the society's history and achievements, as well as a special issue of Bulletin. Dr. Lee Chai Peng has been appointed as the guest editor for the special publications.

The Society is grateful to authors for their contribution, members of the editorial board and reviewers for their time and effort to improve the quality of the Society's publications. I would like to take this opportunity to thank Anna Lee and Puan Wan Aida for their assistance during the editorial process.

WAN HASIAH ABDULLAH
Editor 2016/2017
Geological Society of Malaysia

**APPENDIX IV**

# TREASURER'S REPORT 2016/2017

For the Financial Year 2016, the society's posted a deficit of RM 35,601.00 compared to surplus of RM 71,915 in year 2015. The net current asset showed a slight depreciation from RM 2,586,010 for year 2015 to RM 2,529,364 for year 2016.

Operating revenue for year 2016 posted lower with a total income of RM 58,858.00 compared to year 2015 of RM 140,453.00. The revenue posted for Subscription shows lower from RM 20,508.00 of year 2015 to RM 15,384.00 for year 2016, the income for National Geoscience Conference (NGC) held in Kuantan, Pahang hosted by University Malaysia Pahang posted RM 2,210.00 and Sales of publications are RM 2,277.00 slightly higher compare to RM 2,201.00 for year 2015. Hence, there is slightly higher revenue due to interest from fixed deposit of RM 34,163.00 for year 2016 compared to RM 33,488.00 for year 2015.

Total operating expenditure for Financial Year 2016 shows higher from RM 68,538 for year 2015 to RM 94,459.00. Honorarium shows slightly lower from RM 37,360.00 of 2015 to RM 36,911.00 for year 2016. Balance expenses of NGC 2016 are RM 1,269.00. However, the expenditure for organizing the society`s AGM and Annual Dinner 2016 that was held at PJ Hilton Hotel is RM 9,242.00 and for printing of Warta Geologi is RM 8,384.00. Finally, expenses on speaker`s account and refreshments posted expenditure of RM 3,418.00 and RM 1,104.00 compared to 2015 of RM 171.00.

For year 2016, an increase of Endowment fund, with a total amount of RM 1,592,000.00 compared to RM 1,099,897.00 for year 2015, held as fixed deposit (FD) in UOB Bank given as accrued interest of RM 69,309.83 held in UOB Bank current account.

The Treasurer would like to express his great appreciation to all members of the organizing committee of NGC 2016 led by chairman Dr Mohd Fakhrurrazi Bin Ishak of University Malaysia Pahang for their support and successfully managing a self-funded conference and to the Geoscience Grant from Newton-Ungku Omar Fund that has generously supported the administrative expenses for the Society for year 2016. Great appreciation also to the other donors and sponsors on their contributions and support throughout the year. Last but not least, to Ms Anna Lee for managing the accounts throughout the year.

AHMAD NIZAM HASAN
Treasurer 2016/2017
Geological Society of Malaysia

NOTES

1. The RM 10,957.00 are AAPG-UM student chapter fund held into our current account to finance their activities.
2. Young geoscientist award fund of RM 3,143.00 still held as no candidates nominated.
3. The fixed deposits with licensed bank have a maturity of between 6 to 15 months (2015 : 3 to 15 months. Interest rates for the deposits ranged from 2.85% to 2.95% per annum lower compare to year 2015 of 3.05% to 5% per annum.

PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)
(Registered in Malaysia)

REPORT AND ACCOUNTS
31 DECEMBER 2016

S.F. LEE & CO.
CHARTERED ACCOUNTANTS

PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)
(Registered in Malaysia)

FINANCIAL STATEMENTS
31 DECEMBER 2016

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**PERSATUAN GEOLOGI MALAYSIA**
**(GEOLOGICAL SOCIETY OF MALAYSIA)**
**(Registered in Malaysia)**

**COUNCIL MEMBERS FOR 2016 / 2017**

| | | |
|---|---|---|
| President | : | Dr. Mazlan Madon (PETRONAS) |
| Vice President | : | Mr. Abd Rasid Jaapar (Asian Geos) |
| Immediate Past President | : | Prof. Dr. Joy Jacqueline Pereira (UKM) |
| Secretary | : | Dr. Lim Choun Sian (UKM) |
| Assistant Secretary | : | Mr. Nicholas Jacob (JKR) |
| Treasurer | : | Mr. Ahmad Nizam Hasan (GeoSolution Resources) |
| Editor | : | Prof Dr Wan Hasiah Abdullah (UM) |
| Councillors (1 Year) (2016/2017) | : | Mr. Tan Boon Kong (Consultant) |
| | : | Dr. Nur Iskandar Taib (UM) |
| | : | Dr. Tanot Unjah (UKM) |
| | : | Dr. Jasmi Hafiz Abdul Aziz (UM) |
| Councillors (2 Years) (2016/2018) | : | Dr. Meor Hakif Amir Hassan (UM) |
| | : | Ms. Marelyn Telun Daniel (UM) |
| | : | Mr. Muhammad Ashahadi Dzulkafli (UKM) |
| | : | Mr. Norbert Simon (UKM) |

PERSATUAN GEOLOGI MALAYSIA (GEOLOGICAL SOCIETY OF MALAYSIA)
STATEMENT BY THE COUNCIL

We, Mazlan Madon and Ahmad Nizam Hasan, being the President and Treasurer respectively, of the Persatuan Geologi Malaysia (Geological Society Of Malaysia) do hereby state that, in the opinion of the Council, the financial statements set out pages 4 to 9 are properly drawn up in accordance with applicable approved accounting standards so as to give a true and fair view of the financial position of the Persatuan Geologi Malaysia (Geological Society of Malaysia) as at 31 December 2016, and of the result and cash flows for the year then ended.

Mazlan Madon
President

Ahmad Nizam Hasan
Treasurer

Kuala Lumpur

Dated : 07 APR 2017

PERSATUAN GEOLOGI MALAYSIA (GEOLOGICAL SOCIETY OF MALAYSIA)
DECLARATION BY THE OFFICER PRIMARILY RESPONSIBLE FOR THE FINANCIAL MANAGEMENT OF THE SOCIETY

I, Ahmad Nizam Hasan, the officer primarily responsible for the financial management of the Persatuan Geologi Malaysia (Geological Society Of Malaysia), do solemnly and sincerely declare that the accompanying financial statements set out on pages 4 to 9 are, to the best of my knowledge and belief correct, and I make this solemn declaration conscientiously believing the same to be true and by virtue of the provisions of the Statutory Declarations Act, 1960.

Subscribed and solemnly declared by )

the abovenamed Ahmad Nizam Hasan )

at Kuala Lumpur in Wilayah Persekutuan )

on 0 7 APR 2017 )

Ahmad Nizam Hasan

Before me,

PESURUHJAYA SUMPAH
No: W 678
Name: KAPT (B) AFFANDI BIN AHMAD
MALAYSIA

No. 86, Tingkat Bawah
Jalan Putra
50350 Kuala Lumpur

Commissioner for Oaths

S.F. LEE & CO (AF : 0670)

REPORT OF THE AUDITORS TO MEMBERS OF THE
PERSATUAN GEOLOGI MALAYSIA (GEOLOGICAL SOCIETY OF MALAYSIA)

We have audited the financial statements set out on pages 4 to 9. These financial statements are the responsibility of the Council Members of the Society. It is our responsibility to form an independent opinion, based on our audit, on those financial statements and to report our opinion to you, as a body, and for no other purpose. We do not assume responsibility to any other person for the content of this report.

We conducted our audit in accordance with approved auditing standards in Malaysia. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by the Council Members, as well as evaluating the overall financial statements presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the financial statements give a true and fair view of the statement of assets and liabilities of the Society as at 31 December 2016 and of its statement of income and expenditure and cash flows for the financial year ended 31 December 2016 in accordance with the MASB approved accounting standards in Malaysia.

S.F. LEE & CO. (AF 0670)
Chartered Accountants

LEE SIEW FATT
(1179/9/18J)
Chartered Accountant

Kuala Lumpur

Date : 07 APR 2017

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**PERSATUAN GEOLOGI MALAYSIA**
**(GEOLOGICAL SOCIETY OF MALAYSIA)**
**(Registered in Malaysia)**

**STATEMENT OF ASSETS AND LIABILITIES AS AT 31 DECEMBER 2016**

| | Note | 2016 RM | 2015 RM |
|---|---|---|---|
| **FUND ACCOUNTS** | | | |
| GENERAL FUND | 3 | 852,986 | 1,453,600 |
| ENDOWMENT FUND | 4 | 1,661,323 | 1,099,897 |
| ECONOMIC GEOLOGY WORKSHOP FUND | | - | 3,000 |
| STUDENT LOAN FUND | | 955 | 955 |
| YOUNG GEOSCIENTIST AWARD FUND | | 3,143 | 3,143 |
| AAPG-UM STUDENT CHAPTER FUND | | 10,957 | 7,806 |
| GEOSCIENCE GRANTS | 5 | - | 17,609 |
| | | 2,529,364 | 2,586,010 |
| Represented by: | | | |
| **NON-CURRENT ASSETS** | | | |
| PROPERTY, PLANT AND EQUIPMENT | 6 | 17,128 | 16,685 |
| **CURRENT ASSETS** | | | |
| Deposits and prepayment | 7 | 880 | 600 |
| Fixed deposits with licensed bank | 8 | 2,164,701 | 2,142,535 |
| Cash and bank balances | | 431,235 | 543,728 |
| | | 2,596,816 | 2,686,863 |
| **CURRENT LIABILITIES** | | | |
| Other payables | | 84,580 | 117,538 |
| **NET CURRENT ASSETS** | | 2,512,236 | 2,569,325 |
| | | 2,529,364 | 2,586,010 |

The accompanying notes are an integral part of the financial statements

**PERSATUAN GEOLOGI MALAYSIA**
**(Registered in Malaysia)**

**STATEMENT OF INCOME AND EXPENDITURE FOR THE YEAR ENDED 31 DECEMBER 2016**

| **INCOME** | **2016 RM** | **2015 RM** |
|---|---|---|
| SEA paleogene workshop | - | 8,605 |
| Speakers account | - | 4,106 |
| Entrance fee | 520 | 1,000 |
| Fixed deposits interest income | 34,163 | 33,488 |
| Subscription | 15,384 | 20,508 |
| Sales of publications | 2,277 | 2,201 |
| Petroleum Geology Conference | - | 62,240 |
| Short course : Jan de Jager | - | 4,331 |
| Geology of Peninsular Malaysia | - | 310 |
| National Geoscience Conference | 2,210 | 2,882 |
| Working Groups | 3,000 | - |
| Geological Evolution of Southeast Asia | 1,304 | 248 |
| Sales of compass | - | 182 |
| Minerals workshop | - | 352 |
| | 58,858 | 140,453 |
| **EXPENDITURE** | | |
| Annual dinner | 9,242 | 66 |
| Audit fee | 1,200 | 1,200 |
| Bank charges | 48 | 99 |
| Depreciation on property, plant and equipment | 2,310 | 1,979 |
| Department of geology | 13,830 | - |
| Map/CD | - | 1,080 |
| Geoscience | 4,154 | 808 |
| Geology of Peninsular Malaysia | 3,295 | - |
| Honorarium | 36,911 | 37,360 |
| Income tax | - | 981 |
| National Geoscience Conference | 1,269 | 2,680 |
| Photocopy expenses | 327 | 376 |
| Postages | 3,668 | 4,487 |
| Printing and Stationery | | |
| - Warta Geologi | 8,384 | 3,180 |
| - Bulletin | - | 11,321 |
| Refreshment | 1,104 | 171 |
| Speakers' account | 3,418 | - |
| Sponsorship for student's activities | 1,000 | - |
| Student's award | 1,000 | - |
| Subscription to COSTAM | - | 100 |
| Miscellaneous expenses | 2,175 | 1,493 |
| Telefax | 562 | 663 |
| Telephone | 562 | 494 |
| | 94,459 | 68,538 |
| (Deficit) / surplus for the year | (35,601) | 71,915 |

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PERSATUAN GEOLOGI MALAYSIA
(Registered in Malaysia)

## CASH FLOW STATEMENT FOR THE YEAR ENDED 31 DECEMBER 2016

| | 2016 RM | 2015 RM |
|---|---|---|
| **Cash flows from operating activities** | | |
| (Deficit) / Surplus of income over expenditure for the year | (35,601) | 71,915 |
| Adjustments for:- | | |
| Depreciation on property, plant & equipment | 2,310 | 1,979 |
| Interest income | (34,163) | (33,488) |
| (Deficit) / Surplus before working capital changes | (67,454) | 40,406 |
| Increase in student loan fund | - | 299 |
| (Decrease) / Increase in Geoscience fund | (17,609) | 17,609 |
| (Decrease) / Increase in Endowment Fund | (3,587) | 15,740 |
| Decrease in inventories | - | 8,178 |
| Decrease in Economic Geology Workshop Fund | (3,000) | - |
| Increase in receivables | (280) | - |
| Increase in AAPG-UM Student Chapter Fund | 3,151 | 2,261 |
| Decrease in other payable | (32,958) | (96,253) |
| Cash used in operations | (121,737) | (11,760) |
| Interest income | 34,163 | 33,488 |
| Purchase of property, plant and equipment | (2,753) | - |
| Net cash (used in) / generated from operating activities | (90,327) | 21,728 |
| **Net (decrease) / increase in cash and cash equivalents** | (90,327) | 21,728 |
| **Cash and cash equivalents at beginning of the year** | 2,686,263 | 2,664,535 |
| **Cash and cash equivalents at end of the year** | 2,595,936 | 2,686,263 |
| **Cash and cash equivalents comprised of:** | | |
| Deposits held with licensed banks | 2,164,701 | 2,142,535 |
| Cash and bank balances | 431,235 | 543,728 |
| | 2,595,936 | 2,686,263 |

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PERSATUAN GEOLOGI MALAYSIA
(Registered in Malaysia)

NOTES TO THE FINANCIAL STATEMENTS - 31 DECEMBER 2015

1. PRINCIPAL OBJECTIVES

The objective of the Society is to promote the advancement of the geological sciences in Malaysia.

2. ACCOUNTING POLICIES

(a) Basic of Accounting
The financial statements have been prepared under the historical cost convention and comply with applicable Approved Accounting Standards issued by the Malaysian Association Standards Board.

(b) Property, Plant and Equipment
Property, plant and equipment is stated at historical cost less accumulated depreciation. Depreciation on property, plant and equipment is computed on the reducing balance basis calculated to write-off the cost of the assets over their estimated useful lives.
The principal annual rates used are:-

| | |
|---|---|
| Information technology equipment | 20% |
| Office equipment | 10% |

The carrying values of the assets are reviewed for impairment when there is an indication that the assets might be impaired. Impairment is measured by comparing the carrying values of the assets with their recoverable amounts.

An impairment loss is charged to the income and expenditure account immediately, unless the asset is carried at revalued amount. Any impairment loss of a revalued asset is treated as a revaluation decrease to the extent of previously recognised revaluation surplus for the same asset.

Subsequent increase in the recoverable amount of an asset is treated as reversal of the previous impairment loss and is recognised to the extent of the carrying amount of the asset that would have been determined (net of amortisation and depreciation) had no impairment loss been recognised. The reversal is recognised in the income statement immediately, unless the asset is carried at revalued amount.

c) INVENTORIES
Inventories consists of compass and maps valued at the lower of cost and net realizable value.

**PERSATUAN GEOLOGI MALAYSIA**
**(Registered in Malaysia)**

d) INCOME RECOGNITION
Membership subscription is payable annually at the beginning of the financial year. Fee is recognised on an accrual basis and customer acceptances.
Income from sale of publications is recognised upon delivery of goods.
Income from organising conference is recognised on received and receivable basis.
Fixed deposits interest income is recognised on an accrual basis.

| 3. GENERAL FUND | 2016 RM | 2015 RM |
|---|---|---|
| At 1 January | 1,453,600 | 1,381,685 |
| (Deficit) / surplus for the year | (35,601) | 71,915 |
| Transfer to endowment fund | (565,013) | - |
| At 31 December | 852,986 | 1,453,600 |

| 4. ENDOWMENT FUND | 2016 RM | 2015 RM |
|---|---|---|
| As at 1 January | 1,099,897 | 1,084,157 |
| Add : Fixed deposit interest income | 19,412 | 15,740 |
| | 1,119,309 | 1,099,897 |
| Add : Placement of fixed deposits | 542,014 | - |
| As at 31 December | 1,661,323 | 1,099,897 |

| 5. GEOSCIENCE GRANTS | 2016 RM | 2015 RM |
|---|---|---|
| As at 1 January | 17,609 | - |
| Additions | 41,030 | 50,000 |
| | 58,639 | 50,000 |
| Less : Annual Dinner | 10,330 | 840 |
| National Geoscience Conference | 6,534 | 3,000 |
| Printing and Stationery | 8,244 | 6,511 |
| Refreshment | 5,650 | 2,030 |
| Secretarial services | 4,500 | 3,000 |
| Telephone charges | 549 | 441 |
| Travelling | 22,832 | 16,569 |
| As at 31 December | - | 17,609 |

PERSATUAN GEOLOGI MALAYSIA
(Registered in Malaysia)

## 6. PROPERTY, PLANT AND EQUIPMENT

| | Cost | | | |
|---|---|---|---|---|
| | Balance at 1/1/2016 | Additions | Disposal | Balance at 31/12/2016 |
| | RM | RM | RM | RM |
| Information technology equipment | 5,078 | 2,753 | - | 7,831 |
| Office equipment | 132,175 | - | - | 132,175 |
| | 137,253 | 2,753 | - | 140,006 |

| | Accumulated depreciation | | | |
|---|---|---|---|---|
| | Balance at 1/1/2016 | Charge for the year | Disposal | Balance at 31/12/2016 |
| | RM | RM | RM | RM |
| Information technology equipment | 4,176 | 732 | - | 4,908 |
| Office equipment | 116,392 | 1,578 | - | 117,970 |
| | 120,568 | 2,310 | - | 122,878 |

| **Net Carrying Amount** | **2016** | **2015** |
|---|---|---|
| | **RM** | **RM** |
| Information technology equipment | 2,923 | 902 |
| Office equipment | 14,205 | 15,783 |
| | 17,128 | 16,685 |

## 7. DEPOSITS AND PREPAYMENT

| | **2016** | **2015** |
|---|---|---|
| | **RM** | **RM** |
| Deposits | 600 | 600 |
| Prepayment | 280 | - |
| | 880 | 600 |

## 8. FIXED DEPOSITS WITH LICENSED BANK

The fixed deposits with licensed bank have a maturity of between 6 to 15 months (2015 : 3 to 15 months). Interest rates for the deposits ranged from 2.85% to 2.95% (2015 : 3.05% to 5%) per annum.

**APPENDIX VI**

# GSM ENDOWMENT FUND: BOARD OF TRUSTEES REPORT

## 51ST ANNUAL GENERAL MEETING OF THE GEOLOGICAL SOCIETY OF MALAYSIA

21 April 2017, Kuala Lumpur

### Background

1. The 47th AGM in 2013 confirmed the establishment of the GSM Endowment Fund and endorsed the Terms of Reference prepared by Advocates and Solicitors, Messrs Yeap, Yong and Amy. The AGM also agreed that the Council obtain "tax deductible" status to encourage donations directly into the "GSM Endowment Fund"; and that the interest portion accrued, be used to meet expenses incurred in the implementation of programmes run by the Society.
2. The 48th AGM in 2014 approved an amendment to the Terms of Reference to provide for the establishment of the "Board of Trustees of the GSM Endowment Fund", whose members shall comprise the President, Immediate Past President, Secretary, Treasurer, Editor and at least three independent Full Members "in good standing", to be appointed at the AGM.
3. The 49th AGM in 2015 accepted the following recommendations of the Board of Trustees:-
   i. The In-Coming GSM Council be requested to appoint a tax consultant to obtain "tax deductible" status of GSM to inform potential donors on the tax deductible status of their donation;
   ii. The In-Coming GSM Council prepare an annual budget proposal for the Endowment Fund, covering programmes specified in the 48th GSM AGM (see Appendix 2) to be tabled for endorsement by the Board of Trustees;
   iii. The In-Coming GSM Council be encouraged to increase the principal amount in the GSM Endowment Fund through fund raising activities; and
   iv. The In-Coming GSM Council to consider transferring a portion of the fixed deposit of the GSM operating to the Endowment Fund to increase the principal amount.
4. The 50th AGM in 2016 accepted the following recommendations of the Board of Trustees:-
   i. The GSM Council should "think out of the box" to focus on increasing the Endowment Fund in any way possible;
   ii. The GSM Council explore the possibility of transferring some funds from the GSM Fixed Deposit into the GSM Endowment Fund to get a higher interest;
   iii. The AGM accept and endorse the Standard Operating Procedure for the GSM Endowment Fund.

### Report of the Board of Trustees

1. This report covers the period since the 50th AGM to 31 December 2016, when the Board of Trustees met to scrutinise the administration of the GSM Endowment Fund. The meeting was chaired by Dato' Yunus Abd Razak. Members in attendance were GSM President, Dr. Mazlan Madon; Immediate Past President, Prof. Joy Jacqueline Pereira; Secretary, Mr. Lim Choun Sian; Treasurer, Mr. Ahmad Nizam Hasan; Editor, Prof. Wan Hasiah Abdullah; and GSM Members Datuk Fateh Chand and Mr. Ahmad Said.
2. The principal amount now stands at RM 1,591,999.99 with United Overseas Bank Malaysia (UOBM). The principal amount has been increased by RM 500,000 (via four transactions approved by the GSM Council). A special operating account is also maintained with UOBM to receive interest accrued from the principal.
3. The total interest accrued in 2016 as of 31 December 2016 was RM 69,309.83.
4. The interest portion accrued has not been utilised to-date. The interest is kept in a GSM current account at UOBM (which is separate from the operational account of GSM at the Standard Chartered Bank Bhd).
5. Since the 50th AGM (2016):-
   i. The GSM Council is still in the process of obtaining "tax deductible" status for GSM, to inform potential donors on the tax deductible status of their donation;
   ii. The Board of Trustees took note that RM 50,000.00 is proposed by the GSM Council to be used as seed-funding for the NGC 2017.
   iii. The GSM Council has increased the principal amount in the GSM Endowment Fund by RM 500,000.00 in 2016.

**Recommendations to the 51st AGM of the GSM**

The Board of Trustees of the GSM Endowment Fund makes the following recommendation to be considered by the 51st AGM of the GSM to be held on 21 April 2017:-

i. The GSM Council appoints a new Endowment Fund Chairman for a period of three years, subject to approval of a majority of members present at the AGM.
ii. The AGM appoints at least three independent Full Members in good standing for a period of three years.

On behalf of the Board of Trustees, I declare that I am satisfied that the GSM Endowment Fund is being administered in a satisfactory manner and that the terms of reference are adhered to. I hereby approve the report prepared for the 51st AGM of the GSM.

**Dato' Yunus Abdul Razak**
Chairman
Board of Trustees of the GSM Endowment Fund
Geological Society of Malaysia
24 March 2017

**APPENDIX VII**

# OTHER MATTERS

Other Matters:

**a. PIDM on bank deposits**

Savings in bank under the protection of Perbadanan Insurans Deposit Malaysia (PIDM). Snippets taken from PIBM website says "All types of depositors, whether businesses or individuals, are protected. The maximum limit of coverage is RM250,000 per depositor per member bank."

**b. Note from K.M. Leong, in appreciation of GSM Councils on Sabah Pre-Cretaceous Geology**

In Appreciation of GSM Councils' Transparency; Affirmation of Sabah Pre-Cretaceous Geology; Emeritus Prof Dr Tjia's Comment by K.M. Leong:

*First I wish to express my Appreciation for the Transparency of Geological Society of Malaysia Council/Editor. They had, without fear or favour, published Leong (2016) and earlier Leong (1998, 2009), who re-affirmed Sabah Pre-Cretaceous (Jurassic or older) Crystalline Basement granitic and metamorphic rocks underlying Cretaceous formations/ophiolites in Geological Survey GS /Minerals and Geoscience Geological Maps of Sabah (Wilford 1967; Lim 1985).*

- *There are 2 versions Geology of Sabah (sales to Geologists, students, public):*
  *1. GS/JMG publications Geological Maps of Sabah etc with Pre-Cretaceous.*
  *2. Some GSM publications, Sabah Geology without Pre-Cretaceous Geology. (Disclosures on a stand-alone for–sale GSM publication in Leong 1998, 2009, and 2 stand-alone for-sale GSM publications and 2 others in Leong 2016).*
- *As stated in Leong (2016): Miles and miles of Pre-Cretaceous granitic and metamorphic rocks outcrops in Upper Segama area, east Sabah do not simply disappear and vanish.*
- *At AGM 2016, Emeritus Prof Dr Tjia stated deletion of Sabah Pre-Cretaceous was Factual Error. Factual Error results in 'Dissemination of Disinformation'*

**APPENDIX VIII**

# NOMINATION COMMITTEE REPORT

## COUNCIL FOR 2017/2018

Upon the closing of nominations, only single nominations were received respectively for the positions of President, Vice President, Vice President, Secretary, Treasurer, Assistant Secretary and Editor. There were four nominations for the four 2-year Councillor positions.

**The Council for 2017/2018:**

| | | |
|---|---|---|
| **President** | : | Mr. Abd. Rasid Jaapar (GeoMapping Technology Sdn. Bhd.) |
| **Vice-President** | : | Dr. Che Aziz Ali (UKM) |
| **Imm. Past President** | : | Dr. Mazlan Madon (PETRONAS) |
| **Secretary** | : | Mr. Lim Choun Sian (UKM) |
| **Assistant Secretary** | : | Mr. Askury Abd Kadir (UTP) |
| **Treasurer** | : | Mr. Ahmad Nizam Hasan (GeoSolution Resources) |
| **Editor** | : | Prof. Dr. Wan Hasiah Abdullah (UM) |
| **Councillors (1 year) 2017/2018** | : | Dr. Meor Hakif Amir Hassan (UM)<br>Ms. Marelyn Telun Daniel (UM)<br>Mr. Muhammad Ashahadi Dzulkafli (UKM)<br>Dr. Norbert Simon (UKM) |
| **Councillors (2 years) 2017/2019** | : | Mr. Tan Boon Kong (Consultant)<br>Dr. Nur Iskandar Taib (UM)<br>Nicholas Jacob (JKR)<br>Dato' Yunus Abdul Razak (SEADPRI-UKM) |

# PRESIDENTIAL ADDRESS FOR 2017/2018

## 50 years and Beyond: Towards Fossilisation or Evolution?

By: ABD RASID JAAPAR, P.GEOL, MIGM
MSc (Dist.) (HKU), BSc (Hons) (UKM), Cert. SHO (NIOSH)
President, Geological Society of Malaysia

Bismillahi Rahmani Rahim

Assalamualaikum Warahmatullahi Wabarakatuh

*"God changes not what is in the people, until they change what is in themselves" – Quran, 13:11*

Terima kasih Dr Mazlan Madon, mantan Presiden, Persatuan Geologi Malaysia. Rakan-rakan ahli majlis Persatuan Geologi Malaysia.

Dato'-Dato', Professor-professor, Tuan-tuan dan puan-puan sekalian. Pertama-tamanya saya ingin mengucapkan ribuan terima kasih kepada barisan kepimpinan Persatuan yang mengundurkan diri setelah memberi sumbangan yang amat berharga kepada Persatuan dan kepada masyarakat geologi seluruhnya. Selamat datang kepada ahli majlis baru.

Rakan-rakan yang saya hormati, terima kasih juga saya ucapkan kerana memberi kepercayaan kepada saya untuk menerajui Persatuan bagi sesi 2017/18. Memimpin sesuatu organisasi yang genap berusia 50 tahun merupakan satu cabaran yang hebat. Bayangkan bagaimana menjaga seorang bijak pandai yang berumur 50 tahun. Ahli Persatuan mempunyai ratusan ahli bijak pandai yang melebihi 50 tahun! Memang sesuatu yang sukar!!

### INTRODUCTION

Ladies and gentlemen,

The late Prof Dr N. S. Haile was elected as the first President of Geological Society of Malaysia (then it was known as Kesatuan Kajibumi Malaysia in Bahasa Melayu). He stepped down after served as the President for 1 year. It was noted in the GSM Newsletter No. 11 (March, 1968) that 'the retiring President, Dr N. S. Haile then delivered his Presidential Address entitled, 'Meaning, Precision, and Quantification in Geology'. The copy of first Presidential Address was circulated together with GSM Newsletter No. 15 (Nov 1968) with a note, 'this is the first of what we hope will become a regular and valuable series, distilling the wisdom of the Society's successive President'.

The last Presidential Address by retiring President recorded in GSM Newsletter was delivered by Dr Mohd Ayob in 1982 entitled 'Petroleum Exploration in Malaysia'. I couldn't find record on Presidential Address beyond 1982.

This year, after 50 years in existence, GSM should set a new trend where the incoming President will deliver serious Presidential Address to set his/her aspiration as the President of GSM. This Presidential Address should be published in Warta Geologi together with the Annual Report.

The first time I served the Council of GSM was in 2000 until I stepped down in 2005 to pursue my second degree. I served back the Council in 2014. There were up and down throughout the years but most of the things remain status quo. Some of the topics in this address are based on issues that I highlighted in my three articles published in Warta Geologi Vol. 30 (No. 5 & 6) and Vol. 31 (No. 1) between 2004 and 2005. I was the Secretary, then. Some of it are still relevant today (after more than 10 years).

### GEOSCIENCE TRIANGLE

Ladies and gentlemen,

It is important for all of us here to adopt the Geoscience Triangle as presented in the figure below. I would say most of geologists out there are still confuse and not really know the different between GSM, IGM and BOG. I will not surprise should any of us who serve one of the organisation also still confuse. The triangle clearly differentiate the function of each organisation. The Board is the regulator of the geoscience profession in Malaysia. The Institute is responsible to promote and enhance the practice of geoscience within Malaysia while the Society is responsible to promote and advance the science (knowledge) of geology in Malaysia and the region.

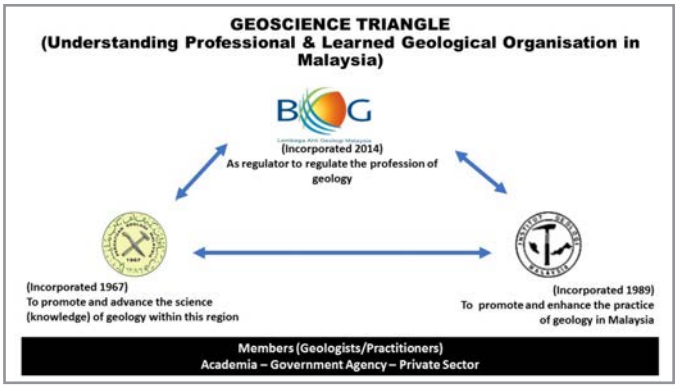


**Figure 1:** Geoscience Triangle.

## COMPETITION OR COMPLACENT

Ladies and gentlemen,

The greatest threat encountered by any organisation today is not competition, neither is it increasing demands placed by members, nor is it pace of change brought about by globalisation. The greatest threat to survival of organisation is complacency of people inside organisation. It is the no. 1 enemy in any successful organisation today.

It is the sense of complacency that leads to poor quality of products (such as publications, activities, etc.) and services. Members who are not happy with an organisation's products or services will not only stop being members but will inform 10 other people they know about their dissatisfaction. Complacent organisation may not understand the changing member need, and may continue to produce the same products, publications, activities and services which member may no longer need and may leads to poor attendance. Even the office bearers are not regularly attending major functions, never mind the many activities. Being complacent, people may not explore new activities, new services or new memberships. The missed opportunities affect the potential revenue growth of the society. In a very competitive and fast-changing environment, remaining status quo is the surest path to losing membership. Nevertheless, there are few who still believe in maintaining the status quo, positioning themselves as guardians of the classical ways and derailing efforts towards change and there are those who are said to be largely using GSM for their personal interests. GSM should not lack of quality and loss credibility and should not too commercial oriented.

It is because of complacency, GSM lost its prestigious Petroleum Geology Conference and Exhibition to iCEP and Petronas and because of do not want to be complacent that many international organisations such as AAPG, EAGE, SEG and SPE willing to explore new frontiers and set up their office in KL. Nevertheless, all these organisations are mainly related to oil and gas exploration. Geology is not only about oil and gas.

## REFLECTION ON RESPONSIBILITIES

Ladies and gentlemen,

All professionals have a major responsibility to support the largest and most important contributor to their career – the profession!

If we want GSM to be the leader in the promotion and advancement of geology, then we must be committed and dedicated to building GSM into an organisation that truly represents the science of geology. Geological community still has no representative in many national committees or bodies despite the enactment of Geologist Act in 2008.

Geological organisations must get involve at level of policy making, national budget planning and other decision making platforms, or else our profession progress will not be considered in the national budget as well others.

*'As professional geologists and private citizen, we should participate in the decision-making process. We live in a unique time on a unique earth and there is nowhere else to go" – Perry H. Rahn (1986)*

*'On issues where geologists as a group are affected or have the potential to be affected, we must speak out, offer our support to those who may be in more of a front-line position than we, and take stand on issues. Not to do so would forego our professional responsibility, thereby creating vacuum which unqualified tend to fill" – John P. Ivey, President, AEG (1980)*

Idealistic goals for GSM are service to mankind and advancement of science and knowledge. Duties of the members are to advance the knowledge by writing technical papers or carrying out continuous professional development as life-long duties and to train younger members. Members need to write papers to benefit to others or to benefits from others. Mentoring programme should be developed as it has shown impacts in other countries. These are the ways that profession can progress well and in the right direction. We, as an individual, can advance only if our profession as a whole is advancing.

Peter M Llyod in his EAGE Distinguished Lecture 2005 outline the five reasons why we need learned organisation (like GSM):

i) Training and development
ii) Keeping technically up to date
iii) Presenting one's own work
iv) Networking
v) Giving back

Based on Warta Geologi, the initiative to document Standard Operating Procedure (SOP) and Term of Reference (TOR) has started in 1982. Repeated in 2003 and lastly is current initiative. All these documents should be published yearly together with AGM report or to be published on the website so it will be permanent documents that can be reviewed from time to time. Maybe it is timely to re-visit and re-develop another strategic plan and activities for GSM.

GSM's strategy to increase public awareness on the roles of geology must be continued such as:

- Intensity promotion of geoscience in schools. GSM may encourage students' geological club at universities to take this role.
- Conduct more frequent public lectures in geology

- Disseminate geological information in public media and internet
- Involve actively in public campaigns

## EVOLUTION?

Ladies and gentlemen,

There are four main areas that are closely related with learned organisation like GSM as follow:

i) Publications
ii) Memberships
iii) Activities and Participations
iv)Financial and/or Asset Management

### Publications

GSM supposed to publish Warta Geologi quarterly. GSM Council in recent council meeting decided that the programme and abstract book of the National Geoscience Conference shall be published as one of the Warta Geologi. The content of the Warta shall be organised accordingly so that sufficient materials available for publications on time. With that, more timely Warta Geologi shall be distributed to members. Hopefully, the Warta can be on track in near future. We should look into option using electronic Warta Geologi especially for international members to manage unnecessary cost.

GSM is supposed to publish its Bulletin twice a year. However, we are short of good technical papers to be published on timely manner. The Editor is working hard to ensure that the Bulletin to be recognised by ISI. The Bulletin is currently recognise by Scorpus only. We need to have a consistent and better quality publication. We need to think how to encourage geologists to write and publish with GSM. We should also explore to be the official publisher for GEOSEA.

### Memberships

GSM like any other learned organisation is absolutely dependent upon its membership to survive. Without members, GSM is 'nobody' – a voiceless 'paper organisation' unable to gain any respect in any arena. Based on 2016 report, our members stand at 703.

We will initiate new initiative where the President will visit every geological department in the university to have session with the students and the geological club. GSM need to be closed to the geological students in local universities to ensure GSM is not losing them to other organisations. There are 7 universities in Malaysia that have geological department, i.e. University of Malaya, Universiti Kebangsaan Malaysia, Universiti Malaysia Kelantan, Universiti Malaysia Sabah, Universiti Sains Malaysia, Universiti Teknologi Petronas, and Curtin University, Sarawak.

GSM also need to discuss with all regional representatives and working group chairpersons on the best way to move forward. GSM also should have more communication channels through the mushrooming social media.

### Activities and Participations

Any activities organised by GSM should be market driven (but not commercially driven). GSM should have open policy on event organising where we should welcome anybody to organise event as long as for the advancement of the science of geology and to benefit mutually the society and the members

GSM Council has decided that the NGC shall be elevated becoming one of the prestige event in this region. GSM used to do that with PGCE and I am sure we can do that with NGC. We need to think how to re-brand our NGC. NGC will be organised in KL every odd year and to be organised outside KL every even year.

Field trips, visits and expeditions used to be one of GSM core activities must be encouraged to the fullest. GSM members need these to enhance their skills at field – remember that geologist's office is in the field!

GSM need to start to initiate a prestige and special Annual Lecture Series in Applied Geology by prominent geologists from all over the world. This going to be a platform and opportunity to share and enhance our knowledge. The proposed Annual Lecture Series shall be sponsored by the industry. I would like to suggest that the proposed Annual Lecture Series to be named after the late Prof Dr Tjia Hong Djin due to his significant contributions to the development of geology as applied science in Malaysia.

### Financial and /or Asset Management

GSM average operation expenditure varies from year to year depending on activities we have. However, on average, the amount is around RM94,000 per year.

While GSM fixed operating expenditures mainly on office rental, honorarium for secretariat, publications, utilities and miscellaneous. To-date, nothing is conclusive on rental with UM. It is estimated that the fixed operating expenditure for GSM is almost RM60,000 per year. To run GSM professionally, my estimation is we need to double

up the figure becoming RM120,000 per year. If we can get 15% or RM18,000 of nett profit per year, I believe it is worth to run GSM professionally. This will need to be deliberated thoroughly by the Council

GSM also need to upgrade its library and resources centre where currently stored in the Klompe Library.

## INTERNATIONAL OR REGIONAL COLLABORATIONS

GSM as the secretariat of GEOSEA should strengthen further the Regional Congress. GSM should also be the champion in organising more regional collaboration and initiatives such as thematic seminars, trainings, short courses, visits, etc.

GSM should try to explore opportunities to collaborate with the geological societies in the Far East such as Japan, China, Taiwan and Hong Kong.

GSM should encourage the formation of national group for international associations. IAEG and ISRM Malaysian National Group is now re-group under single banner of SEGRM. GSM should support all events organised by them. Very soon we will have the IAH Malaysian National Group.

## CONCLUSIONS

*"If you want to do something new, you have to stop doing something old" – Peter Drucker*

Over the years, GSM has been continually making conscious efforts to establish itself internationally. The performance of GSM to-date can be considered as satisfactory and the key success factors for the future are identified as follow:

Support from universities and government agencies such as the Mineral and Geoscience Department, Malaysian Remote Sensing Agency, Malaysian Nuclear Agency, National Hydraulics Research Institute of Malaysia, Ministry of National Resources and Environments, Academy of Science, etc.

Dedicated and competent work-force in term of council members, organising committees, working groups, regional representatives, students' geological club group, etc.

Increasing effectiveness in management and services

The key strengths of GSM lie with its members, culture and values. Financially, GSM is considerably sound. Its low operating cost, cheap membership fee plus zero bureaucracy in membership application constitute other areas of strength. GSM has established its own strength throughout the years.

The weakness of GSM is within the organisation itself. Some members still want GSM to remain status quo. Unwillingness to operate GSM professionally where profits count, unnecessary worry about mild and positive publicity and reluctant in changing the image of GSM are weaknesses. All great professional and learned organisations in the world and its profession have their own home. It is high time for geologists in Malaysia to have theirs' own official home as well. We will explore further on this issue with IGM and other relevant organisations. GSM needs to overcome such resistances in order to overcome all the weaknesses.

The opportunities available to GSM come from local and regional arena. The increasing number of intakes of geology undergraduate students in every geological department in local universities for the past few years must be considered as a potential area where future full members and leaders of GSM can be tapped and groomed. The regional initiative, GEOSEA is on track now and moving towards right direction. Thanks to the hard work of previous Presidents. The advantage of the rapid development and competition of many local and regional airlines must be fully utilised.

It seems that the threats to GSM are the competitors at regional and international level. Many international organisations are now venturing into Malaysia and Southeast Asian region such as EAGE, AAPG, SEG, etc. We should not to worry as most of the organisations are related to oil and gas industry. Geology is not only about oil and gas. For me, we should work together and be friendly to them rather than have using confrontational approach. After all, we are all have the same mission which is to promote and advance the science of geology. Nevertheless, GSM has learned bitter lesson, therefore, we must fully involve and not to be 'Ali Baba' type of organisation.

There are always three group of people in any organisation; those who make things happen, those who see things happen and those who wonder what happen. So, which one suits us?

Lastly, let's hope the new Council can deliver success. Nobody can go back and start new beginning but anybody can start today and make a new ending.

Thank you.

# GSM 51st AGM & DINNER 2017

# Society of Exploration Geophysicists (SEG) meets with GSM

On 2 May 2017, Ms Laurie Whitesell from the Society of Exploration Geophysicists (seg.org) was in Kuala Lumpur to meet with GSM representative as well as with geophysicists in PETRONAS. A meeting was held at the PETRONAS Tower 2 in Kuala Lumpur City Centre. GSM was represented by its Immediate Past President, Dr Mazlan Madon. The Petronas personnel, some of whom are SEG members, met specifically to discuss the upcoming event they are co-organising, the Offshore Technology Conference 2018, in Kuala Lumpur. Besides that, the purpose of SEG meeting with GSM is to explore potential collaboration between the two societies, especially in organising geoscience seminars that would be of mutual benefit to members. Discussions are ongoing with regard to areas of potential collaboration, e.g. exchange of publications, co-hosting technical talks, promotion of society events, and organising joint events such as conferences. It is hope that this collaboration would materialise soon, as it would provide opportunity for GSM members to have linkage with geophysicists, not only in petroleum-related activities, but in other sectors such as engineering, construction and hydrogeology.

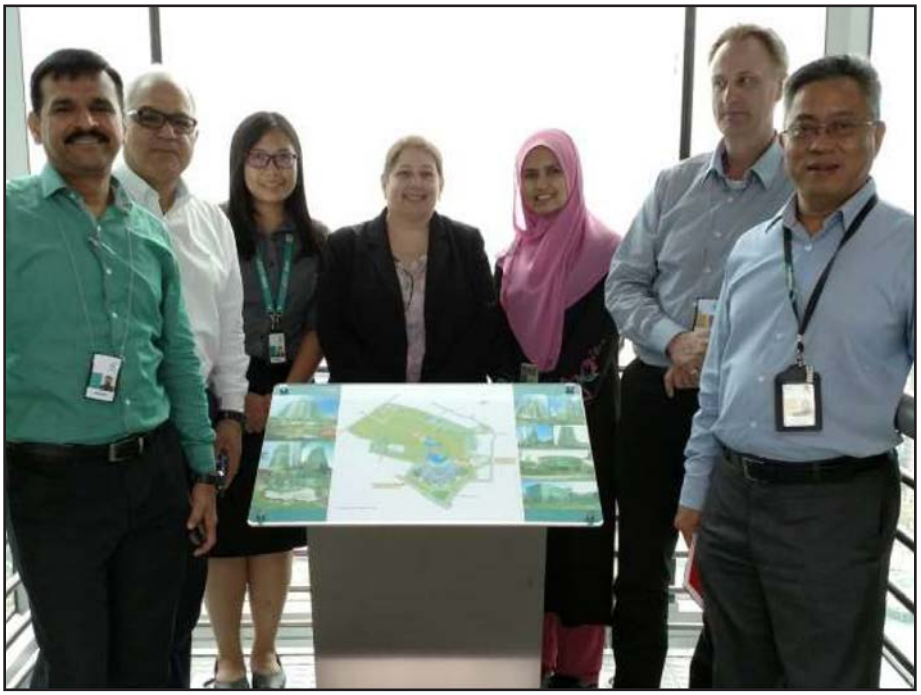

Photo taken on level 42 Skybridge between the Petronas Twin Towers, 2nd May 2017. L-R: Sandeep Kumar (Petronas), Nabil El Kady (Petronas), Ang Chin Tee (Petronas), Laurie Whitesell (SEG), Norhasliza Kasim (Petronas), Eric Andersen (Petronas), Dr Mazlan Madon (GSM). *Photo courtesy of Laurie Whitesell.*

# CERAMAH TEKNIK TECHNICAL TALK

## Soil related factors controlling landslides and flooding hazards in Malaysia

S. Paramananthan

Param Agricultural Soil Surveys (M) Sdn. Bhd.
Date: 14 April 2017
Venue: Dept. of Geology, University of Malaya

This talk was presented by Dr. S. Paramananthan on 14th April, 2017 at the Dept. of Geology, UM. An abstract of the talk is attached below.
As usual, there was a lively discussion session following the presentation.
We thank Dr. Param for his contribution to the Society's activities.

Tan Boon Kong,
Chairman, W/G on Engineering Geology, Hydrogeology & Environmental Geology

**Abstract:** Malaysia is located in a tropical environment. It has a high temperature and high intensity of rainfall which results in most soil profiles having depths that are to a large extent controlled by the original rock from which the soil is developed from. Consequently, many of the soil properties determine to a large extent the type of soil erosion and the size of landslides and floodings occur on a particular slope/site.

This presentation looks at the differences in soils formed under a temperate and tropical environments. It then compares how the different rock types influence many of the soil properties such as the depth of soil, texture and structure, waterholding capacity, its porosity and clay mineralogy which directly or indirectly influence the size of the resulting landslips and the frequency of flooding that can take place at a particular location. Other factors that influence the landslides and flooding are the vegetation,landuse, the use of cover crop, terracing and intensity of the rainfall.

Recent studies of soils have shifted their focus from agriculture and food production to non-agricultural purposes such as seeking foundation materials for engineering structures or storage basins for water retention to minimise flooding. The importance of the soil as part of the landscape to use for construction of houses, buildings and their resultant impact on the environment have increasingly became important.

All soils, like people, are not the same as they can have different colours, have different amounts of clay, silt and sand. A soil normally occurs on the land surface. It can occur on level, hilly or steepland. It can be shallow (<50 cm), moderately deep (50-100 cm), or deep (>100 cm). A soil can be well or poorly drained. It can be sandy, clayey or consist of mixtures of both. It can be organic or mineral. Soils are formed by the action of climate (rainfall and temperature) and plants with their associated organisms on the parent materials over a period of time. This action is greatly influenced by the relief or slopes or shape of the land on which the soil is found. This can be represented as follows:

s = f (c, o, p, r, t)

| | | | |
|---|---|---|---|
| *where* | s | = | soil |
| | c | = | climate |
| | o | = | organisms/vegetation |
| | p | = | parent materials |
| | r | = | relief |
| | t | = | time |

Where all the five soil forming factors are the same, the resultant soil will be the same. All of these factors are interrelated. Because these factors can vary widely, different kinds of soils can develop.

For example, a steep area allows the rain to runoff the surface resulting in severe erosion and shallow soils result. Temperature and moisture influence the kind of vegetation and hence different soils support different types of crops/vegetations.

Parent material or rock type influences the texture and some chemical properties of the soils. Sandy soils are formed from sandstones while granites often give rise to soils with coarse sandy clay textures and shales and basalts form clay textured soils. Basalts give rise to soils rich in iron while granites to soils with low free iron oxides. Similarly the fertility, clay mineralogy and soil structure of a particular soilis also influenced by the parent rock or the parent material as modified by climate and time.

# CERAMAH TEKNIK TECHNICAL TALK

## Why would sea-level rise for global warming and polar ice-melt?

Professor Dr. Aftab Alam Khan (University of Dhaka, Bangladesh)
Date: 27th April 2017
Venue: Geology Department, University of Malaya

**Abstract:** Two major causes of global sea level rise such as thermal expansion of the oceans and the loss of land-based ice for increased melting have been claimed by IPCC. On the otherhand, the climate threat investigation revealed that atmosphere–ocean modeling is an imperfect representation of the climate system, paleo-data consist mainly of proxy climate information usually with substantial ambiguities, and modern observations are limited in scope and accuracy. Here, my study shows that although global warming and polar ice-melt a reality but are not the potential components for the sea level rise. Polar sea-ice on melting can reoccupy same displaced volume of the floating ice-sheets, while polar land-ice cover on melting reduces load on the land activating elastic rebound of the crust that eventually raise the land to attain isostatic equilibrium in the polar region. Such characteristics can not contribute to the sea level rise. Global palaeo-sea level rise and fall in macro-scale (10 to 100 m or so) are related only to the geological events like converging and diverging plate tectonics, orogenic uplift, basin subsidence, volcanism, prograding delta buildup, ocean floor height change and sub-marine mass avalanche. Further, palaeo global sea level rise and fall due to the geologic events were not uniform and varied its pattern with global and local conditions. This study further reveals that geophysical shape, gravity attraction and the centripetal acceleration of spinning and rotation of the earth act against sea level rise.

### REPORT BY NUR ISKANDAR TAIB:

The talk began at around 5pm, with a small but very interested audience. The Q&A session after the talk was the most animated I have ever witnessed during a technical talk and extended past 6:30pm. Since we were informed that the hall was soon to be closed, the speaker and several members of the audience adjourned to the Old Town White Coffee at Jaya One to continue the discussion over dinner.

A short summary of the talk.

Prof. Aftab began by giving an overview of the IPCC's (Intergovernmental Panel on Climate Change) projections of sea level rise due to global warming (e.g. Church *et al*., 2013, Fig. 13.27). He objects to idea that sea level will rise even if global warming takes place, for the following reasons:

1. The Earth is an oblate spheroid. The distance from the surface of the earth to its center is greater by approximately 21 kilometers at the equator than at the poles. This is far greater than any estimate of sea level rise (the most pessimistic estimates are on the order of 1.2 meters). Since water cannot "flow uphill", and the equator is 21 kilometers "higher" than the poles, then any excess water generated at the poles by melting ice will not flow towards the equator but will remain near the poles.
2. A lot of time was spent on the subject of polar sea ice, whether it is growing or shrinking. Professor Aftab pointed out that only a miniscule amount of sea ice is actually above sea level, while the bulk of it is submerged. Even if sea ice melts, it would cause, at most, a miniscule rise in sea level.
3. Professor Aftab showed several examples where coastlines are rising, or were prograding (e.g. the Ganges Delta). He asserts that if the polar ice caps melt, this would produce isostatic rebound, and this would cause a DECREASE in sea level.

He ended the talk by asserting that sea level rise could NOT take place due to climate change, only phenomena such as tectonics (and others listed in the abstract) could cause sea level rise.

Arguments presented by the audience during the Q&A period and afterwards (and embellished by myself when writing this report):

1. The Earth is an oblate spheroid due to its spin, and it is the centrifugal force[1] caused by that spin that flattens

the sphere. This centrifugal force acts as much on the oceans as it does on the solid Earth, so that sea level at the equator is 21 meters further from the center of the Earth than it is at the poles. Water will "find its own level", this level is influenced by gravity as well as this centrifugal force. Any addition of water to the oceans will cause a sea level rise EVERYWHERE, not just at the poles. Water will easily flow "uphill" from the poles, because it really isn't flowing uphill. If the equator were really "uphill", then the water at the equator would flow "downhill" to the poles until sea level at the poles is as far away from the center of the earth as it is at the equator, and it does not.

2. Professor Aftab is right, the forming and melting of sea ice does not affect sea level, because floating ice displaces its own weight. The amount which presents itself above sea level is immaterial, since water shrinks when it melts, and a melted ice displaces the exact volume that t would when solid. This ignores the slight difference caused by the change in salinity (sea ice is fresh, sea water isn't), but sea ice actually contains pools of brine (trapped by the exclusion of salt during freezing). Besides, if sea ice had anything to do with sea level, sea level would rise in summer and decrease in winter (and it does not).
3. The audience pointed out that if the ice caps melt, the isostatic rebound occurs AT THE POLES, and not where people live (at lower latitudes). Sea level may indeed decrease at the poles due to isostatic rebound (though one should note that these areas where the rebound takes place are actually above sea level at this time due to the ice cover, and even with isostatic rebound, the result would be invasion by the sea if the land ends up below sea level when the ice melts). If isostatic rebound causes a sea level drop at the poles, this will displace seawater and cause a sea level RISE elsewhere.
4. Professor Aftab did not take into consideration that the Antarctic and Greenland ice caps are perched above sea level. In places, the Antarctic ice cap is over 4000 meters in thickness (Fretwell et al., 2013). Any melting of these ice caps (and glaciers at lower latitudes) will result in the addition of water to the oceans. Indeed, if both Antarctic and Greenland ice sheets were to melt entirely, simple volumetric calculations show that this would cause a eustatic sea level rise of 65 meters (Davies, 2017, Vaughn, 2013), far above even the most pessimistic of predictions. The extent and the presence or absence of ice sheets has been the cause of huge changes in sea level throughout geologic history. Professor Aftab mentioned evidence for higher sea levels during the Holocene, but was apparently not aware of the extremely low eustatic sea levels 23,000 years before present, when huge ice sheets covered North America and Europe, and when the Sunda Shelf was completely exposed. Eustatic sea level at this time was 120 meters below the present (Hanebuth, 2000). During the Paleocene, with the absence of ice sheets, eustatic sea level was 200 meters above the present (Haq et al., 1987). While it is true that the geological factors mentioned in the abstract (plate tectonics, progradation of deltas, etc.) can influence eustatic (i.e. global) sea level changes, however, these influences take place over geologic time (10s of millions of years). LOCAL sea level changes, can which take place over shorter time periods, can be caused by such phenomena as delta progradation and volcanism. Short term eustatic sea level changes (such as the fluctuations during the Pleistocene and Holocene) must therefore be caused by changes in the ice budget at the poles. Incidentally, these short term fluctuations are what give rise to what we know as stratigraphic sequences and parasequences.

[1] Most of us who had Physics in secondary school know that there is no such thing as "centrifugal force", that it is simply a manifestation of the acceleration of a body around a circular path caused by a centripetal force, but it is useful to think in terms of centrifugal forces in some instances such as this.

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# CERAMAH TEKNIK TECHNICAL TALK

Mr. Rasid Jaapar (Geomapping Technology)
Date: 18th May 2017
Venue: Geology Department, University of Malaya

Sdr. Abd. Rasid Jaapar (Geomapping Technology) presented two talks on 18th May, 2017 at the Dept. of Geology, Univ. Malaya. Details and abstracts for the two talks are as follows. As usual, there was a lively discussion after the talks.

Tan Boon Kong,
Chairman, W/G on Engineering Geology and Environmental Geoogy

## Paper 1: A new comprehensive rock slope protection solution (with 2 case studies from China)

**Abstract:** This talk will present a comprehensive rock slope protection solution where a new system from China will be introduced. The talk will touch on types of protection or netting system follow with the process on assessment and analysis of rock slope. The netting system can be divided into three categories; for slope stabilisation, as rock fall barrier and as rock fall guiding system. The assessment and analysis will cover site inspection and data gathering, slope stability assessment, rock fall analysis and lastly selection on slope protection or netting system. The selection normally controlled by site condition and rock fall behaviour. Two case studies from China will be presented. The first case study was from Weining Yanshan, Guizhou while the second case study from Lingshan Road, Beijing.

## Paper 2: Embedding geohazards and engineering geological assessment in geological terrain mapping for development proposal

**Abstract:** The needs and the relevance of Geological Terrain Mapping (GTM) has been one of the hot topic among geologists and other technical professionals in construction industry in Malaysia. IAEG Malaysia National Group with the support from Geological Society of Malaysia and Institute of Geology Malaysia has organised a workshop among the practitioners in the field of engineering geology to discuss on way forward of Geological Terrain Mapping on 14th January 2016. This talk will present the findings from the workshop for documentation purpose and as a reference by the industry as well as for the Department of Minerals and Geoscience (JMG). It is also proposed the minimum standard table of content for GTM with the incorporation of geohazards assessment and engineering geological aspects for the use in construction industry. Consideration was also made on typical engineering geological report used worldwide. A case study from Selangor was used and presented as a test of concept to illustrate the standard Geological Terrain Mapping with the embedment of geohazards and engineering geological assessment.

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3. John Coffin
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5. Guang Rong Shi
6. Ian Longley
7. Muhammad Ammar Aziz Mohd Nassir
8. Nor Ridhwah Abdol Malek
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# NGC 2017 NATIONAL GEOSCIENCE CONFERENCE

## 2nd Circular: Call for Papers

**Hotel Istana Kuala Lumpur**
**9 – 10 October 2017**

In conjunction with the Geological Society of Malaysia 50th Anniversary

## Invitation

The Geological Society of Malaysia (GSM) proudly presents the National Geoscience Conference (NGC) 2017. The Society invites the international geoscientists community to join the event and engage in the knowledge sharing session in Kuala Lumpur on 9th – 10th October 2017.

The main theme for this 30th NGC edition is "Geoscience for a Sustainable Future". As the economy is driving into a continuous uncertainty, geoscientists have to adapt to ensure sustainability in the geological field. In conjunction with the 50th anniversary of GSM, the conference will also look from past experiences to prepare for the future of fellow geoscientists and the direction of geoscience in general.

## Themes

### Main Theme

**Geoscience for a Sustainable Future**

Limited natural resources and increasing concerns on the environment has forced geoscientists to venture into multiple fields to cater to the ever changing needs. While several traditional geoscience sectors are currently experiencing a slump, new arising opportunities are waiting to be capitalized and ensuring the sustainability.

### Sub Themes

- Engineering Geology and Rock Mechanics
- Petroleum Geology
- Mineral Resources
- Regional Geology
- Professionalism, Ethics and Education in Geosciences
- Disaster Risk Reduction and Climate Change Adaptation
- Geoheritage, Geoparks and Geotourism

## GSM 50th Anniversary

The society was founded in 1967 with the aim of promoting the advancement of the earth sciences in Malaysia and the Southeast Asian (S.E.A) region. Currently, it has a membership of more than 600 earth scientists worldwide of various disciplines and expertise.


## Sponsorship and Exhibition

### Sponsorship Packages

| | |
|---|---|
| **Platinum – RM30,000**<br>Logo on opening screen and goodies, advertisement (colour) on front/back page of event magazine, 5 admission tickets and 5 tickets for student sponsorship & 1 slot of talk | |
| **Diamond - RM20,000**<br>Logo on opening screen and goodies, advertisement (colour), 4 admission tickets and 2 tickets for student sponsorship & 1 slot of talk | **Gold - RM10,000**<br>Logo on opening screen and goodies, advertisement (black and white), 3 admission tickets and 1 tickets for student sponsorship & 1 slot of talk |
| **Silver - RM5,000**<br>Logo on opening screen, advertisement (black and white), 2 admission tickets & 1 slot of talk | **Bronze – RM2,000**<br>Logo on opening screen, 1/2 page of advertisement (black and white) & 1 admission ticket |

**Exhibition:** The price for 3m × 3m booth is RM 3,000.

## Registration

| Categories | Fees |
|---|---|
| GSM Members | RM 550 |
| Non – GSM Members | RM 750 |
| Student GSM Members | RM 350 |
| Student Non – GSM Members | RM 550 |
| Student Daily Pass | RM 200 |
| Late Registration | RM 1000 |

**Entitlements**
All participants are entitled for tea breaks and lunch meals except for student daily pass

Payment: Please bank the money into our account:
Geological Society of Malaysia
Standard Chartered Bank
794 105402263

Please mail the bank in slip to us for verification.

## Venue & Accommodations

**Venue**

Hotel Istana Kuala Lumpur

Located at the heart of Kuala Lumpur, Hotel Istana offers a strategic place in the middle of the bustling area of Bukit Bintang. The venue offers exquisite bedrooms at affordable price

**Nearby Hotels**

Parkroyal Kuala Lumpur

Hotel Grand Millennium

Hotel Metro 360

## Important Dates

Submission of Extended Abstract: 30th June 2017
Acceptance of Extended Abstract: 1st August 2017
Early registration deadline: 15th September 2017

Registration deadline is on 15th September2017. Registration after that date will be considered as late registration

Kindly submit the full papers once the acceptance notice is issued

## Programme Tentative

| Date | 8th Oct | 9th Oct | 10th Oct | 11th Oct | 12th Oct |
|---|---|---|---|---|---|
| Morning | Golf/Short Courses | Keynote Speech | Technical Sessions 3&4 | Field Trip | Field Trip |
| Afternoon | | Technical Sessions 1&2 | Technical Sessions 5&6 | | |

*Golf, Short Courses and Field Trips are charged separately. Tea breaks and lunch are provided to all participants

## Publications

Full papers from the presentations at the conference will be published in the Bulletin of the Society. All presenters are required to submit the full papers once the acceptance notice is issued.

## Keynote Lectures

**Prof. Dr. John Kuna Raj**

Tentative Title: Historical Perspective of GSM

After 50 years of its establishment, the Geological Society of Malaysia has experienced numerous ups and downs, from the days of bustling tin mining to recent decline in oil and gas industry. The history of GSM in turn provides a valuable experience to prepare for the future of geological field in Malaysia.

**Prof. Emeritus Dato Dr Ibrahim Komoo**

Tentative Title: Challenges and Future Prospects for Geoscientists

Modern challenges including depleting mineral resources and increasing concerns about the climate change has forced geoscientists to venture out of the traditional geological job scope to cater the ever changing environment. Geoscientists must adapt to these challenges and open new opportunities to ensure the relevance of geological field in driving the economy.

## Short Courses

| | |
|---|---|
| Geohazards and Disaster Risk Reduction | Mineral Resources |
| Petroleum Geology | Engineering Geology and Professional Practices |

* All short courses will be charged separately. The short courses will be held at Hotel Istana, Kuala Lumpur

## Field Trip

**Tambun, Ipoh, Perak**

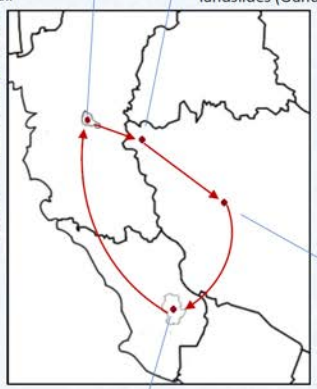
Geoheritage

The karst area of Kinta offers scenic view but geohazards persists in terms of rock fall

**Cameron Highlands, Pahang**

Geohazards

Rapid development with lack of planning often results in disaster such as flash floods and landslides (Gunung Pass area)



**Kuala Lumpur**

Start and Finish Point

The bustling city of Kuala Lumpur where the conference will be held also serve as the starting and finishing point for the field trip.

**Penjom Mine, Pahang**

Mineral Resources

The Penjom mine is among the biggest gold mine in Malaysia, situated along the gold belt east to the Main Range

*The field trip contains two packages; the first one is to visit every locality shown on the map above. The second package is to stay at Cameron Highland on the second day for a short course on geohazards but will not visit the Penjom Mine.

# NGC 2017 NATIONAL GEOSCIENCE CONFERENCE

## Invitation to participate in the student poster competition during NGC2017

Venue : Hotel Istana, Kuala Lumpur
Date : 9 - 10 October 2017

The Geological Society of Malaysia (GSM) proudly presents the National Geoscience Conference (NGC) 2017. The Society invites international geoscience students to join the event and engage in the knowledge sharing session in Kuala Lumpur on the 9th and 10th of October 2017. The main theme for this 30th NGC edition is Geoscience for a Sustainable Future". As the economy is driving into a continuous uncertainty, geoscientists have to adapt to ensure sustainability in the geological field. In conjunction with the 50th anniversary of GSM, the conference will also look from past experiences to prepare for the future of fellow geoscientists and the direction of geoscience in general.

NGC2017 is organizing a student poster competition in conjunction with the conference. The topics of the posters may range according to these sub themes; Engineering Geology and Rock Mechanics, Petroleum Geology, Mineral Resources, Regional Geology, Professionalism, Ethics and Education in Geosciences, Disaster Risk Reduction and Climate Change Adaptation and Geoheritage, Geoparks and Geotourism.

Registration particulars are as such,
Student GSM Members: RM350
Student Non-GSM Members: RM550
Student Daily Pass: RM200
Please bank in the money into GSM's account: Geological Society of Malaysia (Standard Chartered Bank) 794 105402263. Please refer to NGC2017's second circular for more details.

University undergraduate and graduate students are invited to participate in the competition during the upcoming conference. The posters will be evaluated by a panel of expert judges and their decision is final. Please submit the extended abstract of your poster, proof of payment and your details (poster title, name, address, organization, university (year), telephone (o), telephone (h/p) and email) by 30th of July 2017 to **geologicalsociety@gmail.com** to be reviewed by the panel, and notification of acceptance will be sent out by 31st of August 2017. Softcopy in .pdf format of the full poster shall be submitted via email to the person in charge after the acceptance notice is issued.

IN CONJUNCTION WITH THE GEOLOGICAL SOCIETY OF MALAYSIA 50TH ANNIVERSARY

NGC 2017 NATIONAL GEOSCIENCE CONFERENCE

# STUDENT POSTER COMPETITION

## Main Theme: Geoscience for a Sustainable Future

Limited natural resources and increasing concerns on the environment have forced geoscientists to venture into multiple fields to cater to the ever changing needs. While several traditional geoscience sectors are currently experiencing a slump, new arising opportunities are waiting to be capitalized and ensuring the sustainability

## Sub Themes

Engineering Geology and Rock Mechanics
Petroleum Geology
Mineral Resources
Regional Geology
Professionalism, Ethics and Education in Geosciences
Disaster Risk Reduction and Climate Change Adaptation
Geoheritage, Geoparks and Geotourism

## Deadlines

Submission of extended abstract: 30th June 2017
Extended deadline of submission: 30th July 2017
Acceptance of extended abstract: 31st August 2017

## Format

Poster must be in size A1
Posters must include University logo and GSM logo
Font used must be Calibri
Participants must be below 30 years old

## Registration Inquiries

marelyntd@gmail.com
shaidatulmunirah44@gmail.com

## Extended abstract submission

geologicalsociety@gmail.com

## PRIZES

1ST RM500 + CERTIFICATE
2ND RM350 + CERTIFICATE
3RD RM150 + CERTIFICATE
SPONSORED BY GEOMAPPING TECHNOLOGY SDN BHD

IN CONJUNCTION WITH THE GEOLOGICAL SOCIETY OF MALAYSIA 50TH ANNIVERSARY

# Program Perkongsian Pintar Geologi UKM bersama UPN Veteran Yogyakarta dan Program Amal di Yogyakarta

Pada 16 hingga 22 Januari 2017, Kelab Geologi UKM telah mengadakan satu program dua hala bersama pihak UPN Veteran di Yogjakarta iaitu Program Perkongsian Pintar dimana program ini melibatkan perkongsian ilmu geologi serta budaya di antara kedua-dua universiti. Bertepatan dengan Program Citra Universiti Kebangsaan Malaysia (UKM) yang kini telah diiktiraf di peringkat global, maka Kelab Geologi bercadang mengadakan lawatan antarabangsa demi memperkasakan lagi status UKM tersebut. Bagi meneruskan matlamat mengantarabangsakan UKM, Kelab Geologi sesi 2015/2016 berhasrat untuk mengadakan Program Lawatan Ilmiah ke Indonesia dan Institusi Pengajian Tinggi sekitar Indonesia pula. Bertepatan dengan tema "Merintis Ilmu Seiring Tautan Kasih di Bumi Yogjakarta" program ini bertujuan mendedahkan kepada mahasiswa/i UKM mengenai sistem pendidikan dan gerak dakwah yang dilakukan di Indonesia. Selain itu program ini akan membolehkan mahasiswa/i dari kedua-dua pusat pengajian mempelajari dan mengetahui perbezaan budaya di antara dua negara di samping dapat bertukar-tukar pendapat antara mahasiswa/i di institut pengajian tinggi.

Program ini disertai oleh seramai 25 orang pelajar Tahun 3 Geologi UKM diiringi oleh seorang pensyarah iaitu Dr. Mohd Rozi Bin Umor. Antara matlamat yang dicapai melalui program ini ialah membentuk hubungan dua hala antara Geologi UKM dan UPN Veteran, Yogjakarta di peringkat Institut Pengajian Tinggi. Disamping itu, mengadakan perbincangan idea antara mahasiswa bagi kedua-dua buah universiti sekaligus melahirkan ahli geologi yang mempunyai pemahaman tinggi dan berintelektual selaras dengan pembangunan teknologi. Objektif bagi program ini adalah menjejaki warisan geologi serta menghayati nilai sejarah geologi di Indonesia dan mendapatkan pendedahan awal tentang geobencana di Indonesia. Selain mempersadakan Geologi Malaysia di peringkat antarabangsa, program ini juga bertujuan untuk menjana mahasiswa/i Geologi yang berkempimpinan, berilmu, berketerampilan, berakhlak, berwawasan, bermatlamat tinggi serta berbudaya saing yang sihat dalam semua bidang.

Program ini diadakan selama 6 hari bermula dengan 16 Januari 2017 iaitu bertolak dari KLIA2 ke Lapangan Terbang Antarabangsa Adisujipto. Antara tentatif yang telah dijadualkan adalah program perkongsian pintar antara mahasiswa di UPN Veteran Yogjakarta. Program ini diwakili oleh dua panel dari UKM dan juga dua panel dari UPN Veteran. Panel dari UKM diwakili oleh Dr. Mohd Rozi bin Umor dengan tajuknya "Taburan Batuan Igneus di Semenanjung Malaysia dan juga Sumber Petroleum di Malaysia" dan juga Nusaibah Syahidah Bt Abu bakar dengan kajiannya yang bertajuk "Kajian Mikrofosil Radiolaria Batuan Bersilika di Jenderam Hilir, Selangor". Manakala panel dari UPN Veteran pula membentangkan tajuk mereka iaitu "Gunung Merapi, Yogjakarta" dan juga "Pengaruh Struktur Geologi terhadap Keterdapatan Air Tanah Daerah Non Cat dan Upaya Konservasi Air Tanah dalam Rangka Mendukung Pembangunan yang berkelanjutan, Gunung Kidul, Yogjakarta".

Seterusnya, lawatan ke Muzium Geologi Universitas Pembangunan Nasional Veteran (UPN). Lawatan ini mendedahkan para pelajar kepada pemprosesan petroleum dan permineralan bijih di Indonesia selain daripada jenis-jenis fosil yang terdapat di Muzium tersebut. Para pelajar juga di bawa melawat ke Alun-Alun Kidul iaitu salah satu daripada tempat tarikan pelancong yang merupakan tempat bersejarah yang mempunyai istana lama iaitu Istana Taman Sari. Tidak dilupakan tempat yang menjadi tarikan utama para pelajar geologi iaitu Gunung Merapi dan juga kawasan yang musnah kesan daripada erupsi Gunung Merapi yang terbaru iaitu pada tahun 2010. Program bersama Panti Asuhan Al Wahhab juga menjadi tarikan para pelajar kerana disamping menimba ilmu dan juga pengalaman,

tidak dilupakan juga pada golongan yang kurang bernasib baik seperti anak-anak di panti asuhan. Para pelajar tidak terlepas daripada melawat tempat yang menjadi tarikan utama dan merupakan simbolik warisan budaya bagi Indonesia iaitu Candi Borobudur. Selain itu, tempat perlancongan lain yang sempat unutk dilawati juga adalah Goa Pindul, Hutan Pinus dan juga Kebun Buah Mangunan. Permandangan yang cantik serta suasana yang nyaman membuatkan kawasan-kawasan ini amat diminati oleh para pelancong yang melancong ke Yogjakarta.

Kesimpulannya Program perkongsian ini telah memberi banyak pengetahuan baru serta pengalaman berharga yang akan digunakan para pelajar pada masa hadapan kelak. Berdasarkan geologi di Indonesia, para pelajar seharusnya bersyukur kerana dilahirkan dan tinggal di Malaysia kerana tidak terdedah kepada bahaya bencana alam seperti gunung berapi. Selain itu, program ini juga memupuk nilai kasih sayang tanpa mengira rumpun dan bangsa. Hubungan baik yang terjalin antara mahasiswa UKM dan UPN perlu dieratkan dengan program-program akan datang yang melibatkan kedua-dua Universiti.

Nusaibah Syahidah Bt Abu Bakar,
Geologi UKM.

Perkongsian Pintar di antara Mahasiswa UKM dan UPN Veteran Yogykarta, Indonesia.

Melawat Gunung Merapi.

Alun-alun Kidul.


Program bersama anak-anak yatim.

# GEOSCIENCE INDUSTRIAL WEEK AT UNIVERSITY OF MALAYA

## 18 - 20 April 2017, Department of Geology, University of Malaya

Geoscience Industrial Week 2017 (GIW2017) is a project organized by the first year and second year undergraduate students of the Department of Geology in collaboration with Kelab Geologi Universiti Malaya (KAGUM), American Association of Petroleum Geologists (AAPG) and the Department of Geology. The 3 days event was successfully conducted from the 18th to the 20th of April 2017, on Tuesday until Thursday. Along with a good respond and success from last year's Geoscience Industrial Week 2016 (GIWEEK16) and previous Mining, Oil and Gas Week 2015 (MOG '15), GIW2017 have the same objectives which mainly to introduce the wide range of geoscience fields toward secondary school, matriculation students and also undergraduate students and generate their interest in geoscience by providing them the necessary information regarding the course and to expose the bright career prospects as a geologist in various geoscience disciplines. For this event, sponsorship unit managed to get the sponsor from Geoscience Society of Malaysia (GSM), Manhattan Fish Market and Gempak starz. Kelab Geologi Universiti Malaya (KAGUM) also contributed for the fund of the event. Participants came all the way from Padjajaran University, Universitas Gadjah Madah, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, Universiti Teknologi Petronas, Universiti Teknologi Malaysia, Universiti Malaysia Kelantan, Sekolah Seri Puteri, SBPI Rawang, MRSM Alor Gajah, SBP Tunku Jaafar, Sekolah Dato' Abdul Razak and also from University of Malaya.

Geoscience Industrial Week 2017 (GIW2017) was officiated by Assoc. Prof. Dr. Rosli Ramli, Deputy Dean of Science Faculty, on the morning of the first day of the three days project. There are also competitions being held joined by secondary school students and university students from Malaysia and Indonesia which are GeoQuiz Competition, King of MRF Competition, Photography Competition, Volcano Competition and Mini Oil Rig Competition. An introductory talk to school students by Dr Jasmi Hafiz and Mr Halim Assadiqi was conducted after the opening ceremony and also an alumni session in the evening with Dato Anwar Adnan, Mr Halim Muhamad, Ms Shereen Farisha and Ms Ungku Natasya. On the second day, there is a technical talk with Mr Simret Singh from Petronas, entitled The Petronas Journey followed by a talk about Gemology by Encik Mat Ruzlin Maulud. On the last day, Mr Abdul Rasid Jaapar gave a talk about The Profile of Professional Geologist & Geologist in Civil Works and Construction Industry. Closing ceremony was held at Gazebo in Kompleks Perdana Siswa, University of Malaya. The closing ceremony was excellent from a smooth movement of participants from the department until the high tea session. It was officiated by Dr Meor Hakif Amir Hassan. The high tea session gave a good chance for the committee members and participants to interact and built relationships with geoscience students.

Overall, the event was a success and there are still lots of room for improvements. There should be a continuation of the event in the coming years and that the event should be maintained at the Department of Geology. GIW2017 managed to build a rapport between industry players and students as well as introducing the various geosciences field to secondary school students. Apart from that, the committee members were given opportunities to develop theirs soft skills through the tasks given and through communicating with the visitors and crowd during the event. The event also managed to create a closer bond between the students of different batches, as well as among the same batch itself as for the first year students batch.

Intan Irwani Binti Mohamad Zin
Director, Geoscience Industrial Week 2017

# UPCOMING EVENTS

September 13-14, 2017: AAPG Technical Symposium 2017: Hidden Potential in Mature Basins; Play Analogs and Best Practices, Bandung, Indonesia. Email to apereira@aapg.org for more information.

September 13-17, 2017: Conference on Accessory Minerals (CAM – 2017), Vienna. Visit website http: //www.univie.ac.at/Mineralogie/CAM-2017 or contact Lutz Nasdala (lutz.nasdala@univie.ac.at) for enquiries.

September 14-15, 2017: GSL (Geological Society of London) The evolution of flooding and flood risk: past, present and future, Burlington House, London. More information at: www.geolsoc.oorg.uk/flooding17

September 19-22, 2017: World LNG & Gas Series:Asia Pacific Summit, Singapore. Details at: http://asiapacific.cwclng.com/

September 25-27, 2017: Fermor Meeting 2017: Factory Earth, Burlington House, London. More information at: www.geolsoc.org.uk/fermor17

October 3-5, 2017: William Smith Meeting 2017: Plate Tectonics at 50, Burlington House, London. More information at: www.geolsoc.org.uk/wsmith17

October 4-5, 2017: 1st International Congress on Jurassic of Iran and Neighboring Countries, Mashhad, Iran. Visit http://icji2017.conference.gsi.ir for details.

October 9-10, 2017: National Geoscience Conference, Hotel Istana, Kuala Lumpur. Contact: Phone: +(603) -7957 -7036, Fax: +(603)-7956 -3900, Email: geologicalsociety@gmail.com

October 15-18, 2017: AAPG/SEG International Conference & Exhibition 2017, London. Contact: Jeremy Richardson, +44 207 836 3201.

October 26-27, 2017: GSL (Geological Society of London) Conference: Ground Related Risks to Transportation Infrastructure, London. More information at: www.geolsoc.oorg.uk/infrastructure17

October 31-November 2, 2017: GSL (Geological Society of London): Fold and Thrust Belts: Structural style, evolution and exploration. London. More information at: http://www.geolsoc.org.uk/PG-Fold-and-Thrust-Belts-Structural-style-evolution-and-exploration

November 2-3, 2017: Inaugural Conference on Applied Earth Sciences in Myanmar and Neighboring Regions, Yangon, Myanmar. Information at: http://www.maesa.org/info.html

November 6-7, 2017: Janet Watson Meeting 2017, The Future of Contaminated Land Risk Assessment; stakeholder perspectives. Burlington House, London. For more information visit: www.geolsoc.org.uk/jwatson17

November 7-21, 2017: 16th Gondwana Conference, Bangkok, Thailand. Details are at: http://www.dmr.go.th/main.php?filename=gondwana16thailand

November 12-17, 2017: The joint Bangkok Gondwana 16 and IAGR annual convention and IGCP 628 (The Gondwana Map) meeting. Details at: http://www.dmr.go.th/main.php?filename=gondwana16thailand

November 15-18, 2017: 1st International Congress on Earth Sciences, Bandar Seri Begawan, Brunei Darussalam. For details, visit: fos.ubd.edu.bn/foscon

November 20-21, 2017: Asia Petroleum & Geoscience Conference & Exhibition (APGCE 2017), Kuala Lumpur, Malaysia. Email: apgce@icep.com.my for details.

November 28 – December 1, 2017: The CWC 18th World LNG Summit & Awards Evening, Lisbon, Portugal. More information at: http://world.cwclng.com

December 6-7, 2017: Geosciences Technology Workshop AAPG, Oil and Gas Resources of India: Exploration and Production Opportunities and Challenges, Mumbai, India. Contact: Adrienne Pereira, Programs Manager, AAPG Asia Pacific Region, +65 96536728.

January 4-9, 2018: 5th Biennial Structural Geology and Tectonics Forum, Arizona State University, Tempe. Visit the initial 2018 SGTF website: https://sites.google.com/view/sgtf2018

March 15-16, 2018: Alpine Folded Belts and Extensional Basins Geosciences Technology Workshop, Granada, Spain. Website: https://europeevents.aapg.org/ehome/255320/homegranada/

March 20-23, 2018: Offshore Technology Conference Asia (by AAPG), Kuala Lumpur, Malaysia. Website: http://2018.otcasia.org

May 20-23, 2018: AAPG Annual Convention and Exhibition 2018, Salt Lake City, Utah, USA. Website: http://ace.aapg.org/2018/

July 10-13, 2018: Granulites & Granulites 2018 Conference, by the Mineralogical Society of Great Britain and Ireland, Ullapool, NW Scotland. Contact: Tim Johnson, tim.johnson@curtin.edu.au

# GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

**Bulletin 1** (1968). Studies in Malaysian Geology. 79 p. Edited by P.H. Stauffer. (out of stock)

**Bulletin 2** (1968). Bibliography and Index of the Geology of West Malaysia and Singapore. 152 p. D.J. Gobbett. Price: RM5.00.

**Bulletin 3** (1970). Papers in Geomorphology and Stratigraphy (with Bibliography supplement). 146 p. Edited by P.H. Stauffer. Price: RM5.00.

**Bulletin 4** (1971). Papers in Petrology, Structure and Economic Geology. 100 p. Edited by P.H. Stauffer. Price: RM5.00.

**Bulletin 5** (1973). The Search for Tungsten Deposits. 70 p. K.F.G. Hosking. (out of stock)

**Bulletin 6** (1973). Proceedings, Regional Conference on the Geology of Southeast Asia. A Collection of papers, Kuala Lumpur, March, 1972. 334 p. Edited by B.K. Tan. Price: RM5.00.

**Bulletin 7** (1974). A collection of papers on geology. 138 p. Edited by B.K. Tan. Price RM5.00.

**Bulletin 8** (1977). A collection of papers on geology. 158 p. Edited by T.T. Khoo. (out of stock)

**Bulletin 9** (1977). The relationship between granitoids and associated ore deposits of the Circum Pacific region. 277 p. Edited by J.A. Roddick & T.T. Khoo. (out of stock)

**Bulletin 10** (1978). A collection of papers on geology. 95 p. Edited by C.H. Yeap. (out of stock)

**Bulletin 11** (1979). Geology of tin deposits. A collection of papers presented at the International Symposium on Geology of Tin Deposits. 393 p. Edited by C.H. Yeap. (out of stock)

**Bulletin 12** (1980). A collection of papers on geology. 86 p. Edited by G.H. Teh. (out of stock)

**Bulletin 13** (1980). A collection of papers on geology of Malaysia and Thailand. 111 p. Edited by G.H. Teh. Price RM5.00.

**Bulletin 14** (1981). A collection of papers on geology of Southeast Asia. 151 p. Edited by G.H. Teh. (out of stock)

**Bulletin 15** (1982). A collection of papers on geology. 151 p. Edited by G.H. Teh. (out of stock)

**Bulletin 16** (1983). A collection of papers on geology. 239 p. Edited by G.H. Teh. (out of stock)

**Bulletin 17** (1984). A collection of papers on geology. 371 p. Edited by G.H. Teh. (out of stock)

**Bulletin 18** (1985) Special issue on Petroleum Geology. 209 p. Edited by G.H. Teh. & S. Paramanathan. (out of stock)

**Bulletins 19** (1986). GEOSEA V Proceedings Fifth Regional Congress on Geology, Mineral and Energy Resources of SE Asia. Vol. I. 652 p. Edited by G.H. Teh & S. Paramanathan. Members: RM30.00: Non-members: RM60.00

**Bulletins 20** (1986). GEOSEA V Proceedings Fifth Regional Congress on Geology, Mineral and Energy Resources of SE Asia. Vol. II. 881 p. Edited by G.H. Teh & S. Paramanathan. Members: RM30.00: Non-members: RM60.00

**Bulletin 21** (1987). Special issue on Petroleum Geology. 271 p. Edited by G.H. Teh. Price: RM20.00.

**Bulletin 22 (**1988). Special issue on Petroleum Geology. 272 p. Edited by G.H. Teh. Price: RM20.00.

**Bulletin 23** (1989). A collection of papers on the geology of Malaysia, Thailand and Burma. 215 p. Edited by G.H. Teh. Price: RM10.00.

**Bulletin 24** (1989). A collection of papers presented at Annual Geological Conference 1987 & 1988. 199 p. Edited by G.H. Teh. Price: RM10.00.

**Bulletin 25** (1989). Special issue on Petroleum Geology. 161 p. Edited by G.H. Teh. Price: RM20.00.

**Bulletin 26** (1990). A collection of papers presented at Annual Geological Conference 1989 and others. 223 p. Edited by G.H. Teh. Price: RM10.00.

**Bulletin 27** (1990). Special issue on Petroleum Geology 292 p. Edited by G.H. Teh. Price: RM20.00.

**Bulletin 28** (1991). Special issue on Petroleum Geology 292 p. Edited by G.H. Teh. Price: RM20.00.

**Bulletin 29** (1991). A collection of papers presented at Annual Geological Conference 1990 and others. 255 p. Edited by G.H. Teh. Price: RM10.00

**Bulletin 30** (1992). Annotated bibliography of the geology of the South China Sea and adjacent parts of Borneo. 90 p. N.S. Haile. Price: RM10.00.

**Bulletin 31** (1992). A collection of papers presented at Annual Geological Conference 1991 and others. 176 p. Edited by G.H. Teh. Price: RM10.00.

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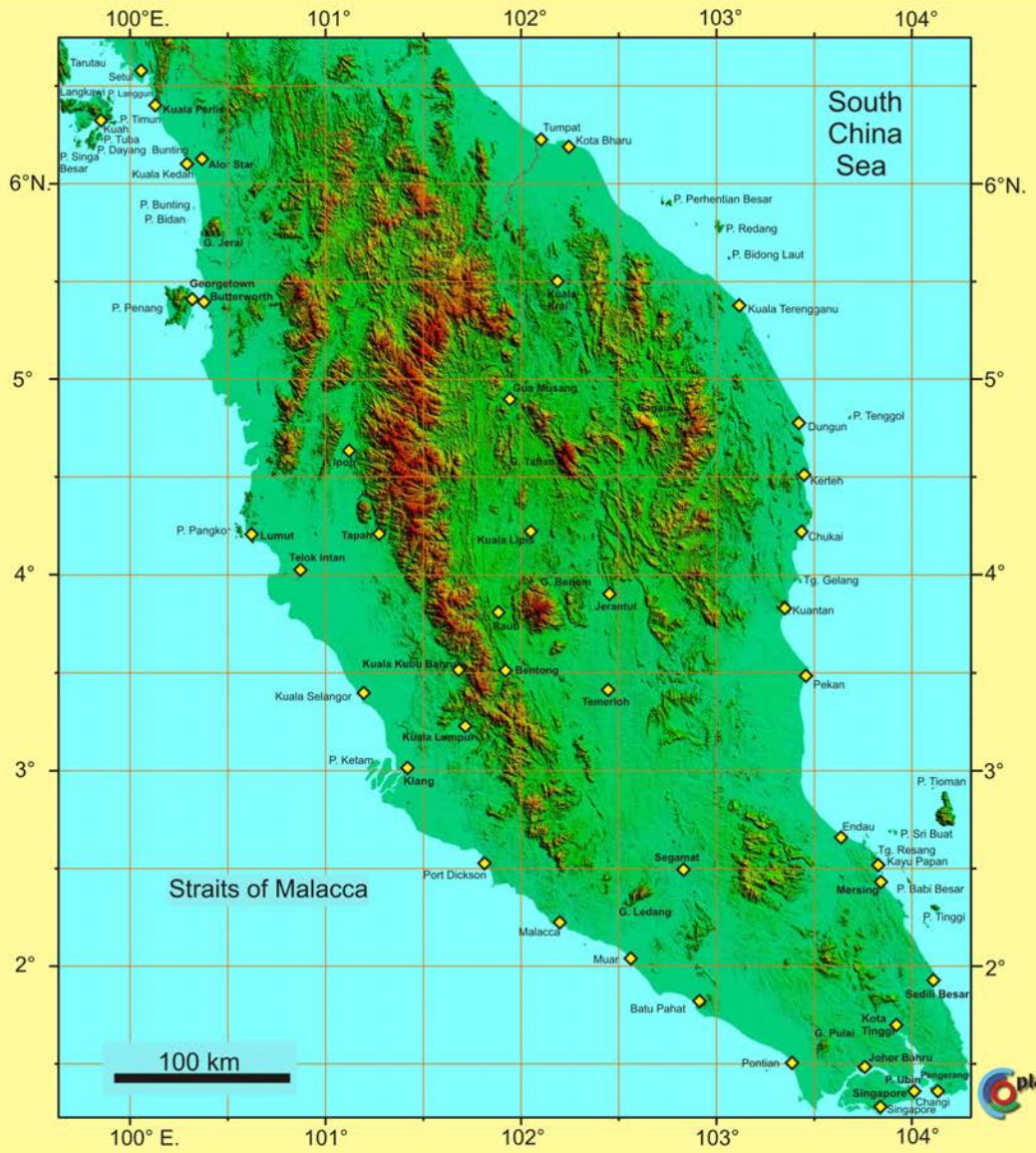


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