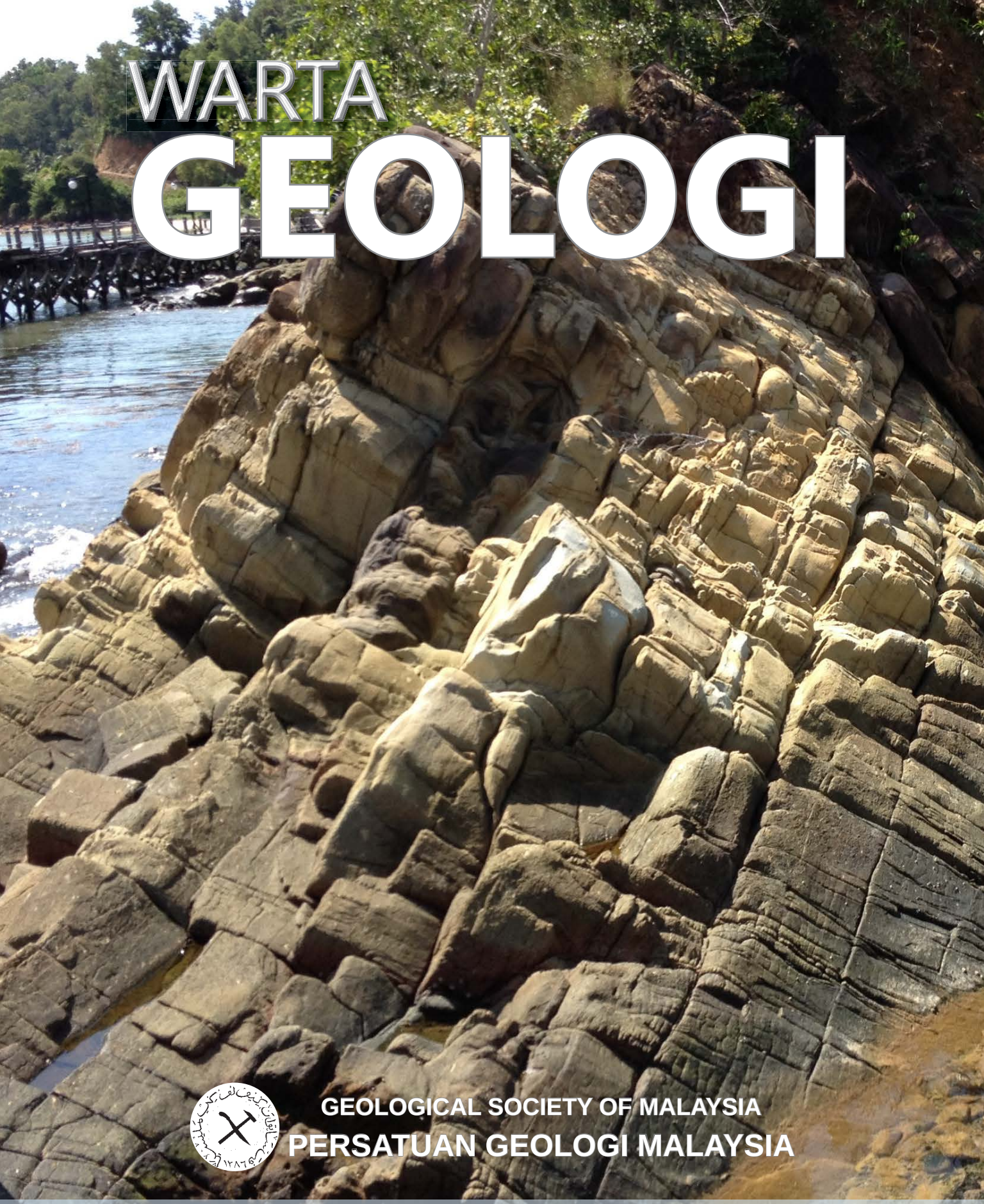

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Cover photo: Fractured turbidite sandstones, West Crocker Formation, Pulau Gaya, Sabah. Photo by Mazlan Madon.

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Estimation of Dar-Zarrouk parameters and delineation of groundwater potential zones in Karlahi, part of Adamawa Massif, Northeastern Nigeria

Yusuf, S.N.[1,*], Ishaku, J.M.[2], Wakili, W.M.[2]

[1] Department of Geology, University of Jos, Nigeria
[2] Department of Geology, Modibbo Adama University of Technology, Yola, Nigeria
* Corresponding author email address: solomonjanjaro@gmail.com

Abstract: Karlahi is largely underlain by granites and migmatites gneiss of the Adamawa Massif. The area lies west of Benue Trough and east of Cameroon volcanic line. The aim of this paper is to determine hydraulic properties of water bearing layer using parameters derived from Dar-Zarrouk equation and characterized them into groundwater potential zones. The resistivity values of the weathered and slightly weathered layers which make up the water bearing layers were added and an average was taken and used as the resistivity of the water bearing formation in computation of Dar-Zarrouk parameters in Karlahi area. The values of resistivity of water bearing formation ranged from 18 to 4963 Ωm with an average resistivity value of 549 Ωm and the thickness of the water bearing formation ranges from 21 to 32 m with an average thickness of 24.5 m. Conductivity values range from 0.000201 to 0.05509 (σ) while the longitudinal conductance range from 0.00483 to 1.2363 Ω^{-1}, the transverse resistance ranges from 407 to 123504.3 Ωm^2. The hydraulic conductivity and transmissivity values range from 0.14 to 25.87 m/day and 3.28 to 580.4 m^2/day respectively. The longitudinal conductance values in Karlahi area revealed poor to good with an average longitudinal conductance value that is moderate. High transverse resistance values are located in the central and southern part of Karlahi area while low values are located in the eastern part. The spatial distribution map of transmissivity in the area revealed moderate to high transmissivity values in the north central part and a negligible to low transmissivity in southern part, extreme northeastern part. The groundwater potential map of Karlahi area shows negligible to weak potential groundwater zones in SW and SE, moderate potential in the central to northern part of Karlahi area.

Keywords: Dar-Zarrouk parameter, groundwater, hydraulic conductivity, transmissivity, transverse resistance, Adamawa

INTRODUCTION

The research was carried out within the Adamawa Massif which consists largely of granites and gneisses (NGSA, 2006). Karlahi is geographically located in between the Cretaceous Benue Trough to the west and the Cameroon volcanic chain to the east. To the north, it is bordered by Hawal Massif and to the south, by Oban Massif (Ferre *et al*., 1996). The three group of massifs run through the Republic of Cameroon and forms part of the north eastern Basement Complex of Nigeria which are classified as three major Basement Complexes in Nigeria (Baba, 2009). Rural and urban areas in Nigeria rely largely on groundwater supply from boreholes because the surface water systems are either not developed or are not even available in most cases, and for this reason communities and individual homes drill their own boreholes for water supply, this results into indiscriminate borehole drilling all over the country despite the fact that towns and rural communities are in need of portable water supply. Application of resistivity method for estimating water bearing formation is based on the relationship between hydraulic transmissivity and transverse resistance (Kelly & Reiter, 1984). (Maillet, 1947) was the first to develop the idea of using thickness and resistivities of rocks to calculate the aquifer parameters using transverse resistance (R) and longitudinal conductance (S). One very useful parameter in studying the aquifer characteristic is hydraulic conductivity (Gemail *et al*., 2011). Dar-Zarrouk parameters play a very important role in determining how groundwater flow within a porous geologic medium (Chang *et al*., 2011). Despite recent discoveries in alternate approach to estimating aquifer parameters and characteristics, the resistivity method remains one of the geophysical techniques widely used in Africa (Okiongbo & Akpofure, 2012), this is because the use of surface geophysics to estimate aquifer potential are effective and

reliable (Soupius *et al*., 2007). According to Soupious *et al*. (2007) longitudinal conductance, transmissivity, hydraulic conductivity, transverse resistance and thickness of the aquifer are vital in determining groundwater flow in a given aquifer and how the medium will respond after withdrawal (Yadav, 1995). (Jones & Buford, 1951) revealed the relationship between electrical and aquifer properties of water bearing formation in basement complex terrain and discovered that as the rate of weathering increases flow rate of fluid increases in water bearing formation. (Chandra *et al*., 2008) studied hydraulic conductivity acquired from electrical resistivity with pumping test result, found that the result correlate and are reliable. Hydraulic conductivity is the most difficult to estimate due to high values or inappropriate laboratory analysis (Soupius *et al*., 2007). One reliable way of calculating hydraulic conductivity is by using pumping test results acquired at borehole locations but because of limited borehole data in the area, field resistivity data were used to achieve the objectives of this study. This paper is aimed at estimating parameters of Dar-Zarrouk equation in Karlahi area.

Karlahi area lies between latitudes 8˚48′ N to 8˚58′ N and longitudes 12˚30′ E to 12˚38′ E (Figure 1) in Fufore LGA, Adamawa State. The area has a total land mass of about 214 km^2. The area is characterized by rural setting and inhabited by the Chamba, Verre and Fulani speaking tribes. The area is drained largely by River Benue and Lake Pariya, Gobako, Gerwedi, Kapo with small rivers like Mayo-Ine.

BRIEF GEOLOGY OF KARLAHI

Geological mapping which was done on a scale of 1:50,000 revealed Karlahi area being underlain by granites

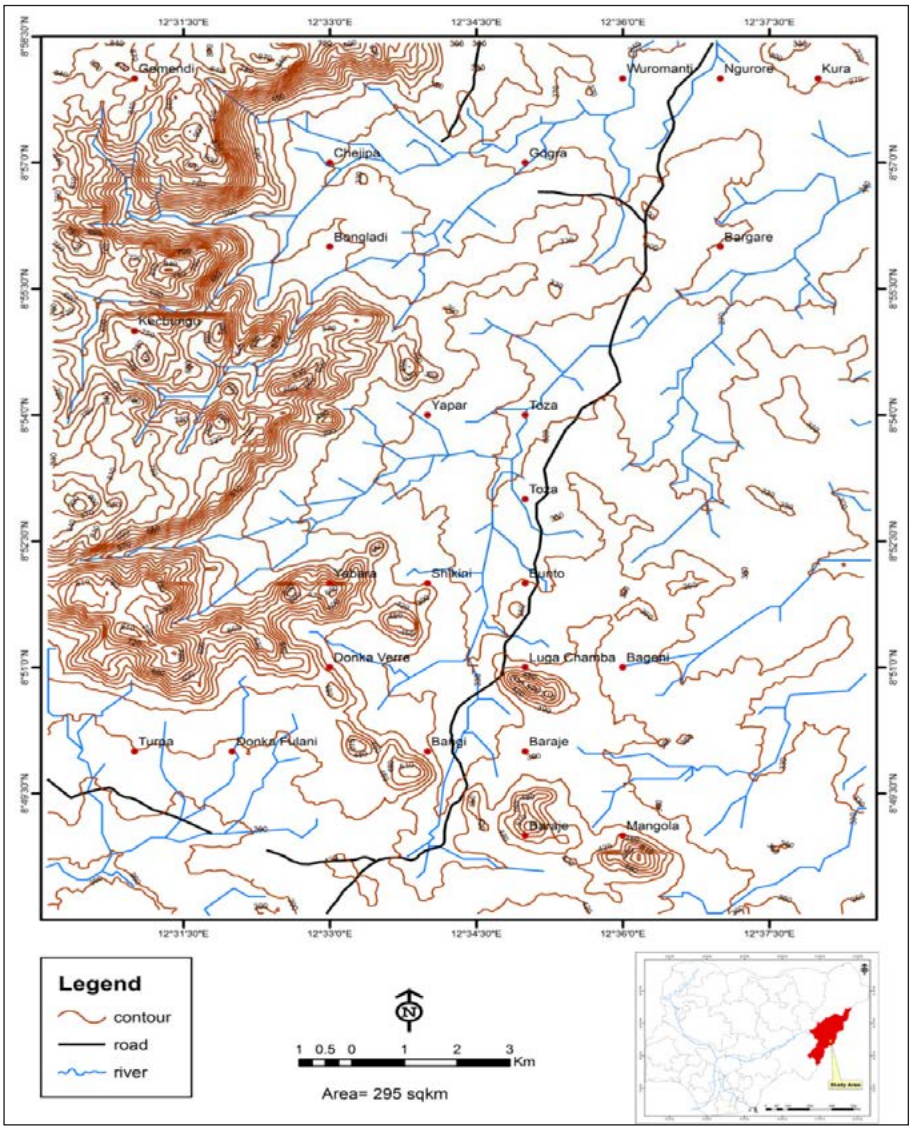

Figure 1: Topographic map of Karlahi and environs (GIS Analysis, 2020).

and metamorphic rocks. The granites are classified into coarse to medium grained size which are dominantly found in the western part of Karlahi (Figure 2). The Older Granites suite constitutes over 60% of outcrops in Karlahi (Rahaman, 1988). They form prominent features such as boulders, steep-sided craggy tors, sub-elliptical plutons to masses of batholithic dimensions as outcropped around Korkai, Lugga Chamba, Karlahi Chamba, Mamlaipa, Donrupa, Bongladi and Begni areas. Banded gneisses, quartz dyke and amphibolite form low-lying and in some places, flat outcrops especially around Baraje, Belwa Gite, Donkan Vera, Sabon Gari Koma and Kila Sarka. Banded gneiss occurs massively, low-lying and as short ridges constituting about 40% of the rock units in the area. Few boulders of about one to three meters in radius were also observed scattered around the base of medium-grained granite north of Jakada, Balwa Gite, Kila-Sakra and Rajiya localities respectively.

MATERIAL AND METHODS

The instrument used for this work was SYSCAL JUNIOR Resistivity equipment, it is a signal averaging system which calculates the voltage by the current and multiplies it with the constant of the field configuration. The equipment is a complete transmitter/receiver system in a single box and it calculate the constant of every AB/2 spread which makes it very quick and easy resistivity meter to use. The machine automatically calculates the Ω (Rho) results and average are presented automatically on the display. The vertical electrical sounding surveys were done using field configuration of AB/2 = 1m and MN = 0.2m, spread was increased as the survey progresses. Potential distance MN were increased at particular cycles to give reliable reading from the resistivity meter. However, the condition of AB/2 ≥ 5MN has to be fulfilled. Readings of resistance is taken directly from the equipment, which is then multiplied by a K factor automatically by the

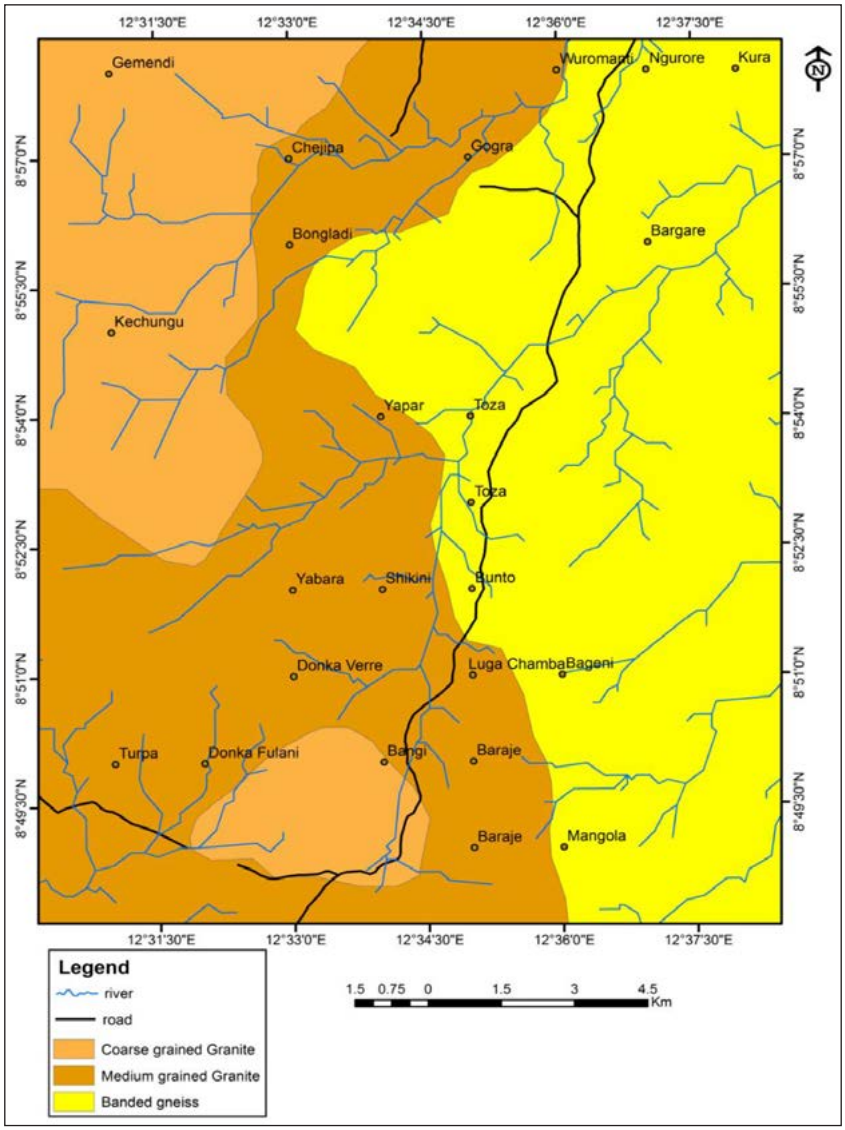

Figure 2: Geology of Karlahi and environs (Modified from NGSA Map, 1996).

machine to calculate the apparent resistivity. This was then plotted on a bi-logarithmic graph sheet, the distance AB/2 on the X axis against the resistivity values on the Y axis, resistivity models were then created and the data interpreted using (IX1D Interpex 2006) computer programme. The hydraulic parameters of each aquifer in Karlahi were calculated from the 30 Vertical electrical soundings data.

Dar-Zarrouk parameters

Theoretically, layered medium possesses good fundamental qualities that are important in interpretation of geoelectric layers (Braga *et al*., 2006), these important parameters are in combination of ρ and h for each geo-electric layer (Batte *et al*., 2010; Singh *et al*., 2004). The unit of longitudinal conductance (S) and transverse resistance (R) are given below as:

$$R = \Sigma^{n}_{i=1}\ hipi \qquad i = 1,2,3,.....n \qquad 1$$

and

$$S = \Sigma^{n}_{i=1}\ hi / pi \qquad i = 1,2,3,.....n \qquad 2$$

Thereby ρi (electrical resistivities) and hi (thickness of i^{th} of a geologic layer).

The average longitudinal resistivity of a porous geologic layer given as,

$$\rho_L = H/S \qquad 3$$

the average transverse resistivity is presented as

$$\rho_t = R/H \qquad 4$$

The longitudinal conductance Si can also be represented as

$$Si = \delta ihi \qquad 5$$

δi is conductivity of the layer which is analogous to the transmissivity, Tr which is used in groundwater studies (Mbonu *et al*., 1991).

It is given by:

$$Tri = Ki\ hi \qquad 6$$

Where Ki is hydraulic conductivity of the i^{th} layer of thickness hi of the aquifer.

The analytic relationship between aquifer transmissivity, transverse resistance and longitudinal conductance demonstrated that in regions where the geologic condition and water quality don't differ significantly, the conductivity product of Kσ, remains consistent (Niwas & Lima, 2003). If the hydraulic conductivity K, of an existing groundwater wells and the electrical conductivity from surface resistivity results are accessible, at that point the transmissivity will be calculated by ascertaining the transverse resistance or longitudinal conductance for the water bearing layer (Niwas & Singhal, 1981).

The theoretical relationship between aquifer transmissivity (Tr) and transverse resistance (R) of water bearing formation and that of (S) were determined analytically by (Niwas & Singhal, 1981) and are given as:

$$Tr = K\delta R = KS/\sigma = Kh \qquad 7$$

Detailed formulations were found in (Niwas & Singhal, 1981, 1985; Chandra *et al*., 2008 and Kosinski & Kelly, 1981).

RESULTS

Aquifer characteristics using Dar-Zarrouk parameter

The calculated vertical electrical sounding (VES) results (thickness and resistivity of water bearing layer), aquifer parameters (transmissivity and hydraulic conductivity) were determined for all the 30 VES and are presented in Table 1, the resistivity estimations of the weathered and the slightly weathered layer which make up the water bearing formation of Karlahi area were added and their average taken and were used as the resistivity of the conductive layer in the computation of Dar-Zarrouk parameters. These parameters show the spatial distribution of longitudinal conductance, transverse resistance, hydraulic conductivity and transmissivity of the area. The values of longitudinal conductance estimated by Dar-Zarrouk equation shows values in Karlahi area with minimum and maximum longitudinal conductance values for Karlahi area as 0.00483 and 1.236 Ω^{-1} respectively with average value 0.306 Ω^{-1}. A spatial distribution map of longitudinal conductance presented in Figure 3 shows yellow and orange which indicate the zones with high longitudinal conductance values whereas the zones of low longitudinal conductance values are represented by shades of blue.

The values of transverse resistance from Dar-Zarrouk equation shows the distribution of transverse resistance data in Karlahi area. Minimum and maximum transverse resistance values of 407.29 and 123504.26 Ωm^2 with an average value of 12,912.66 Ωm^2. A spatial map of transverse resistance was generated and presented in Figure 4 showing very high values indicated in blue colours, green indicates low to moderate zones on the map. The transverse resistance is also used to determined potential zones of groundwater (Cassiani & Medina, 1997).

The values of hydraulic conductivity estimated by Dar-Zarrouk parameter shows the distribution of the hydraulic conductivity values in Karlahi area with minimum and maximum hydraulic conductivity values as 0.1379 and 25.87 m/day with an average value of 6.4208 m/day. A spatial map of hydraulic conductivity presented in Figure 5 shows blue colours indicating zones with high hydraulic conductivity values and zones of low hydraulic

Table 1: VES locations and their geo-electrical parameters computed using Dar-Zarrouk parameters.

VES No	Location	Layer Resistivity (Ωm)	Layer Thickness (m)	Aquifer Conductivity (ohm)	Longitudinal Condutance (Ω)	Transverse Resistance ($Ωm^2$)	Hydraulic Conductivity (m/day)	Transmis-sivity (m^2/day)
1	Belwa Gite 1	56.54	23.05	0.0177	0.4077	1303.13	8.96	206.58
2	Belwa Gite 2	240.85	22.34	0.0042	0.0927	5379.27	2.32	51.79
3	Belwa Gite 3	73.85	22.85	0.0135	0.3094	1686.99	6.99	159.59
4	Dunkan Vera 1	207.07	29.55	0.0048	0.1427	6117.88	2.67	78.88
5	Dunkan Vera 2	122.23	26.65	0.0082	0.2180	3256.69	4.37	116.33
6	Dunkan Vera 3	138.87	22.97	0.0072	0.1654	3189.73	3.88	89.03
7	Kila Sakra 1	4963	24.89	0.0002	0.0050	123504.26	0.14	3.43
8	Kila Sakra 2	326.80	27.18	0.0031	0.0832	8880.65	1.74	47.40
9	Kila Sakra 3	842.39	20.48	0.0012	0.0243	17252.04	0.72	14.77
10	Baraje 1	162.14	23.97	0.0062	0.1478	3886.38	3.35	80.40
11	Baraje 2	173.83	25.51	0.0058	0.1467	4433.41	3.14	80.17
12	Baraje 3	4325.2	20.90	0.0002	0.0048	90375.05	0.16	3.28
13	Lugga Chamba 1	1072.9	24.33	0.0009	0.0227	26103.66	0.58	14.00
14	Lugga Chamba 2	175.78	23.44	0.0057	0.1334	4120.17	3.11	72.92
15	Lugga Chamba 3	146.54	27.44	0.0068	0.1873	4020.92	3.69	101.15
16	Bashinda 1	52.06	24.07	0.0192	0.4623	1252.82	9.68	232.93
17	Bashinda 2	61.21	22.49	0.0163	0.3674	1376.61	8.32	187.17
18	Bashinda 3	118.21	23.29	0.0085	0.1970	2752.52	4.50	104.88
19	Toza Gada 1	85.58	32	0.0117	0.3739	2738.40	6.09	194.82
20	Toza Gada 2	629.23	29.22	0.0016	0.0464	18382.81	0.95	27.66
21	Toza Gada 3	1844.81	22.35	0.0005	0.0121	41231.50	0.35	7.76
22	Alarba Gurigwa 1	19.49	23.91	0.0513	1.2268	466.01	24.20	578.68
23	Alarba Gurigwa 2	32.54	22.64	0.0307	0.6956	736.54	15.00	339.62
24	Alarba Gurigwa 3	26.75	23.20	0.0374	0.8673	620.35	18.02	417.88
25	Barkipa 1	31.68	23.71	0.0316	0.7485	751.01	15.39	364.80
26	Barkipa 2	18.15	22.44	0.0551	1.2364	407.29	25.87	580.42
27	Barkipa 3	90.12	22.93	0.0111	0.2544	2066.00	5.80	132.99
28	Gogra 1	93.83	24.81	0.0107	0.2644	2327.33	5.59	138.59
29	Gogra 2	122.18	25.15	0.0082	0.2058	3072.09	4.37	109.82
30	Gogra 3	204.66	27.80	0.0049	0.1358	5688.39	2.70	75.03
	Min	18.15	20.48	0.0002	0.0048	407.29	0.14	3.28
	Max	4963	32	0.0551	1.2364	123504.26	25.87	580.42
	Average	548.61	24.52	0.0128	0.3062	12912.66	6.42	153.76

conductivity values were represented by shades of green colours as shown on the map. Hydraulic conductivity provides an indication of the ease with which water moves through the subsurface; a higher value represents the ease with which that happens.

The values of transmissivity estimated by Dar-Zarrouk parameter showed the distribution of the transmissivity values in Karlahi area with an average value of 153.76 m^2/day. A spatial distribution of transmissivity map generated from Dar-Zarrouk equation of VES results are presented in Figure 6. Sky blue and shades of blue colours indicate the zones with high transmissivity values whereas shades of green represent low transmissivity values. Transmissivity has high values in the north central

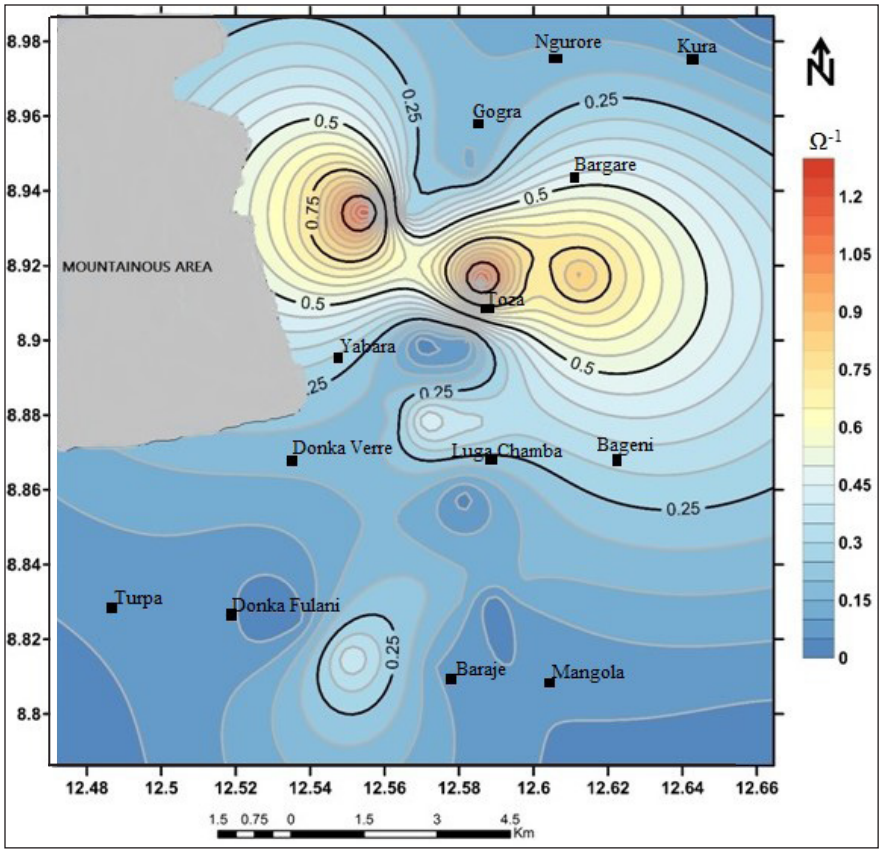

Figure 3: Longitudinal conductance distribution map over Karlahi area.

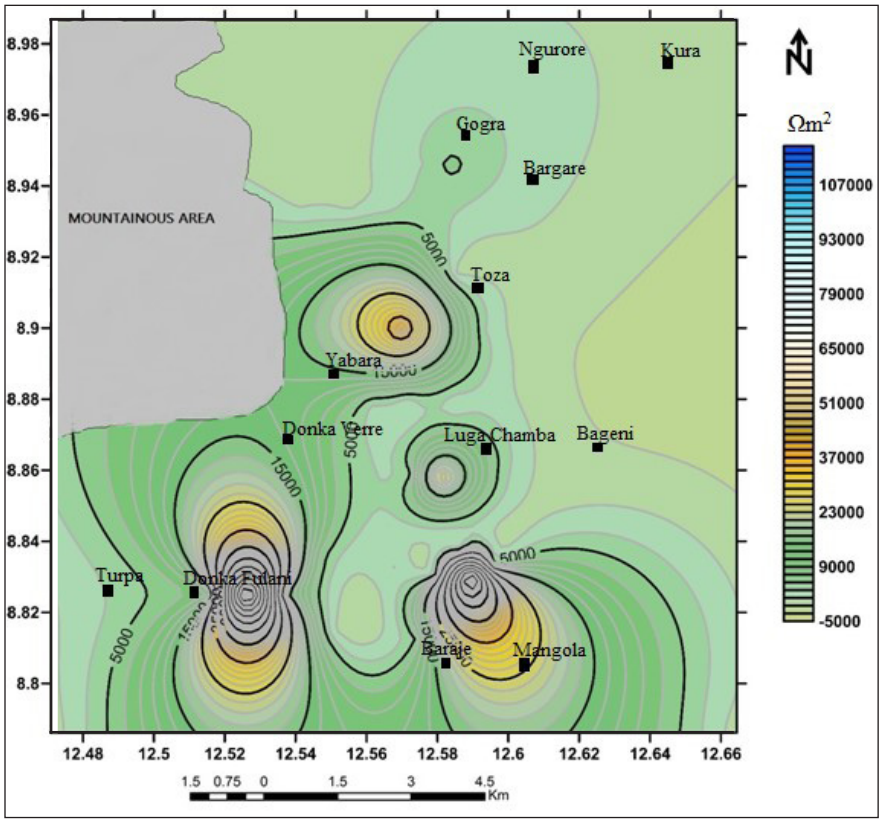

Figure 4: Transverse resistance over Karlahi area.

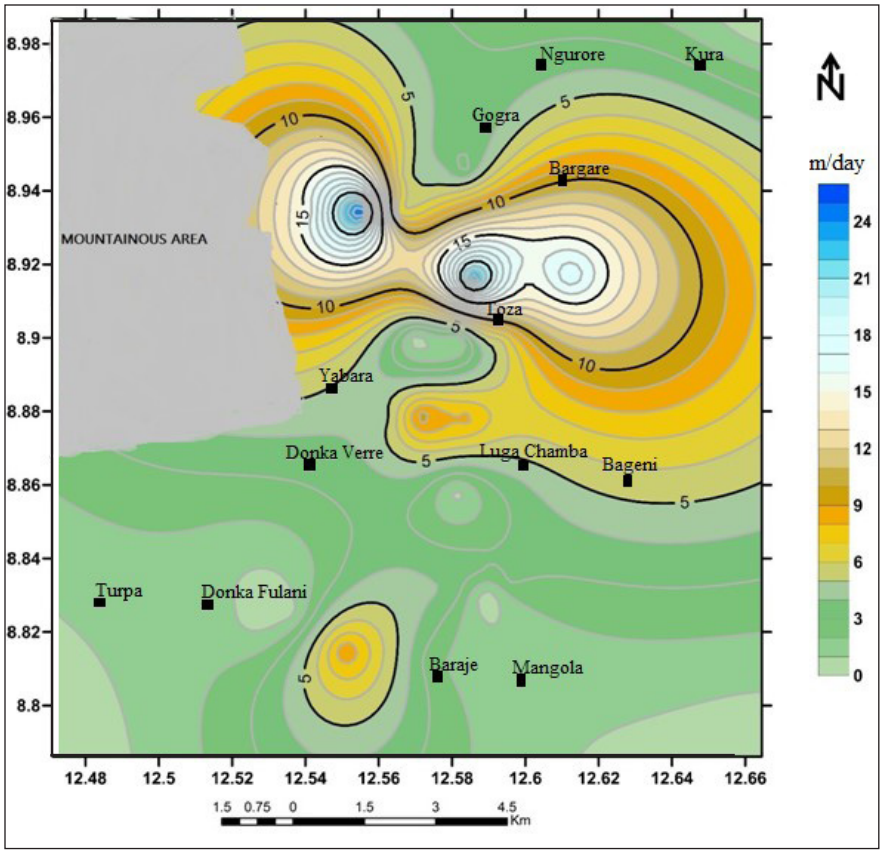

Figure 5: Spatial distribution of hydraulic conductivity over Karlahi area.

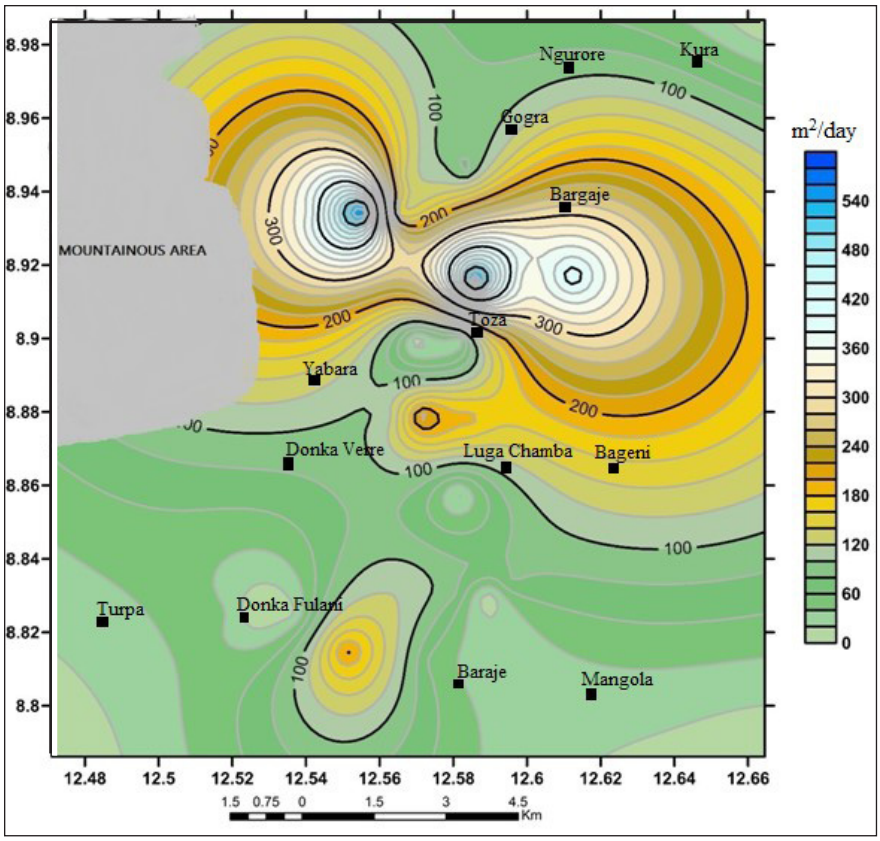

Figure 6: Spatial distribution of transmissivity over Karlahi area.

part of Karlahi area and are low in southern part and extreme northeastern part.

Zones of groundwater potential in Karlahi area

The values of the transmissivity over Karlahi area and the numerical boundary given by (De Wiest, 1965) was modified by grouping all values < 50 together and having three range values of < 50 as negligible and weak, between 50 -500 as moderate and > 500 as high. These standards are used to determine the potential groundwater zones in the area. High transmissivity values correspond to high groundwater potential. The groundwater potential map of Karlahi area presented in Figure 7 shows a negligible to weak groundwater potential zone represented by yellow colours covering 23.3% of Karlahi area, moderate groundwater potential zone represented by green colours covering about 70% of Karlahi area and high groundwater potential zone represented by red colours covering 6.7% of Karlahi area. These moderate zones are mostly concentrated in the central to the northern part of Karlahi. The southern part is characterized by negligible to weak zones and the high zones are concentrated in pockets.

DISCUSSION OF RESULTS

According to (Oladapo & Akintorinwa, 2007) standard, protective capacity value of >10 is excellent, between 5 -10 is very good, 0.7 - 4.9 is good, 0.2-0.69 is moderate, 0.1 - 0.19 is weak and < 0.1 is poor. By this standard, the longitudinal conductance values in Karlahi area revealed poor to good with the average longitudinal conductance as moderate. This analysis revealed Toza and northwestern part of Toza to have moderate protective capacity and are considered to have moderate yield of groundwater. The values of transverse resistance in Karlahi area revealed low to moderate groundwater yield according to (Cassiani & Medina, 1997). In hydrogeological studies, transverse resistance has been discovered to function analogous to transmissivity (Singh & Singh, 2016). These high transverse resistance values are located in Donka Fulani, Baraje, Mangola and Yabara communities while low values are located in Gogra, Bargare, Ngurore and Kura, all situated in the north eastern area corresponding to areas underlain by banded gneiss.

Hydraulic conductivity provides an indication of the effortless flow of water in the subsurface (Ezema *et al*., 2020), higher value represents the ease with which that

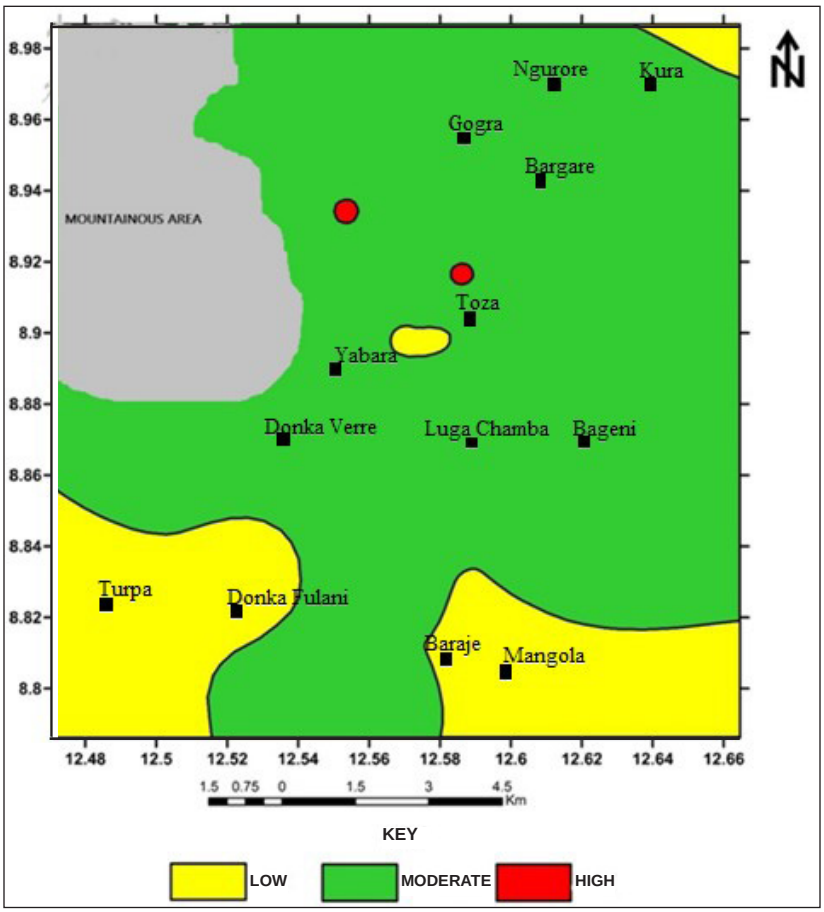

Figure 7: Groundwater potential zones using transmissivity values in Karlahi area.

happens. High permeability will be observed in aquifer zones with high hydraulic conductivity (Niwas & Singhal, 1985). Hydraulic conductivity is high in Yabara, Luga Chamba, Bageni, Toza, Bargare communities all in north central area of Karlahi area with pocket of high hydraulic conductivity on the western part of Baraje while low values are predominantly located in the southern part covering Turpa, Donka Fulani, Baraje and Mangola and also on the extreme part of the northen part of the study area covering Gogra, Ngurore and Kura which are predominantly underlain by coarse to medium grained granite and banded gneiss. Transmissivity values in Karlahi area revealed negligible to moderate groundwater potential based on data reported by (De Wiest, 1976). The spatial distribution map of transmissivity in Karlahi area revealed areas with moderate to high transmissivity values in the north central to northern parts and a negligible to low transmissivity in southern part. Logically, high transmissivity values imply high groundwater potentials and these areas corresponds to high hydraulic conductive zones. Pockets of high groundwater potential zone is observed north of Toza and directly below the mountainous area. The mountainous area characterized by lineaments with high interconnectivity structures for easy flow of groundwater in to weathered geologic materials, these may be the possible reason for moderate groundwater potentials in the area.

CONCLUSION

Dar – Zarrouk parameters proved useful for delineating zones of groundwater potentials in a complex basement terrain. The groundwater potential map delineated central to northern part of Karlahi area with moderate to high groundwater potential and low groundwater potential zones in the southwest and southeastern areas. Low groundwater potential zones in southwest and southeastern area and are attributed to limited or no weathered material in the area. Other low groundwater potential areas are in the extreme northeastern and central parts of Karlahi area. The mountainous areas are serving as possible recharge zones to faults, fissures and weathered basement in the area.

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Saturated hydraulic conductivity (Ks) of earth materials in a weathering profile over the Kuantan Basalt, Pahang, Malaysia

John Kuna Raj

No. 83, Jalan Burhanuddin Helmi 2,
Taman Tun Dr. Ismail, 60000 Kuala Lumpur, Malaysia
Email address: jkr.ttdi.tmc@gmail.com

Abstract: Three broad morphological zones can be differentiated at the weathering profile; the top, 3.80 m thick, pedological soil (zone I with sub-zones IA, IB and IC) comprising soft to stiff, brown clays and the bottom bedrock (zone III) being an outcrop of vesicular olivine basalt. The intermediate zone II (saprock) is 1.12 m thick and consists of brown, very stiff, sandy clayey silt with many lateritic concretions. Laboratory constant head permeability tests show the saturated hydraulic conductivity (Ks) to vary with depth; sub-zone IB having a conductivity of 0.007 cm/hr, and sub-zone IC (saprolite), and zone II (saprock), having conductivities of 0.147, and 0.447, cm/hr, respectively. The conductivity values show no correlation with physical properties of the earth materials, but increase with increasing sand, gravel, and silt, contents. The conductivity values also decrease with increasing clay and colloid contents. The low hydraulic conductivity of sub-zone IB will lead to surface runoff and ponding over natural ground surfaces during rainfall events, though over disturbed ground surfaces, infiltration is anticipated in view of exposed saprolite and saprock earth materials with relatively high conductivity.

Keywords: Weathering profile, Kuantan Basalt, saturated hydraulic conductivity

INTRODUCTION

The movement of water through earth materials is governed by the experimentally derived Darcy's Law [Q = KiA] which states that the discharge of water (Q) through a unit area (A) of porous medium is directly proportional to the hydraulic gradient (i) normal to that area; K being the proportionality constant (Sharp, 2007). In geology, the proportionality constant (K) has been known as the coefficient of permeability, though nowadays, it is referred to as the hydraulic conductivity. Hydraulic conductivity is defined as the rate of flow of water through a cross-sectional area under a unit hydraulic gradient at the prevailing temperature (Bates & Jackson, 1980).

The property or capacity of a porous rock, sediment or soil to transmit a fluid without impairment of the medium is termed permeability and can be considered to be a measure of the relative ease of flow under unequal pressure; the SI unit of measurement being m^2 (for saturated flow) (Bates & Jackson, 1980). The term intrinsic permeability, refers to the permeability of earth materials independent of fluid properties and is related to the hydraulic conductivity (K) by $K = k\rho g/\mu$, where k is the intrinsic permeability, ρ is the density of the liquid, g the acceleration due to gravity and μ is the dynamic viscosity of the liquid (Lewis *et al*., 2006).

In Soil Science, intrinsic permeability (k) is considered to be a quantitative property of porous material that is controlled solely by pore geometry (USDA, 2018). Saturated hydraulic conductivity (Ks) furthermore, is considered to be a quantitative measure of a saturated soil's ability to transmit water when subjected to a hydraulic gradient and can be described as the ease with which pores of a saturated soil permit water movement (USDA, 2018). Saturated hydraulic conductivity is affected by both soil and fluid properties and depends on the soil pore geometry as well as the fluid viscosity and density. In contrast to hydraulic conductivity, intrinsic permeability is independent of fluid viscosity and density.

There is limited published data on the saturated hydraulic conductivity of earth materials in Malaysia where deep weathering profiles are found as a result of prolonged and pervasive weathering throughout most of the Cenozoic Era (Raj, 2009). Limited data is particularly evident in the case of weathering profiles over basic igneous bedrock; there only being a single published paper to date. Hamdan *et al.* (2006) reported that samples of saprolite (soil horizon C) were collected from 16 locations over granite, schist, shale and basalt in Peninsular Malaysia to evaluate their potential use as a wastewater treatment. Infiltration rates both *in-situ*,

and in the laboratory, were determined as were water retention curves using the pressure plate method. Saturated hydraulic conductivity (Ks) was also determined in the laboratory using the constant head method. The study showed that granite saprolite had the highest saturated hydraulic conductivity (Ks), and *in situ* field infiltration rate, of 6.5, and 4.0, cm/hr, respectively, whilst the basalt saprolite had the lowest corresponding values of 0.10, and 0.03, cm/hr, respectively. The schist, and shale saprolites, furthermore had intermediate values of 1.10, and 0.25, cm/hr, for saturated hydraulic conductivity, and 0.60, and 0.06 cm/hr, for field infiltration rate, respectively. Clay and sand contents as well as porosity, pore shape and pore size were found to influence the hydraulic conductivity; the study concluding that shale and basalt saprolites would be suitable for use as *in situ* wastewater treatment due to the low saturated hydraulic conductivity (Hamdan *et al.*, 2006).

In the course of a study on the characterization of weathering profiles in Malaysia, Raj (1983) has investigated a profile developed over the Kuantan Basalt. The characterization of this profile, based on field mapping and the visual differentiation of morphological zones and sub-zones followed by laboratory determination of their physical and index properties, has been earlier discussed (Raj, 2021). In this paper are presented the results of determination of the saturated hydraulic conductivity (Ks) of earth materials within the weathering profile.

METHODOLOGY

The investigated weathering profile was exposed along the Kuantan - Jabor trunk road, close to the overhead bridge of the Kuantan Bypass Highway during excavation works for widening of the road shoulder (Figure 1). The cut is located on the side of a small valley with fresh basalt outcropping in the stream bed. Field mapping was first carried out to identify weathering zones and sub-zones, i.e. layers of earth materials with similar morphological features including color, texture, concretions, relict bedrock structures and core-boulders. Two sets of constant volume samples were then collected at vertical depths of 0.78 m, 2.65 m and 4.36 m; one set for determination of physical and index properties of the earth materials, and the other for determination of the saturated hydraulic conductivity (Ks) (Figure 2 and Plate 1).

Brass tubes of 4.0 cm length and 7.6 cm internal diameter were used for collection of each set of samples; the tubes having a wall thickness of 0.3 cm, except towards one end where the lower 1.5 cm tapered to a thickness of 0.15 cm to provide a cutting edge. Prior to sampling, the tubes were externally greased to facilitate entry into the soil whilst surface materials were cleared to a depth of about 0.5 m to minimize surface disturbance. The exposed earth materials were also cut into an approximately cylindrical shape, slightly larger than the tube diameters, prior to sampling to reduce lateral compaction. A sampling tube with the cutting edge facing downwards was first driven

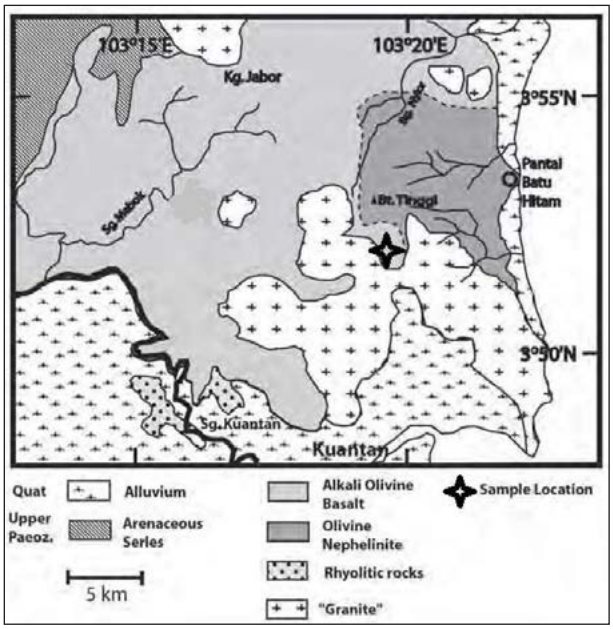

Figure 1: Geological sketch map of the Kuantan area, Pahang (after Azman & Nur Iskandar, 2007).

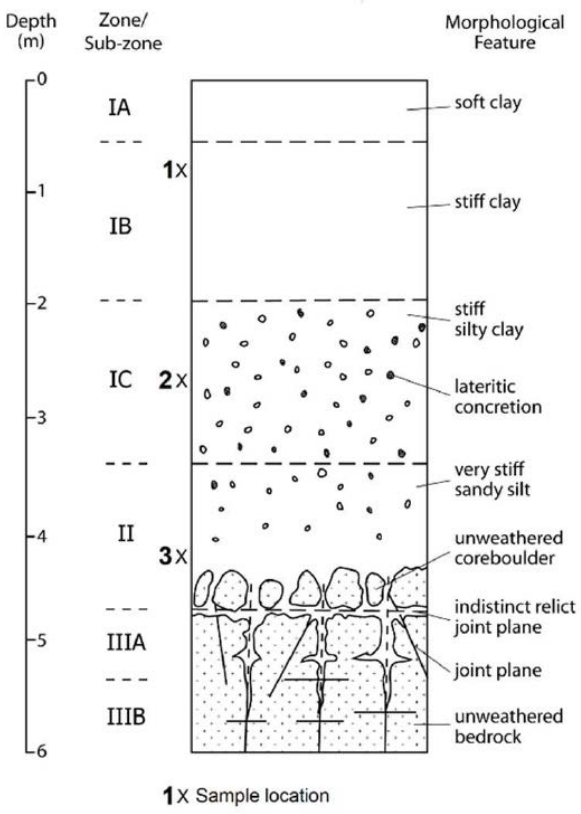

Figure 2: Schematic sketch of morphological features in the weathering profile with sample locations (1 to 3).

into the weathered material by gently hammering on its' top, until the top was flush with the ground surface. A second tube, with its cutting edge facing upwards, was then placed on the first tube and this then driven deeper into the soil by hammering gently on the top of the second tube. A piece of wood was placed on top of the tubes when hammering to minimize damage to the tubes as well as disturbance to the samples. Both tubes were then dug out from the ground by excavating the earth materials surrounding, and under, the two tubes. The sample in the upper tube was discarded, while the sample in the lower (first) tube was trimmed until its upper and lower surfaces were flush with the top and bottom of the tube. The sample was then sealed with rubber end caps and taken to the laboratory. It is to be noted that two separate samples were collected at each sampling site.

Moisture contents, unit weights and densities of one set of the samples were then determined before the specific gravity of the constituent mineral grains was measured using a pycnometer (GBRRL, 1959). Porosities were calculated before the plastic limits of the fine fractions (<0.425 mm size) were determined by standard procedure (GBRRL, 1959). Particle size distributions of the samples were determined by employing the sieving, and sedimentation, methods for the coarse (>0.0625 mm diameter), and fine (<0.0625 mm), fractions respectively (GBRRL, 1959). It is to be noted that definitions of size limits for particles follows that of Wentworth (1922) where gravel refers to particles with diameters between 2 and 64 mm, sand to particles with diameters between 0.625 and 2.00 mm, silt to particles with diameters between 0.0039 and 0.0625 mm and clay to particles less than 0.0039 mm in diameter.

Saturated hydraulic conductivity (Ks) was measured by covering both ends of the sampling tube (from the second set) with filter paper and wire gauze screens before sealing it between araldite end caps. The araldite caps with the enclosed sampling ring were then placed between two brass plates and held in place by three bolts and nuts. The outlet from the upper araldite cap was attached to a vacuum pump whilst the outlet from the lower cap was placed in a large water-filled beaker with its top water level on par with the top of the sample ring. The vacuum pump was then started and water allowed to flow through the sample until it emerged at the outlet of the upper araldite cap. The vacuum pump was stopped and the water-filled beaker raised to a known height. The discharge of water from the outlet of the top araldite cap was then measured over a period of up to 14 hours until a constant rate of discharge was recorded. From the known cross-sectional area (A) and length (L) of the sample, as well as the constant head (H) and rate of discharge (Q/t), the saturated hydraulic conductivity (Ks) was calculated. A schematic sketch of the set-up for the constant head permeability test is shown in Figure 3.

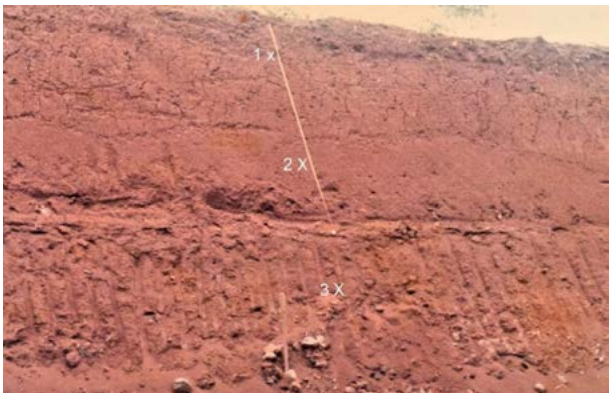

Plate 1: View of exposed weathering profile with sample locations (1 to 3). (Tape is 3.90 m in length).

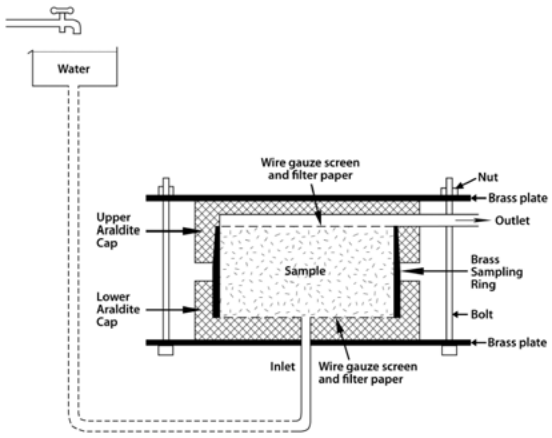

Figure 3: Schematic sketch of set-up for constant head permeability test.

GEOLOGICAL SETTING OF WEATHERING PROFILE

Basaltic lavas and dolerite dykes in the Kuantan area were first mapped and described in detail by the Geological Survey of Malaysia (Fitch, 1951). The basaltic lavas, covering an area of some 125 km^2, overlie, and surround, granite hills to the north and northwest of Kuantan, as well as overlie a sequence of Upper Paleozoic sedimentary-volcanic rocks (Figure 1). The dolerite dykes, ranging in thickness from 2 cm to about 5 m, mainly trend northeast to east and intrude the Upper Paleozoic and granitic rocks. The basaltic lavas are considered to result from fissure type eruptions; the center of extrusion near Bukit Tinggi, which at an elevation of 138 m above sea level, is the highest point where the basalts are found (Fitch, 1951). The basalts have also been considered to result from a central volcanic vent type eruption; the vent located at Bukit Tinggi (Bignell, 1972). Field mapping of the basalt furthermore, yielded paleo-flow directions that indicate the presence of two vents; one at Bukit Tinggi, and another at a hill located 1.9 km northwest of Bukit Ubi (Raj, 1990).

The dolerite dykes were first considered as feeder fissures to the basaltic lavas, though K-Ar dating of a dyke sample at 111 ± 4 Ma, and a basalt sample at 1.6 ± 0.2 Ma, indicated a long time interval between the two igneous events (Bignell & Snelling, 1977). The dolerite dykes and basaltic lavas furthermore, differ in petrology, age and paleo-magnetic directions, and are thus not genetically related (Haile *et al*., 1983). Several K-Ar radiometric dates yielding an average age of 1.7 ± 0.2 Ma clearly indicate the Quaternary occurrence of the Kuantan Basalt (Bignell & Snelling, 1977).

Initial work classified the Kuantan Basalt as an olivine basalt, both with and without nepheline (Fitch, 1951). A detailed study of thin-sections and several chemical analyses, however, concluded that the Kuantan Basalt involved two distinct and perhaps independent magma types, namely alkali olivine basalt magma and olivine nephelinite magma (Chakraborty, 1977). The olivine basalts were largely present in the western part of the Kuantan area, whilst the olivine nephelinites were restricted to the eastern part. The sequence of eruptions is not known, though olivine nephelinite appeared, at least in part, to be later than olivine basalt (Chakraborty, 1979).

A study of trace elements in the Kuantan Basalt noted that the olivine basalt and olivine nephelinite are both enriched in incompatible and light rare earth elements; signatures comparable with Oceanic Island basalts and East African Rift basaltoids. It was thus concluded that the geochemical evidence, as well as the timing, pointed to a mantle plume-related genesis for the Kuantan Basalt, rather than one related to wrench tectonics-induced extension (Azman & Nur Iskandar, 2007).

At the investigated weathering profile, the exposed bedrock is a black to dark green, micro-crystalline, vesicular olivine basalt with horizontal and vertical joints. In thin-sections, the basalt is seen to be composed of calcic plagioclase, augite, olivine, magnetite and limonite. The texture is normally inter-granular with augite crystals occupying the spaces between plagioclase laths. Sub-ophitic textures are also seen in some coarser grained varieties where the euhedral phenocrysts show little or no corrosion and consist mainly of olivine and rarely of plagioclase.

MORPHOLOGICAL ZONES AND SUB-ZONES IN THE WEATHERING PROFILE

Vertical variations in colour, texture and preservation of original bedrock structures allowed differentiation of three broad zones; an upper pedological soil (zone I), an intermediate saprock (zone II), and the underlying bedrock (zone III) (Table 1 and Figure 2). The zones are developed approximately parallel to the overlying ground surface and are similar to those differentiated in earlier studies of weathering profiles over the Kuantan Basalt (Hamdan *et al*., 2000; 2003).

The pedological soil is 3.6 m thick and can be separated into IA, IB and IC soil horizons; the IA and IB horizons constituting the solum, and the IC horizon, the saprolite (Table 1). The IA and IB horizons are relatively thin and comprise soft to stiff, brown clays, whilst horizon IC is 1.52 m thick and consists of a stiff, brown silty clay with many lateritic concretions.

The saprock is only 1.12 m thick and consists of a very stiff, brown sandy clayey silt with many gravel sized lateritic concretions and a few core-boulders towards its bottom (Table 1). The bedrock is a continuous outcrop of basalt and can be separated into an upper sub-zone (IIIA) with effects of weathering along and between joint planes, and a lower sub-zone (IIIB) with effects of weathering along joint planes (Table 1).

Seepage was not observed at the time of investigation, though an unconfined groundwater table is expected at

Table 1: Field description of morphological zones and sub-zones in the weathering profile.

Zone & Sub-zone	Depth (m)	Field Description
IA	0.00 - 0.60	Brown (7.5YR4/4), soft clay; porous; crumbly dry; many roots; some burrows; boundary wavy, diffuse
IB	0.60 - 2.08	Brown (7.5YR4/4), stiff clay; sub-angular blocky moist; friable dry; some large roots; few burrows; boundary wavy, diffuse
IC (Saprolite)	2.08 - 3.60	Brown (7.5YR4/4), stiff silty clay; sub-angular blocky moist; many lateritic concretions; boundary wavy, clear.
II (Saprock)	3.60 - 4.72	Brown (7.5YR4/4), very stiff, sandy silt; many gravel sized, lateritic concretions; sub-angular blocky moist; core-boulders in lower part; indistinct relict joint planes; boundary irregular, diffuse
IIIA (Bedrock)	4.72 - 6.61	Basalt with weathering (staining & alteration to sandy silt) along and between discontinuity planes; boundary irregular, diffuse
IIIB (Bedrock)	>6.61	Basalt outcrop with effects of weathering only along discontinuity planes only.

shallow depth in view of the adjacent perennial stream whose bed is some 5 m vertically below the road shoulder level.

RESULTS OF LABORATORY TESTS

Physical properties of sampled earth materials

The sampled earth materials, although all brown in colour with somewhat similar textural features (Table 2), show some differences in physical properties (Table 3). Sub-zone IC (saprolite) has the highest dry unit weight of 12.36 kN/m^3, whilst sub-zone IB, and zone II, have dry unit weights of 10.80, and 11.50, kN/m^3, respectively. Values of dry density are similar to those of dry unit weight; the saprolite with a dry density of 1,260 kg/m^3, and sub-zone IB, and saprock, with dry densities of 1,101, and 1, 172, kg/m^3. The specific gravity of constituent soil particles is similar (2.73) for the samples from sub-zones IB and IC, but slightly higher for the saprock sample (2.75) due to the lateritic concretions present (Table 3).

Porosity is variable with the saprolite having the minimum value of 53.8%, whilst sub-zone IB, and saprock, have porosities of 59.7%, and 57.4%, respectively (Table 3). Void ratios are similar to those of porosity with saprolite having the minimum value of 1.16, and sub-zone IB, and saprock, having values of 1.48, and 1.36. Moisture contents show a limited variation and range from 39.5% to 49.0% (Table 3).

Index properties of sampled earth materials

Grain size analyses show distinct differences with the saprock (zone II) having relatively large silt and sand contents, whilst sub-zone IB sample has a predominantly clay content, and sub-zone IC (saprolite), large clay and silt contents (Table 3). Fine clay (<0.002 mm size) contents are distinctly variable with sample sub-zone IB having the largest content (73%), whilst the saprolite, and saprock, samples have contents of 35%, and 19%, respectively (Table 3). Colloid (<0.001 mm size) contents are also distinctly variable; the sub-zone IB sample having the largest content of 68%, and the saprock and saprolite samples with contents of 30%, and 15% (Table 3).

Plastic limits of the fine fractions (<0.42 mm size) range from 40.6% to 48.7%, whilst liquid limits are only

Table 2: Descriptions of sampled earth materials.

Sample Number	Sub-zone	Vertical Depth	Description
1	IB	0.78 m	Brown, stiff clay.
2	IC	2.65 m	Brown, stiff silty clay.
3	II	4.36 m	Brown, very stiff, sandy clayey silt with many gravel sized, lateritic concretions.

Table 3: Physical properties of sampled earth materials.

Sample	Vertical Depth	Zone/ Sub-zone	Dry Unit Weight (kN/m^3)	Dry Density (kg/m^3)	Mineral Grain SG	Porosity (%)	Void Ratio	Moisture Content (%)
1	0.78 m	IB	10.80	1,101	2.73	59.7	1.48	49.0
2	2.65 m	IC	12.36	1,260	2.73	53.8	1.16	39.5
3	4.36 m	II	11.50	1,172	2.75	57.4	1.36	45.0

Note: SG refers to specific gravity.

Table 4: Index properties of sampled earth materials.

Sample	Vertical Depth	Gravel (%)	Sand (%)	Silt (%)	Total Clay (%)	Fine Clay (%)	Colloids (%)	Plastic Limit (%)	Liquid Limit (%)
1	0.78 m	0.2	7.8	16.0	76	73	68	48.7	70.0
2	2.65 m	5.2	22.7	34.1	38	35	30	42.2	63.5
3	4.36 m	7.8	27.1	43.1	22	19	15	40.6	ind

Note: Fine clay <2 μm size; Colloids <1 μm size; ind means indeterminate.

determinable for the sub-zone IB and saprolite samples are 70.0%, and 63.5%, respectively (Table 3). These results indicate that the samples would plot below the "A-line" in the Plasticity Chart of the Unified Soil Classification System and thus be classified as silty to sandy clays (Wagner, 1957).

Discharge and saturated hydraulic conductivity (Ks)

The permeability tests were carried out with constant heads of between 132 and 136 cm and involved measurement of the volume (cm^3) of water collected in fixed time periods (minutes) at different elapsed times (in hours) from the start. The results of these tests are presented in Tables 5 to 7 to serve as reference for future work.

The sub-zone IB sample (1) shows a gradual decrease in discharge with time and reaches a constant value after some 12 hours of elapsed time (Table 5). The saprolite sample (2) shows a similar gradual decrease in discharge with time and reaches a constant value after some 9 hours of elapsed time (Table 6). The saprock sample (3) starts with a fairly large discharge that quickly decreases and becomes constant after some 5 hours of elapsed time (Table 7).

Values of saturated hydraulic conductivity (Ks) calculated from the above results are presented in Table 8.

DISCUSSION

Comparison with published data

The limited published data available for comparison is from a basalt saprolite in the Kuantan area (Hamdan *et al.*, 2006). The investigated sample was described as a clay loam with a bulk density of 1.10 g/cm^3, total porosity of 40%, moisture content of 26.7%, and consisted of 16%, 30% and 54%, of sand, silt and clay sized particles, respectively. *In situ* field measurements yielded an infiltration rate of 0.03 cm/hr, whilst constant head

Table 5: Constant head (134 cm) permeability test on sample 1 from sub-zone IB.

Time from start (hours)	Discharge (cm^3/hr)	Saturated Hydraulic Conductivity (Ks) (cm/hr)
0.68	30.73	0.0202
1.88	22.08	0.0145
3.47	18.95	0.0125
7.57	12.44	0.0082
13.52	11.09	0.0073

Table 6: Constant head (132 cm) permeability test on sample 2 from sub-zone IC.

Time from start (hours)	Discharge (cm^3/hr)	Saturated Hydraulic Conductivity (Ks) (cm/hr)
0.08	660.0	0.4409
0.25	618.0	0.4128
0.50	580.0	0.3874
0.78	547.1	0.3654
2.78	450.0	0.3006
2.85	450.0	0.3006
3.03	420.0	0.2806
3.33	396.7	0.2650
3.78	377.8	0.2523
6.32	240.8	0.1608
9.40	220.5	0.1473
14.02	219.9	0.1469

laboratory tests gave a saturated hydraulic conductivity (Ks) of 0.10 cm/hr. A study of the shapes and sizes of the pores present indicated that the basalt saprolite was not very porous with low amounts of micro-, and meso-, pores, and extremely few macro-pores. The high clay content was considered responsible for the low volume of pores as well as relatively low values of infiltration rate and hydraulic conductivity (Hamdan *et al.,* 2006).

The saturated hydraulic conductivity (Ks) of 0.147 cm/hr determined for the saprolite sample in the present study can be correlated directly with the reported rate of 0.10 cm/hr by Hamdan *et al.* (2006). The saprolite samples of the present study furthermore, has fairly similar physical and soil index properties as those of the sample investigated by Hamdan *et al.* (2006).

Saturated hydraulic conductivity (Ks) and properties of sampled earth materials

Regression analyses yield low to very low, correlation coefficients (R^2) when values of saturated conductivity are plotted against physical properties of the earth materials. Plots of hydraulic conductivity versus dry unit weight for instance, yield an extremely low coefficient (R^2=0.0643), as do plots of hydraulic conductivity versus porosity (R^2=0.0353).

Plots of hydraulic conductivity versus index properties of the earth materials, however, yield variable trends with moderate to large, correlation coefficients (R^2) even with the limited number of samples involved. Positive trends for instance, with moderate correlation coefficients are seen when conductivity values are plotted against sand and gravel contents (R^2= 0.7888), and silt contents (R^2=0.8491) (Figures 4 and 5). Saturated hydraulic conductivity (Ks) is thus expected to increase with an increase in the gravel, sand and silt contents.

Plots of hydraulic conductivity versus clay contents furthermore, yield a negative trend with a fairly large correlation coefficient (R^2=0.8198) (Figure 6). Negative trends are also found when hydraulic conductivity is plotted against fine clay (R^2=0.8198), and colloid,

Table 7: Constant head (136 cm) permeability test on sample 3 from saprock (zone II).

Time from start (hours)	Discharge (cm^3/hr)	Saturated Hydraulic Conductivity (Ks) (cm/hr)
0.05	1520.0	0.9855
0.13	1260.0	0.8169
0.30	1170.0	0.7586
0.55	1124.0	0.7287
0.88	1092.0	0.7080
1.32	1059.2	0.6867
1.92	1008.3	0.6537
2.78	933.5	0.6052
3.93	867.8	0.5626
5.40	807.3	0.5234
7.43	729.3	0.4729
10.77	690.0	0.4474

Table 8: Saturated hydraulic conductivity (Ks) of earth materials from the weathering profile.

Sample	Depth (m)	Sub-zone/Zone	Ks (cm/hr)	Earth Materials
1	0.78 m	IB	0.007	Clay
2	2.65 m	IC	0.147	Silty clay
3	4.36 m	II	0.447	Sandy silt

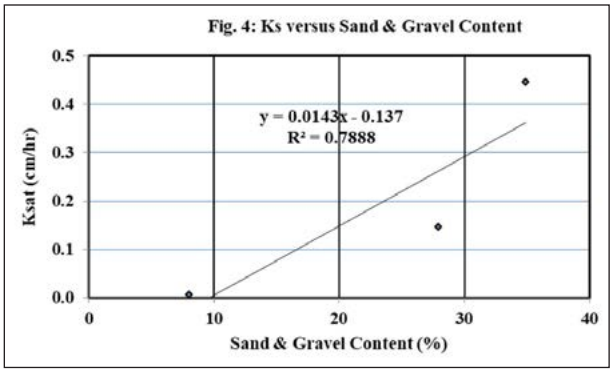

Figure 4: Saturated hydraulic conductivity (Ks) versus sand and gravel content.

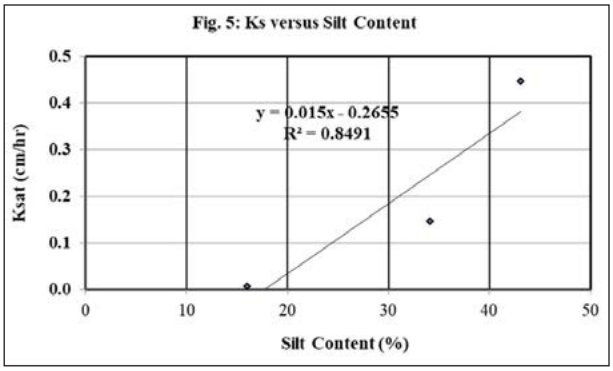

Figure 5: Saturated hydraulic conductivity (Ks) versus silt content.

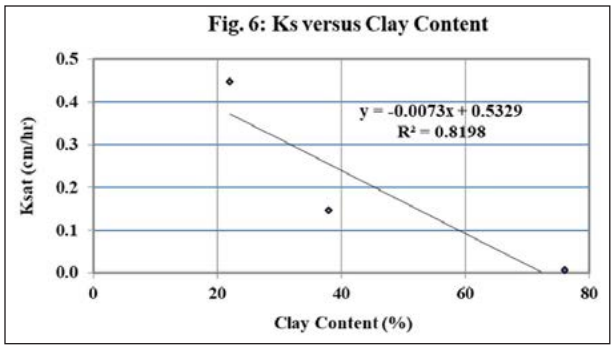

Figure 6: Saturated hydraulic conductivity (Ks) versus clay content

(R^2=0.8085), contents. Saturated hydraulic conductivity is thus expected to decrease with an increase in clay contents.

Variation of saturated hydraulic conductivity (Ks) within weathering profile

The results show the saturated hydraulic conductivity (Ks) to vary with depth; the IB sub-zone having a saturated hydraulic conductivity (Ks) of 0.007 cm/hr, the saprolite (sub-zone IC) a conductivity of 0.147 cm/hr, and the saprock (zone II) a conductivity of 0.447 cm/hr (Table 8). The upper pedalogical soil profile (zone I) thus has the lowest values of saturated hydraulic conductivity, whilst the lower saprock (zone II) has a relatively large conductivity. These variations will influence the infiltration and runoff of water during rainfall events over natural, and disturbed, ground surfaces over the Kuantan Basalt. In areas of undisturbed natural ground surfaces, ponding and surface runoff can be anticipated, though at slope cuts, and other areas of disturbed ground, there will be fairly rapid infiltration and percolation of rainwater.

CONCLUSION

Three broad morphological zones can be differentiated at the weathering profile; the top, 3.60 m thick, pedological soil (zone I) comprising brown, soft to stiff, clays. The intermediate saprock (zone II) is 1.12 m thick and consists of brown, very stiff, sandy clayey silt with many lateritic concretions, whilst the bottom bedrock (zone III) is an outcrop of vesicular olivine basalt with weathering along joints. Laboratory constant head permeability tests show the saturated hydraulic conductivity (Ks) to vary with depth; the IB sub-zone having a conductivity of 0.007 cm/hr, whilst the saprolite (sub-zone IC), and saprock (zone II) have conductivities of 0.147, and 0.447, cm/hr, respectively. The conductivity values show no correlation with physical properties of the earth materials, but increase with increasing sand and gravel contents, as well as increasing silt contents. The conductivity values also decrease with increasing clay contents. The low hydraulic conductivity of sub-zone IB will lead to surface runoff and ponding over natural ground surfaces during rainfall events, though over disturbed ground surfaces, infiltration is anticipated in view of exposed saprolite and saprock earth materials with relatively high conductivity.

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Geological sketches – out of time and fashion, but obsolete? An Essay

F.L.H. Kessler*

Curtin University, Sarawak, Malaysia
Email address: FranzLKessler32@gmail.com

Abstract: The sketching of geological features and objects played an important role in the development of the geosciences. Geological sketches may not be as commonly used for documentation purposes any longer, but may facilitate learning and understanding. By sketching geological features, the eye is trained to observe; this furthers understanding, and so improves study results.

Keywords: Sketches, documentation, history, geoscience, learning, understanding

OBSERVATIONAL DISCIPLINE

Earth Science is an observational discipline, an application of logic and rigorous interpretation. There is no solid trust in a geoscience product as long as critical questions have not been raised and sufficiently answered. Only work performed out of the best possible ingredients brings us to success. In geosciences we are dealing with features we attempt to describe. In crafting a geological sketch we train our eyes on an object, establish connectivity between points and features and establish geological sense.

A HISTORICAL PERSPECTIVE

The roots of any natural science grew out of the art of sketching. There was simply no other way to describe and to share learnings with a greater audience – except through sketches of plants animals, landscapes, stars seen through a telescope or bacteria portrayed under the microscope. Travel writers and explorers used pencil and paper to bring home their experiences and discoveries, to be transformed into copper edgings, water colour or oil paintings. Through sketches the foundations of natural science were laid out, until photography took over at the end of the 19th century. In the current era of fake news and digital photo alteration, there is a realization that photographic pictures may not be as un-biased or innocent as originally thought.

Figure 1: Geological drawing by Johann Wolfgang von Goethe (ca. 1784) showing the weathered granitic Klusfelsen in the Harz Mountains, dissected by several families of minor faults and joints. (Wikipedia download).

LEARNING AND UNDERSTANDING

The way our brain learns is still quite mysterious, but we see results in the form of spontaneous insight and, more commonly, gradual insight. Spontaneous insight is also called Heureka moments. One of the best and probably one of the first geological Heureka moments was experienced by Herodotus, the Greek traveller and historian while visiting ancient Egypt in ca 450 BCE. He arrived in the Nile Delta via the sea and headed for the trade city of Bubastis. Used to the blue, and deep un-fathomable waters of the Mediterranean he became intrigued by the milky brownish appearance of the Nile Delta waters, and its amazing shallowness, whilst the shoreline lay still far away beneath the southern horizon. Then, Herodotus was struck by a sudden understanding: the milky color must have originated from the very fine sediment carried by the water, a sediment which attempted to fill, in his own words, the entire coastal basin (Kessler, 2004).

** The author of this essay is a free-lance geologist and geophysicist, and offers training in field geology, subsurface studies and petroleum science. He is affiliated with the Curtin University Sarawak, where he led the geosciences department as Assoc. Prof. from 2009 to 2012.*

Gradual understanding, however, is proportional to the time and effort invested. Stimulated during patient observation it develops step by step.

ARE GEOLOGICAL FEATURES UNIQUE?

This interesting question is not so easy to answer. In a way, geological features have no equal. This said, they are the results of genuine processes in nature, and a combination of parameters and timing will determine the structure and shape. Let me take an example of two volcanoes, which erupted and formed islands. Made of a very similar type of lava, eruption characteristics and oceanographic settings, two nearly morphologically identical islands developed: Stromboli in the Mediterranean (Italy), Figure 2 left, and Batu Tara Lembata, Figure 2 right in the Flores Sea (Indonesia).

Both islands are strikingly similar. Therefore, it can be concluded that features are replicated over and over again in geological time, following the logic of the same processes, leading to highly similar manifestations. For this very reason it makes sense to study analogues, knowing that the studied examples may pave our way to understanding of the processes at work. There are many cases where we can study source rocks, reservoirs and sealing units in coastal areas, whilst, nearby in the offshore similar but not the same units are part of a petroleum system. Generations of geoscientists have shown their understanding through sketches and maps, particularly in the context of stratigraphic analysis (Figure 3). But let´s address first another issue: different data properties.

BI-POLAR GEOSCIENCE

Geosciences also appear to be bi-polar. One pole is relatively recent and dwells in a crowd of numbers mostly dealt with in the context of empirical science: data, large in number, such as in geophysical 3D interpretation, can speak for themselves, as long as they are properly filtered and cleaned. The other pole maybe called scientific-artistical understanding. It developed in several leaps as early as in old Egypt, Greece and then, with increasing impact, from the Renaissance onwards. Often, this pole is characterized by an analog and relatively low-data-intensity environment.

The digital pole

Over the last 100 years, an increasing flood of available data backed by powerful computing has pushed geology in the direction of empirical science. Data are forced into a model which can be measured and compared against other data models, and assessed in money terms. Quite often data points may contain elements of interpretation that can be overlooked. The ability to separate real data from interpretative contamination is in itself a struggle, which must be won if scientific goals are cherished. 3D simulations and maps are among the most important geoscience products and are derived in most cases from

Figure 2: The volcanic islands Stromboli (Italy, left) and Batu Tara Lembata (Indonesia, right) are stunningly similar in terms of size, morphology, altitude and magma composition.

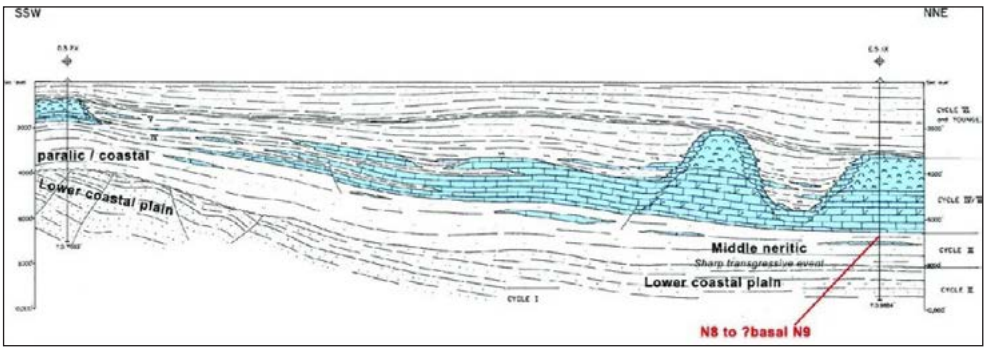

Figure 3: A stratigraphic section of the Luconia carbonate platform in Northern Sarawak. It illustrates a presumed structure of the carbonate layers on the Miocene Sarawak shelf, and displaying a crestal reef development. The above version stems from P. Lunt & M. Madon, Bulletin of the Geological Society of Malaysia, Volume 63, June 2017. Sketches like the shown example are very useful in showing stratigraphic and facies relationships. Downloaded from Researchgate.

a large amount of data. In our profession as well as in almost any other, artificial intelligence conquers elements of human craftsmanship.

Although modern workstations and programs offer excellent cross-section displays from seismic, it can be a good exercise, and often helpful to summarize and sketch one´s understanding of a computer display on a piece of paper.

The scientific-artistical pole: sketches offer excellent learning

Let´s talk now about the other geoscience spectrum pole, characterized by a lower data density, and mostly analog data. Observing rocks can be challenging, given that nature is complex (either truly complex or appearing to be complex due to mis-understanding or mis-interpretation). In other words, there is a difference between a feature being naturally complex, and one that may be simply difficult to comprehend. Understanding is typically a gradual result of observation and study- such as during the process of making a geological sketch. An understanding may not be there at the beginning, but may develop during the time a sketch is made. The aim and purpose of any good sketch is to communicate details of a feature, but often simplified in such ways that it delivers its essence in one glance. Historically, we see here a shift from a tool used to document a finding to a tool which helps to document and understand geology.

UNDERSTANDING, QUALITY, SIMPLICITY

It is a characteristic of the current zeitgeist to focus on results, and to make use of sophistic algorithms to speed up work and reduce cost. Unfortunately, it has been shown that this approach can lead to results of poor or mediocre quality. It is obvious that understanding is sourced by a good scientific analysis, and this applies to both the above mentioned data poles in the geoscience spectrum. A good approach would be to simply spend as much time as possible with our data, be it in the field or in front of a computer screen. This would allow us to develop our thinking and understanding through pertinent, careful observation. We might label it as a data-observation structure or protocol.

Quality is achieved if we are able to develop geological insight and a mindful work and a good training protocol. A couple of years ago we discussed, together with the eminent geologist, the late C.S. Hutchison the issues around complexity and simplicity. We then came to the conclusion that simple solutions are more likely when compared to complex ones, which means that simplicity may be a magic red thread leading to an improved understanding. Accordingly, it might be worthwhile to achieve simplicity within a product. Strong personal exposure to fieldwork and field mapping may help develop such a skill, even if one is dealing mainly with geophysical data. It is a fruitful exercise to sit down, take one´s time and study and sketch the features in front of our eyes. Such activity does not replace photography as such, but helps to distill the most important elements of a scene or outcrop. In a nutshell, sketching serves as an excellent approach to develop our capacity to understand.

In my second sketch example (Figure 5), I am showing a sketch done on a hot summer day in the mountains of Tyrol. I was in the middle of my PhD studying a relatively thin evaporitic sequence called Raibl Beds wedged between the Late Triassic reefal Wettersteinkalk and the evaporitic mudflat sequence of the Hauptdolomit. I sat down and watched carefully, then sketched what I

Figure 4: Planning and review: a primitive stratigraphic sketch of an Alpine sequence (Triassic, carbonates and clastic strata), both serving as documentation as well as a planning tool for further field work. Planning of field trips in rugged terrain is crucial in view of logistics and safety, and such a sketch can help locate and document previous field work points as well.

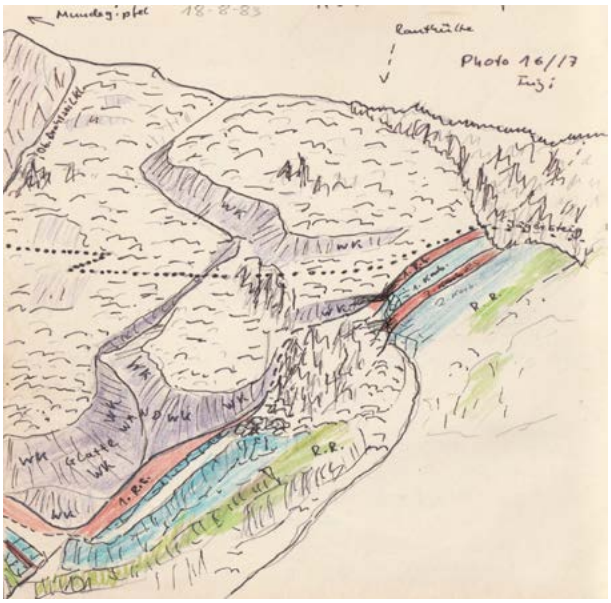

Figure 5: An attempt to encompass and understand a tectonic setting by adding colours to a sketch.

saw. Colouring the outcrops in the scenery helped me to clarify or simplify what I saw. Then I finally understood: a plunging anticline with an axial declination of some 50°, in which the eroded younger sequences were wrapped around an anticlinal core of hard limestone

CONCLUSION

Concluding this paper, I would like to state that there are much better examples of geological sketches, compared to the ones shown in Figures 4 and 5, but published drawings are quite often protected by copyright. There are also a few good (unfortunately expensive) books on the market (reference 3 below), that teach how to sketch in a professional way.

Finally, let me ask: are sketches obsolete? Personally, I believe sketches are fairly obsolete in the context of only documenting features, but possibly essential for and during the process of learning and understanding.

It is not so much about what we capture and portray, but instead how much honest energy and patience we invest in the act of observing and sketching (in the field or on a computer display), and how we can obtain a fruitful learning result from it.

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I would like to present my thankfulness and pay tribute to the late Prof. Reinhardt Pflug and Prof. C.S. Hutchison, teachers who significantly influenced my geological thinking and understanding. I would also like to thank Dr. Mazlan Madon and other colleagues for a good discussion on photographical documentation and sketching, as well as constructive criticism. I also appreciate the thorough constructive criticism and comments offered by the reviewers of this article.

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Metamorphic rocks of the Kuching Zone Sarawak: Comment on Najiatun Najla Mohamad *et al*. (2020) The geology and stratigraphic framework of the Kuching Zone Sarawak: Current understanding and unresolved issues

H. Tim Breitfeld[*,1,2], Robert Hall[1]

[1] SE Asia Research Group, Department of Earth Sciences, Royal Holloway University of London, Egham, TW20 0EX, UK
[2] Chemostrat Ltd., Buttington Cross Enterprise Park, Welshpool, UK
*Corresponding author email address: tim.breitfeld@rhul.ac.uk

Abstract: Metamorphic rocks of Sarawak have been dated and are not Upper Carboniferous or older rocks nor are they correlatives of the Pinoh Metamorphics of Kalimantan. Two newly-dated rocks are Triassic and are named the West Sarawak Metamorphics and a third sample is Cretaceous.

Keywords: Kuching Zone, metamorphic rocks, dating, Sarawak

It is good to see the recent geological note concerning the Kuching Zone by Najiatun Najla Mohamad *et al*. (2020) in Warta Geologi identifying unresolved issues and new work needed to better understand the Kuching Zone of Sarawak. No one interested in the geology of Borneo could disagree with their conclusion that "The geology of Kuching Zone is very complex, and the interpretations concerning the geological history are still arguable and not fully resolved". However, the note overlooked or misunderstood some recent work concerning the age of metamorphic rocks despite citing a recent paper by Breitfeld *et al*. (2017) which recorded the new age data.

The note comments that "undated Pre-Upper Carboniferous Kerait Schist and Tuang Formation were considered to be the oldest rocks in this zone due to similarities with the Pinoh Metamorphic in Kalimantan (Tan, 1986)". Several other authors have made the same correlation despite the fact that metamorphic rocks in Sarawak are separated from the Pinoh Metamorphic rocks in Kalimantan by a wide zone including melanges considered to mark sutures. It is true to say that until recently the metamorphic rocks known as the Kerait Schist and Tuang Formation were undated, although the claim that the rocks are "Pre-Upper Carboniferous" should be identified as an assumption. As Table 1 records, the Kerait Schist was considered to be older than the Terbat Formation merely because it is a metamorphic rock and is more strongly deformed; there is no other evidence. No contacts have been observed between metamorphic rocks and other rocks and the supposed Pre-Upper Carboniferous age was based on the assumption that the metamorphic rocks represent an older basement to the unmetamorphosed Terbat Formation and other sedimentary rocks.

Table 1 also records that "There is no proper age dating conducted to this metamorphic basement (Tan, 1986; Tate, 1991). The Pinoh Metamorphic is also undated and assumed to be Paleozoic (Breitfeld *et al*., 2017)". None of these assertions is correct although they may have been considered reasonable before the publication of Breitfeld *et al*. (2017) and recent dating studies cited by them. Breitfeld *et al*. (2017) did not assume the Pinoh Metamorphics to be Paleozoic although they did point out in their introduction that "until recently, the metamorphic rocks in SW Borneo and the Kuching Zone of Sarawak were undated but were considered to be Paleozoic basement". However, they then went on to cite work by Davies (2013) and Davies *et al.* (2014) that had dated the Pinoh Metamorphics as Cretaceous. A detailed account of the dating of the Pinoh Metamorphics and other rocks of the Schwaner Mountains can be found in Breitfeld *et al*. (2020) and there can be no doubt of their Cretaceous age.

In the same paper Breitfeld *et al*. (2017) pointed out that their new results, from previously undated metamorphic rocks in Sarawak, required revision of the assumption that they were Permian/Carboniferous or older basement. Ar-Ar dating of micas from two samples of the Kerait Schist and Tuang Formation yielded Triassic ages and since the different formation names were based

only on their occurrence in different areas Breitfeld *et al*. (2017) proposed that they should be grouped together and named the West Sarawak Metamorphics. One sample of a chlorite-quartz-mica schist previously assigned to the Tuang Formation yielded a Cretaceous age. It is therefore clear that metamorphic rocks previously assigned to the Kerait Schist and Tuang Formation are not pre-Upper Carboniferous basement, nor are they equivalents of the Pinoh Metamorphics of Kalimantan.

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PERSATUAN GEOLOGI MALAYSIA
GEOLOGICAL SOCIETY OF MALAYSIA

55th ANNUAL GENERAL MEETING & ANNUAL REPORT 2020

30th April 2021
Aloft Hotel Kuala Lumpur &
ZOOM Online Meeting Platform

AGENDA

The Agenda for the Annual General Meeting is as follows:

1. Welcoming Address by the President for Session 2020/2021
2. Confirmation of Minutes of the 54th AGM
3. Matters Arising
4. Annual Report for Session 2019/2020
   a. President's Report
   b. Secretary's Report (including Assistant Secretary's Report)
   c. Editor's Report
   d. Treasurer's Report
   e. Honorary Auditor's Report
   f. GSM Endowment Fund Report
5. Election of Honorary Auditor
6. Other Matters

PERSATUAN GEOLOGI MALAYSIA
GEOLOGICAL SOCIETY OF MALAYSIA (GSM)

MINUTES OF THE 54th ANNUAL GENERAL MEETING

Date: 26th June 2020
Time: 5.00 p.m.
Platform: ZOOM Online Meeting

1. Abd Hanan B Ahmad Nadzeri
2. Abd Rasid Jaapar
3. Abdul Ghani Md Rafek
4. Abdul Halim Abdul Latiff
5. Adila Fateha Bt Abdul Mudtalib
6. Ahmad Ashraf
7. Ahmad Nizam Hassan
8. Ahmad Tariq Ahmad Ziyad
9. Andrew Chan Jon Kit
10. Andy Anderson Bery
11. Askury Abd Kadir
12. Awg Mohd Faizal Awg Mohamad Hamssin
13. Azimah Ali
14. Choo Mun Keong
15. Elvaene James
16. Farah Fazulah Abdullah
17. Fateh Chand, Datuk
18. Felix Tongkul
19. Jeciel Benavidez
20. Jong Tiang Shen (John Jong)
21. Joy Pereira
22. Khor Peng Seong
23. Lim Choun Sian
24. Ling Nan Ley
25. Ling Sin Yi
26. Loganathan Ponnambalam
27. Low Keng Lok
28. Maryam Syazana Dzulkefli
29. Mazlan Madon
30. Mohamad Shaufi Bin Sokiman
31. Mohd Badzran Bin Mat Taib
32. Mohd Hariri Arifin
33. Nicholas Jacob
34. Nur Iskandar Taib
35. Nurfashareena Binti Muhamad
36. Ong Min
37. Roger Yong
38. Sheila Rozalia Binti Abdul Rashid
39. Supriyadi
40. Tan Boon Kong
41. Tan Chun Hock
42. Tanot Unjah
43. Wan Hasiah Abdullah
44. Wong Jing Quan
45. Yunus Abd Razak, Dato'
46. Zainuddin Md Yusoff

1. Welcoming Address by the President for Session 2019/2020

Mr Abd Rasid Jaapar, the President of Geological Society of Malaysia acted as the Chairperson of the AGM and called the meeting to order at 5.00 pm.

2. Adoption of Agenda

The Chairperson tabled the following agenda to the AGM for acceptance:

1. Welcoming Address by the President for Session 2019/2020
2. Confirmation of Minutes of the 53rd AGM
3. Matters Arising
4. Annual Report for Session 2019/2020
   a. President's Report
   b. Secretary's Report
   c. Editor's Report
   d. Treasurer's Report
   e. Honorary Auditor's Report
   f. GSM Endowment Fund Report
5. Election of Honorary Auditor
6. Other Matters

6.1 Formation of IGM-GSM Chapters for Sabah and Sarawak
6.2 Affirmation of Upper Segama Sabah Jurassic and Triassic Granitic Rocks by Radiometric U-Pb Dates
6.3 Reappointing Board of Trustees Members of the GSM Endowment Fund
7. Announcement of New Council for 2020/2021
8. Presidential Address for 2020/2021

The agenda was unanimously accepted.

3. Confirmation of Minutes of the 53rd AGM

The Minutes of the 53rd AGM was tabled for confirmation.
Datuk Fateh Chand proposed that the minutes be confirmed, seconded by Prof. Joy Pereira. The minutes were unanimously confirmed without any amendment.

4. Matters Arising (53rd AGM Minutes)

Matters Arising	Responses
4a. i. NGC to GSM-IGM Conference ii. More activities with USM's Geophysics iii. More geological excursion activities iv. Compilation of geoscience-related thesis titles/ abstracts	i. More involvement with IGM in future NGC, i.e. a session for IGM in NGC and representative in NGC Organisation Committee. ii. There was some communication being carried out and a geological club in USM was planned. iii. A few excursion and fieldtrip activities were carried out during the year. iv. Not yet carried out. A proposal was made to digitilise GSM databases and website in order to store and be able to share to public. A digital library website was proposed.
4b. i. Increase GSM membership ii. Engaging with GSM members iii. Relook into GSM Working Groups	i. There was an improvement and AGM was informed GSM members until end of 2019 is at 762 and at the date of AGM is at almost 1000. ii. The Council was working on the effort to engage GSM members. iii. The AGM was informed the Council would revamp the Working Groups.
4c. Charging fee for publishing in GSM publications	GSM Council proposed to maintain its publications open access and not charging any fee.
4d. i. Usage of GSM fund to promote GSM ii. Provide budget for Working Group activities	i. Effort was made and it was reflected in the annual account. ii. The AGM was informed Working Groups were asked to propose budget for their activities in the early year and detailed budget for specific activities.
4f. Recommendations from GSM Endowment Fund's Board of Trustees	This section to be reported under GSM Endowment Fund agenda.
7a. GSM Digital Publications	The AGM was informed it had been carried out with gradually reducing its paper-prints.
7b. Meeting Allowances	Approved by the 53rd AGM but no claim was made so far.
7c. ASEAN Federation of Geoscience Organisations (AFGO)	The Council reported, the item was expected to be discussed during GEOSEA 2020 but the event had been postponed due to COVID-19.

No comment from members of AGM.

Information

5. Annual Report for Session 2019/2020

a. President's Report
Abd Rasid Jaapar tabled the President's Report.
The AGM discussed the following matters:
• Prof Joy Pereira commended on the successful establishment of Malaysian Geoscience Consultants and Services Association (MyGeo), also suggested that the final remark in the report "… GSM, IGM, BOG and new comer, MyGeo and of course, under the umbrella of JMG should come together to develop a solid National Geoscience

Policy/Agenda, …" , and proposed that "work closely in partnership with JMG" would be more concise.
• Dato' Yunus Abdul Razak proposed GSM should connect to young geologists and active in Young Earth Scientists (YES) Network.

Action: Incoming Council

Dr Abdul Ghani Md Rafek proposed that the President's Report to be accepted, seconded by Mr Nicholas Jacob and Mr Abd Hanan B Ahmad Nadzeri.

b. Secretary's Report

Lim Choun Sian tabled the Secretary's Report and Assistant Secretary's Report.
The AGM discussed the following matters:
• Prof Joy Pereira and Dato' Yunus Abdul Razak proposed to add that GSM as the GEOSEA Secretariat.

Action: Incoming Council

Prof Joy Pereira proposed that the Secretary's Report to be accepted, seconded by Dato' Yunus Abdul Razak and Datuk Fateh Chand. Mr Abd Hanan B Ahmad Nadzeri proposed that the Assistant Secretary's to be accepted, seconded by Dato' Yunus Abdul Razak and Dr Abdul Ghani Md Rafek.

c. Editor's Report

Wan Hasiah Abdullah tabled the Editor's Report.
The AGM discussed the following matters:
• Mr Askury Abd Kadir suggested GSM Bulletin to be link up with AAPG. Suggestion via text message in ZOOM: Mr Askury Abd Kadir proposed an Honorarium for Chief Editor (TBC in constitution).

Action: Incoming Council

Dr Abdul Ghani Md Rafek proposed that the Editor's Report to be accepted, seconded by Mr Abd Hanan B Ahmad Nadzeri.

d. Treasurer's Report

It was reported under 4(e), see item 4(e).

e. Honorary Auditor's Reports

Ahmad Nizam Hasan tabled the Treasurer's Report and Honorary Auditor's Report.
The AGM discussed the following matters:
• In general the AGM proposed for more monies to be invested for the advancement of its infrastructures for GSM members.
• Prof Joy Pereira proposed to set up a place with a computer for members to do referencing from UM digital library online subscription.
• The Council and members proposed an upgrade to GSM website to add search function (search engine) towards materials and publication in a web-based digital library, i.e. effective search function, collection of thesis titles from local geology universities. That would need some "investment' from GSM fund to carry out a major overhaul of its current website.

Action: Incoming Council

Datuk Fateh Chand proposed that the Treasurer's and Honorary Auditor's Report to be accepted, seconded by Mr Abd Hanan B Ahmad Nadzeri.

f. GSM Endowment Fund Report

Datuk Fateh Chand, Chairman in Board of Trustees of the GSM Endowment Fund, tabled the GSM Endowment Fund Report and Recommendations from the Board of Trustees (Appendix A).
Dato Yunus proposed that report and recommendations from the Board of Trustees to be accepted by AGM, Mr Abd Hanan B Ahmad Nadzeri seconded.

Action: Incoming Council

6. Election of Honorary Auditor

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

Action: Incoming Council

7. Other Matters

Matters and Responses:

7.1 Formation of IGM-GSM Chapters for Sabah and Sarawak

The AGM in principal agreed to the proposal. The Council to report on the term of references and financial commitment of the formation.

Action: Incoming Council

7.2 Affirmation of Upper Segama Sabah Jurassic and Triassic Granitic Rocks by Radiometric U-Pb Dates.

Mr Leong K.M., the proposer of the agenda, was absent at the AGM. No discussion was made.

Information

7.3 Reappointing Board of Trustees Members of the GSM Endowment Fund

Due to the COVID-19 pandemic, many meetings were suddenly made not feasible to be carried out. The Council proposed for the Board of Trustees Members of the GSM Endowment Fund that due in the year 2020 to be maintained. The AGM approved to the reappointing of the Chair and members the GSM Endowment Fund committee for another term.

Action: Incoming Council

8. Announcement of New Council for 2020/2021

Election Committee chaired by Dr. Mazlan Madon, scrutinised by Prof. Azman Abd Ghani and Assoc. Prof. Dr. Ng Tham Fatt.

President	: Mr. Abd. Rasid Jaapar (Geomapping Technology)
Vice-President	: Mr. Ahmad Nizam Hasan (GeoSolution Resources)
Immediate Past President	: Dr. Mazlan Madon (Consultant)
Secretary	: Ms. Farah Fazulah Abdullah
Assistant Secretary	: Ms. Norazianti Asmari (GDS Sdn Bhd)
Treasurer	: Dr. Lim Choun Sian (UKM)
Editor	: Prof. Wan Hasiah Abdullah (UM)

Councillors 2020/2022:

Mr. Ahmad Tariq Ahmad Ziyad (Orogenic Resources Bhd)
Mr. Awg Mohd Faizal Awg Mohamad Hamssin
Ms. Maryam Syazana Dzulkefli
Mr. Tan Chun Hock

Councillors 2020/2021:

Prof. Joy Jacqueline Pereira (SEADPRI-UKM)
Dr. Nur Iskandar Taib (UM)
Mr. Tan Boon Kong (Consultant)
Dato' Yunus Abdul Razak (SEADPRI-UKM)

Information

9. Presidential Address for 2020/2021

The President, Abd Rasid Jaapar expressed that it is a great honour for him to be re-elected to serve as the President and followed by delivering his inaugural speech. He pledged that he and the new Council would try their best to serve for the good of the Society.

The AGM adjourned at 7:00 pm.

LIM CHOUN SIAN
Secretary 2019/2020
26 June 2020

PRESIDENT'S REPORT 2020/2021

1.0) INTRODUCTION

The Geological Society of Malaysia (GSM) has sustained its objective of actively promoting the advancement of the geological sciences in the country and the region. Over the past year, GSM continued with activities that were designed to strengthen the capacity of geoscientists and had embarked on initiatives to formalise collaborations and alliances with key institutions within the geoscience fraternity. The pandemic covid-19 really holding us back in many ways. The year 2020 was very quiet for GSM. Most of events has been organised or to be organised virtually. This is a new normal that we have to live in. Soon, all events may be organised in hybrid format, partly face to face and partly online.

2.0) PROMOTION AND COLLABORATIONS

The IGM-GSM Joint Committee had met virtually once over the year on Monday, 19 April 2021. The Joint Committee will continue to oversee the collaboration between the two institutions, especially on capacity building, outreach & promotion and geoscience policy. Recently IGM-GSM JC has agreed to embark into entry level training and mentor-mentee programme.

GSM has signed MOU with the following local universities:

i) Universiti Malaysia Kelantan (UMK) on 30th May 2019
ii) University of Malaya (UM) on 8th October 2019
iii) Universiti Kebangsaan Malaysia on 15th June 2020

GSM also has signed a MOU with Society of Exploration Geophysicists (SEG) in June 2017.

GSM has commissioned the Geological Student Club of UMS to be the first GSM Students Club' @ UMS. All GSM Students Club will receive financial support of RM2,000 per year to organise activities and events related to advancement of geoscience knowledge and the promotion of geoscience. GSM also organised Convention for Future Leaders on Geoscience on 25 February 2021. The participants were the leaders of geological clubs at local universities. Trust GSM can tap future members and future leaders at very early stage even before students enter the real-world challenge. The President and/or appointed Council Members will continue to visit as many geological departments in local universities possible throughout the year. The visit to Universiti Sains Malaysia and Curtin University, Sarawak has yet to be materialised.

3.0) KEY PERFORMANCE INDICATORS FOR GSM

3.1) Activities and Participations

3.1.1) National Geoscience Conference (NGC)

Pandemic Covid-19 has affected most of our daily activities including our 33rd National Geoscience Conference & Exhibition 2020 (NGC2020) with the theme 'Urban Geoscience and IR4.0' was postpone to 2021 and known as NGC2020/21 to reflect single conference for two different years. NGC2020/21 was a virtual conference and successfully co-organised with Universiti Kebangsaan Malaysia (UKM), Universiti Tenaga Nasional (UNITEN) and Jabatan Mineral dan Geosains Selangor dan Wilayah Persekutuan between 5th and 6th April 2021. Four post-conference workshops were organised between 7th and 8th April 2021. The events were organised in April in conjunction with Geologists Day celebration on 4th April 2021 and Earth Day on 22nd April 2021.

For the first time, the Prof. H. D. Tjia Memorial Lecture was introduced. The lecture for this inaugural event was delivered by Emeritus Professor Dato' Dr. Ibrahim Komoo. We also have 3 international experts as keynote speakers besides the Director General of Malaysian Space Agency (MySA).

The 34th National Geoscience Conference & Exhibition 2022 (NGC2022) will be co-organised with Jabatan Mineral dan Geosains Sarawak in October 2022 in Miri, Sarawak with the theme of 'Geoscience, Geotourism and Georesources'.

3.1.2) Field Excursions

I will maintain my use of old adage that 'the best geologist is (the one) who has seen the most geology' (Read, 1940). Unfortunately, due to Covid-19 pandemic, most of planned field excursion activities has to be postponed or cancelled. GSM will pursue further on similar activities like this even to other countries.

3.1.3) GEOSEA

GSM continued to be the secretariat for the Regional Congress on Geology, Minerals and Energy Resources of Southeast Asian (GEOSEA) until 2022. The 16th edition of the Congress or GEOSEAXVI which was supposed to be organised in December 2020 has been postponed to December 2021. It will be hosted by the Geological Society of the Philippines (GSP) scheduled to be in full virtual format with the theme of '5+1 years after ASEAN integration: Milestones, Challenges and Perspectives for Geoscientists'.

Four founding members of GEOSEA, i.e. GSM, GSP, GST and IAGI has signed a MOU for the establishment of ASEAN Federation of Geoscience Organisation (AFGeo) on 7th April 2021. Next will be the roadmap for ASEAN Register of Professional Geologists.

We also proposed to change the name of Regional Congress on Geology, Minerals and Energy Resources of Southeast Asian to 'Regional Geoscience Congress of Southeast Asia' with the same abbreviation of GEOSEA to reflect the vast expansion of application of geoscience in many aspects, activities and industries.

The 17th GEOSEA will be organised by GSM in Miri, Sarawak in October 2022. We are planning to organise a joint conference featuring NGC2022 and IGM's SGP2022 with a week full of geoscience activities. Announcement will be made soon by the upcoming President.

3.1.4) CCOP

GSM will continue to remain as observer status in CCOP and be part of Malaysian delegations as agreed by Director-General of Jabatan Mineral dan Geosains Malaysia (JMG) in 2018. Trust GSM members will benefit from the many events organised by CCOP.

3.2) Publications

E-publication initiative really helps improving our financial status greatly. The Editorial Committee will continue to improve and upgrade our Warta Geologi which is published three times a year now to be Scorpus-indexed. The Bulletin of the Geological Society of Malaysia, consistently published twice a year now and on the right track to achieve ISI-index status. The index will ensure our Bulletin to become one of the sought-after publications in this region by researchers and readers.

I would like to thank Editorial Committee lead by Prof. Dr. Wan Hasiah as Editor, Associate Professor Dr. Ng Tham Fatt as the Managing Editor for the Bulletin and Puan Wan Aida as the Editorial Executive for their tireless efforts.

3.3) Membership

My initial target that GSM may achieve 1,000 memberships by the end of 2020 is materialised. GSM membership is now standing at 1,097 as at 31 December 2020. The challenge now is on how to maintain and/or increase the numbers.

3.4) Financial and/or Asset Management

Same as previous year, I strongly urge the members of GSM to support on the improvement on the management of GSM. We need to manage GSM professionally like a business entity, with more full-time staffs. Upcoming GSM Council must be ready with succession plan for our only secretariat, Madam Anna Lim.

Website Sub-committee under Dr. Lim Choun Sian is in the process to re-vamp GSM website to be more user-friendly with members and visitors. The new website will incorporate on-line payment, on-line technical papers submission, easier access to publications and other interactive system.

4.0) CONCLUDING REMARKS

Since this will be my final term as the President of GSM, I would like to thank all GSM members for the trust and continuous support that I received. I would like to thank the outgoing council members for the contributions. Thanks to all organising chairs and working group chairs. Last but not least, a big thank you to the one and only secretariat member, Ms Anna Lee for another excellent year of contribution. I am really going to miss the moment when we have different in opinions.

I am glad that new leadership of JMG as well as BOG have taken several steps that I believe will benefit geoscience fraternity.

As a final remark, I used 'Better Practice through Research' as one of my business tag line which I believe research or improvement of knowledge and practice are inseparable. I also believe that academic and industry should walk hand in hand. Therefore, I also believe that one day, when all of us are ready, the GSM and IGM should be merged into single entity so that we are more focus on our existence and purposes.

Prepared by:
Abd Rasid Jaapar
President 2020/2021
30 April 2021

SECRETARY'S REPORT 2020/2021

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 2020/2021.

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 10 Working Groups, and an Editorial Committee (formerly known as Editorial Group). There is no regional representative as of this term. The Working Groups were increased from 9 to 10 in the year 2020, details to be table out in subsequent section.

The Council

The Council for the Geological Society of Malaysia for 2020/2021 session resumed their office after the 54th AGM on the 26 June 2020. Council for 2021/2022, upon the closing of nominations, only single nominations were received respectively for the positions of President, Vice President, Secretary, Treasurer, Assistant Secretary, Editor and Councillors.

The Council for 2020/2021 are:

President	:	Mr. Abd Rasid Jaapar (Geomapping Technology)
Vice-President	:	Mr. Ahmad Nizam Hasan (GeoSolution Resources)
Immediate Past President	:	Dr. Mazlan Madon (Consultant)
Secretary	:	Ms. Farah Fazulah Abdullah
Assistant Secretary	:	Ms. Norazianti Asmari (GDX Sdn Bhd)
Treasurer	:	Dr. Lim Choun Sian (UKM)
Editor	:	Dr. Wan Hasiah Abdullah (UM)

Councillors 2020-2022:

- Mr. Ahmad Tariq Ahmad Ziyad (Orogenic Resources Bhd)
- Mr. Awg Mohd Faizal Awg Mohamad Hamssin (Vale)
- Ms. Maryam Syazana Dzulkifli (Petronas)
- Mr. Tan Chun Hock (Shell)

Councillors 2020-2021:

- Prof. Joy Jacqueline Pereira (SEADPRI-UKM)
- Dr. Nur Iskandar Taib (UM)
- Mr. Tan Boon Kong (Consultant)
- Dato' Yunus Abdul Razak (SEADPRI-UKM)

Council Meetings

During the 2020/2021 session, given the pandemic of COVID-19 circumstances, virtual meeting was preferred and held on various times. The Council met virtually 5 times. The attendance of the council members to the meetings is presented in the table below:

Attendance of Council Members at Council Meetings:

	Name	1 (Zoom)	2 (UM & Zoom)	3 (Zoom)	4 (Zoom)	5 (Zoom)	Total
1	Mr. Abd Rasid Jaapar	/	0	/	/	/	4 / 5
2	Mr. Ahmad Nizam Hasan	/	/	/	/	/	5 / 5
3	Dr. Mazlan Madon	/	/	/	/	/	5 / 5
4	Ms. Farah Fazulah Abdullah	/	/	/	/	/	5 / 5
5	Ms. Norazianti Asmari	/	/	/	/	/	5 / 5
6	Dr. Lim Choun Sian	/	/	/	/	/	5 / 5
7	Dr. Wan Hasiah Abdullah	/	/	/	/	/	5 / 5
8	Mr. Ahmad Tariq Ahmad Ziyad	/	/	/	/	/	5 / 5
9	Awg Faizal Awg Hamssin	/	/	0	0	0	3 / 5
10	Maryam Syazana Dzulkifli	/	/	/	/	/	5 / 5
11	Tan Chun Hock	/	/	/	/	0	4 / 5
12	Prof. Joy Jacqueline Pereira	/	/	/	0	/	4 / 5
13	Dr. Nur Iskandar Taib	/	0	/	/	/	4 / 5
14	Mr. Tan Boon Kong	/	/	0	/	/	4 / 5
15	Dato' Yunus Abdul Razak	0	/	/	/	/	4 / 5

Four (4) meetings were conducted via online Zoom Meeting and one (1) was attempted via hybrid, of meeting room at the of the Department of Geology, University of Malaya, Kuala Lumpur, with online option at the other end. However, the network issue remain as constant obstacle that the council decided on reverting to virtual option.

Working Groups

The Working Groups and the Chairs for the session were appointed during the Council Meeting as follows:

	WORKING GROUP	Chairpersons
1	Engineering Geology, Hydrogeology & Environmental Geology	Tan Boon Kong
2	Promotion of Geoscience, Social Media & Digital Content	Ms Azianti Asmari
3	Economic Geology & Mineral Resources	Dr. K.K. Cheang
4	Regional Geology	Askury Abd Kadir
5	Geophysics	Jamaluddin Othman
6	Petroleum Geoscience	Tan Chun Hock
7	Young Geologist & Student outreach	Maryam Dzulkifli
8	GSM-IGM Joint Committee	Ahmad Nizam Hassan
9	IT & Website	Dr. Lim Choun Sian
10	GSM-IGM Flagship on Geoscience to Action for Disaster Risk Reduction (G2A4DRR)	Prof Joy Pereira

Membership

As at 31st December 2020, the total number of members in the Society stands at 1099, has increased from 762 as of 2019. The increase is mainly from Student category and slight drop decrease in Full Member category. The table below presents the breakdown in membership categories and their geographical breakdown.

Breakdowns of Membership:

COUNTRY	Hon	Life	Full	Assoc.	Student	Inst.	Total 2020	Total 2019	Total 2018
Malaysia	12	400	127	2 (9)	472 (145)	-	1013	672	561
Australia	1	17 (20)	-	-	-	-	18	22	20
Bangladesh	-	1	-	-	-		1	2	2
Brunei	-	2	-	-	-		2	2	1
Canada	-	3	-	-	-		3	2	1
China	-	1	-	-	-		1	1	3
Europe	-	14 (11)	-	-	-	3 (3)	17	15	13
Hong Kong	-	1	-	-	-		1	1	2
India	-	1	-	-	-		1	1	1
Indonesia	-	8	-	-	0 (3)		8	10	3
Japan	-	3	-	-			3	3	2
Libya	-	3	-	-			3	3	2
New Zealand	-	2	-	-			2	2	-
Philliphines	-	2	-	-			2	1	2
Qatar	-	1	-	-			1	0	-
Singapore	-	9	-	-			9	9	8
Thailand	-	2	-	-			2	3	3
USA	-	11	-	-	1		12	12	7
Total 2020							**1099**		
Total 2019	13	465	122	10	149	3		**762**	-
Total 2018	12	435	92	9	138	3		-	**689**

Note : i) (X)Y , Whereby X is current year and Y is previous year numbers.
Country listed are based on mailing address, not Nationality-based

Project, Agreement, Secretariat and Activity

Research Project:

GSM is one of the partners in the research project on Disaster Resilient Cities: Forecasting Local Level Climate Extremes and Physical Hazards for Kuala Lumpur, led by SEADPRI-UKM that received funding from the Newton-Ungku Omar Fund.

GSM's role is to benchmark the process and guide knowledge transfer in the research. The project supported the GSM-IGM Flagship on Geoscience to Action for Disaster Risk Reduction (G2A4DRR).

Agreements:

Two (2) MoU's were inked within this Council Year, which was done virtually.

- GSM x GEOSEA
- GSM X UKM

We are also in discussion with UMS for an MoU.

Joint Secretariat:

This Council year, the GSM-IGM Joint Committee met on 27 Nov 2020 and 19th April 2021. The Joint Committee, an initiative under an 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. The meetings discussed on future joint organisation of NGC, technical talks, geoscience curricula and continuous professional development program.

Activities:

Bil	Date	Activity	Topic	Venue	Collaborators
1	15-Nov-19	Hotspring Hunting Field Trip	Geo Hike	Perak	-
2	Apr-20	National Geology Photography Competition(NGPC)	Competition	-	-
3	20 & 21 Nov 2020	Webinar Geo Career Talk 2020	Webinar	Zoom	IDRC, UKM, UM, UTP, UMT, Academy GEX.
4	3-Dec-20	Advance Seminar on Economic Geology & Mineral Resources in Supporting Malaysia's Growth and Development	Online	Zoom	Malaysia Chamber of Mine, Institute of Mineral Engineer Malaysia, IGM, GSM, UMP,USM
5	25-Feb-21	Convention for Future Leaders in Geoscience	Online	Zoom	
6	22-Mar-21	Seminar on Coastal & Marine Geology	Online seminar	Zoom	IGM, UMT, Geodream.
7	05 – 09 April 2021	NGC 2020/2021: 33rd National Geoscience Conference & Exhibition	Online conference	Zoom	JMG, UNITEN, UKM
8	14-Apr-21	Seeing Through The Earth's Crust: Modelling Magma Propagation Using Gelatine Dr. Suraya Hilmi Hazim	Technical Talk	Zoom	Geology Programme, UKM
9	22-Apr-21	GSM Heals the Earth Campaign in commemoration of Earth Day 2021	Online competition	Online	-

Despite the movement restriction, the society has successfully organised its Virtual 33rd National Geoscience Conference & Exhibition 2020 (NGC2020) in April 2021 with the theme 'Urban Geoscience and IR4.0" with the collaboration of Universiti Kebangsaan Malaysia and Jabatan Mineral dan Geosains.

Eight (8) technical session was held with four (4) post-conference workshops were organised between 5th and 8th April 2021.

Working Group Activities:

	WORKING GROUP	Activity
1	Engineering Geology, Hydrogeology & Environmental Geology	N/A
2	Promotion of Geoscience, Social Media & Digital Content	• Webinar Geo-Career Talk 20th Nov & 21st Nov 2020. • Bantuan Komputer riba GSM March 2021 • GSM Survey Analysis on GSM Membership
3	Economic Geology & Mineral Resources	• Advanced Seminar on Economic Geology and Mineral Resources (26th Nov 2020)
4	Regional Geology	• GeoXPDC@Bentong-Raub Suture, postponed to 2021 & cancelled.
5	Geophysics	N/A
6	Petroleum Geoscience	• Extended invitation to members for virtual talks/conferences from various sources
7	Young Geologist & Student outreach	• Convention for Future Leader in Geoscience (February 2021). • Converting student membership to full membership. • #GSMRestoreOurEarth campaign through digital media (Ongoing)
8	GSM-IGM Joint Committee	• IGM-GSM JC Meeting 27th Nov 2020 • IGM-GSM JC Meeting 19th April 2021
9	IT & Website	Conceptualize next website design.
10	GSM-IGM Flagship on Geoscience to Action for Disaster Risk Reduction (G2A4DRR)	• Training on DDR & Climate Change

GSM Awards

GSM has set up numerous awards for members, namely Hutchison Best Student Award and N.S. Haile Publication Award. Here are the awards given by the Society for the year 2020:

- N.S HAILE PUBLICATION AWARD 2020 : Yeng Yu He
- HUTCHISON BEST STUDENT AWARD 2020 : Mohd Adli Zikry Mohd Norzaidi (UKM)
- HUTCHISON BEST STUDENT AWARD 2020 : Noor Mohamed Mohd Kassim (UM)
- HUTCHISON BEST STUDENT AWARD 2020 : Chang Shen Chang (UMK)
- HUTCHISON BEST STUDENT AWARD 2019 : Carel Tan (UKM)
- HUTCHISON BEST STUDENT AWARD 2020 : Nur Khaleeda Muhamad Adzrill (UM)

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)
- Formation Evaluation Society Malaysia (FESM)
- American Association of Petroleum Geology (AAPG)
- Newton Ungku Omar Fund and IGM-GSM Flagship since July 2015
- GEOSEA
- MoU with NrgEdge, University of Malaya, Universiti Malaysia Kelantan
- Asian Network on Climate Science and Technology, and Newton-Ungku Omar project partners
- Society of Exploration Geophysicists (SEG)
- For the Student's Geological Club Collaboration; AAPG Student Chapter of University of Malaya, UMK, UMS etc.

Acknowledgement

The Society would like to record its utmost appreciation to all the individuals and organisations in supporting the virtual activities (NGC). 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, ANCST and Newton-Ungku Omar project partners is recorded with gratitude. The unwavering support of Ms. Anna Lee and Ms Wan Aida 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, and special mention to Dr. Lim Choun Sian (previous secretary, currently treasurer) on your guidance, reminder and support throughout the session.

FARAH FAZULAH ABDULLAH
Secretary 2020/2021
Geological Society of Malaysia

ASSISTANT SECRETARY'S REPORT

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 2020 (Bulletin only)

Publications	Sales 2020	Stock remaining by end of 2020	Remarks
Bulletin 1	Out of Stock		
Bulletin 2	0	164	
Bulletin 3	0	126	
Bulletin 4	0	40	
Bulletin 5	Out of Stock		
Bulletin 6	0	361	
Bulletin 7	0	220	
Bulletin 8	Out of Stock		
Bulletin 9	Out of Stock		
Bulletin 10	Out of Stock		
Bulletin 11	Out of Stock		
Bulletin 12	Out of Stock		
Bulletin 13	Out of Stock		
Bulletin 14	Out of Stock		
Bulletin 15	Out of Stock		
Bulletin 16	Out of Stock		
Bulletin 17	Out of Stock		
Bulletin 18	Out of Stock		
Bulletin 19	0	341	
Bulletin 20	0	294	
Bulletin 21	0	93	
Bulletin 22	0	170	
Bulletin 23	0	183	
Bulletin 24	0	342	
Bulletin 25	0	50	
Bulletin 26	0	150	
Bulletin 27	0	24	
Bulletin 28	0	59	
Bulletin 29	0	74	
Bulletin 30	0	100	
Bulletin 31	0	76	
Bulletin 32	0	50	
Bulletin 33	0	208	

Bulletin 34	0	29	
Bulletin 35	Out of Stock		
Bulletin 36	0	62	
Bulletin 37	0	114	
Bulletin 38	0	180	
Bulletin 39	Out of Stock		
Bulletin 40	0	64	
Bulletin 41	Out of Stock		
Bulletin 42	0	Out of Stock	
Bulletin 43	0	96	
Bulletin 44	0	14	
Bulletin 45	Out of Stock		
Bulletin 46	Out of Stock		
Bulletin 47	Out of Stock		
Bulletin 48	0	6	
Bulletin 49	0	268	
Bulletin 50	0	305	
Bulletin 51	0	178	
Bulletin 52	0	192	
Bulletin 53	0	290	
Bulletin 54	0	240	
Bulletin 55	0	264	
Bulletin 56	0	312	
Bulletin 57	0	23	
Bulletin 58	0	Out of Stock	
Bulletin 59	0	77	
Bulletin 60	0	78	
Bulletin 61	0	38	
Bulletin 62	Out of Stock		
Bulletin 63	Out of Stock		
Bulletin 64	Out of Stock		
Bulletin 65	0	688	
Bulletin 66	0	689	
E-Bulletin 67	0	36	
E-Bulletin 68	0	36	
Bulletin 69	4	33	5 copies to National Library
Bulletin 70	4	33	8 copies to Minister of Internal Affairs

Sales and stock of publications for 2020 (All other GSM publications)

Other Publications	Sales 2020	Stock remaining by end of 2020
Proceeding AGC 2000	Out of Stock	
Proceeding AGC 2001	0	102
Malaysian Stratigraphic guide	Out of Stock	
Lexicon of stratigraphy	Out of Stock	
Stratigraphic correlation	Out of Stock	
Rocks poster	Out of Stock	
Geology of Borneo (CD)	Out of Stock	
Geology of Borneo (Map)	0	682
Geol. Evolution of SEA	9	412
Geology of P. Malaysia	61	398

There was a consensus decision made to digitize the Bulletin as of 2019, E-Bulletin 67 onwards, only 50 hard printed copies with limited distribution to standing orders subscribers.

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

NORAZIANTI BINTI ASMARI
Assistant Secretary 2020/2021
Geological Society of Malaysia

EDITOR'S REPORT

In 2020, the publication frequency of Warta Geologi was revised, from 4 to 3 times, with the first publication i.e. Warta Geologi volume 46 no. 1 in April, number 2 in August and the third in December. Two volumes of the GSM Bulletin (Volume 69 and 70) were published, and thus the status of publication is currently up to date. The publication months of the Bulletin was also revised to May and November, beginning 2020. The Society is grateful to authors for their contributions, the reviewers for their time and effort to improve the quality of the Society's publications, and members of the Editorial Board for their support. The reviewers for the 2020 Bulletin and Warta issues are as listed in Warta Geologi volume 47(1). At present, all issues of the Bulletin and Geological Notes and Other Notes from Warta Geologi of volume 44 onwards are available from the MyJurnal repository site.

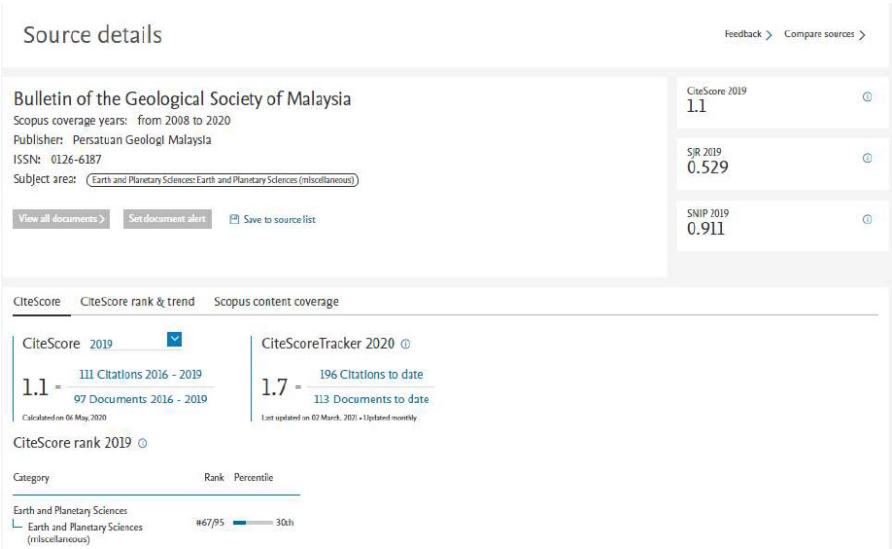
The GSM online publication website is now in its 8th year. In 2020, the website was viewed by more than 62,500 visitors (with an average of 5,220 visitors/month) from more than 120 countries (mainly Malaysia, United States, Iraq, Indonesia, China, Russia, Canada, Japan, Great Britain and some unknown localities), with 41,441 views/downloads.

WoS indexing

The application for indexing of the Bulletin in the Web of Science will be pursued in 2021. The Editorial Committee will submit the volume 71 Bulletin of 2021 for revaluation.

Impact factor of the Bulletin

Total CiteScore and recent citation (2016-2019; updated by Scopus on 2/03/2020) is as shown below:



May I take this opportunity to thank all the editorial committee members for their assistance during the editorial process.

WAN HASIAH ABDULLAH
Editor 2020/2021
Geological Society of Malaysia

TREASURER'S REPORT

For the Financial Year 2020, the society posted a net surplus of RM 5,134 compared to RM 42,588 year 2019. Comparatively, the 2020 surplus was higher than 2019 where in the year 2020 there was no withdrawal of RM 50,000 from Endowment Fund as GSM Council had withdrawn in 2019. If we did, that would be an equivalent surplus of 29% higher than the previous year.

Total income for year 2020 was RM 77,364 in 2020 as compared to RM 161,972 in 2019. Total operating expenditure decreased from RM 119,112 (year 2019) to RM 72,099 (year 2020).

Operating revenue and expenditure showed a reduction due to restriction of operation under COVID-19 pandemic. Thus, a decline to the norm of carrying out society activities in physical. In addition, much decline in interest rates in fixed deposits, reduced the income from bank interest, from RM 18,194 (year 2019) to RM 13,075 (year 2020).

Membership subscription also dropped slightly from RM 17,585 (year 2019) to RM 16,211 (year 2020). This could be due to no National Geoscience Conference was held for that year; partly Full Members gradually converting to Life Members; and lesser society activities during COVID-19 decreased enrolment of new membership.

Sales of publication in the form of royalty, shows a consistency increases since last few years. Sales of publications was RM 41,060 (year 2020) compared to RM 34,781 (year 2019), Note, the classification of "Sales of Bulletin and Warta Geologi" in the year 2020 was previously subsumed under the "Sales of Publication" in the year 2019.

Further (70%) saving was visible under the Printing of Warta Geologi and Bulletin, were reduced respectively to RM 6,200 and RM 7,175, as compared to RM 19,625 and RM 25,650 for year 2019. This also reduced the postage significantly from RM1,748 (year 2019) to RM 316 (year 2020).

However, regardless the Sales of Publication showing a promising trend, the Publication unit of GSM in its own is still at deficit. In the year 2020, the "red" was approximately RM 30,000 (38%) which the larger portion include allowances for human resource and electronic journal publishing including its websites for publication and submission. It still relies greatly on the funding from GSM Endowment Fund and shared resources from projects jointly carried out with SEADPRI-UKM.

GSM should look into the long term sustainability of the Publication unit via infrastructure, info- structure, content building and human resource investment as well as revenue optimisation (with knowledge generation in mind for members) from publication and activities via seminars, talks and programmes to cater for Continuous Professional Development for Board of Geologists Malaysia in virtual or physical environment.

The Treasurer would like to express a great appreciation to the donors, sponsors and all parties on their contributions and supports throughout the year. Last but not least to Ms Anna Lee on her contribution managing the accounts and many miscellaneous throughout the year.

LIM CHOUN SIAN
Treasurer 2020/2021
Geological Society of Malaysia

HONORARY AUDITOR'S REPORT

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

FINANCIAL STATEMENTS
31 DECEMBER 2020

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

THE COUNCIL MEMBERS INFORMATION FOR 2020 / 2021

President	:	Mr. Abd Rasid Jaapar (Geomapping Technology)
Vice President	:	Mr. Ahmad Nizam Hasan (GeoSolution Resources)
Immediate Past President	:	Dr. Mazlan Madon (Consultant)
Secretary	:	Farah Fazullah Abdullah (Consultant)
Assistant Secretary	:	Norazianti Asmari (Geoxpert Sdn Bhd)
Treasurer	:	Dr. Lim Choun Sian (UKM)
Editor	:	Prof Dr Wan Hasiah Abdullah (Consultant)
Councillors	:	Mr. Tan Boon Kong (Consultant)
	:	Dr. Nur Iskandar Taib (UM)
	:	Joy Jacqueline Pereira (LESTARI-UKM)
	:	Dato' Yunus Abdul Razak (LESTARI-UKM)
	:	Mr. Ahmad Tariq Ahmad Ziyad (Orogenic Resources Bhd)
	:	Awg Mohd Faizal Awg Mohamad Hamssin (Vale Malaysia Minerals)
	:	Maryam Syazana Dzulkefli (Petronas Carigali)
	:	Tan Chun Hock (Shell)

PERSATUAN GEOLOGI MALAYSIA
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(Registered in Malaysia)

FINANCIAL STATEMENTS
31 DECEMBER 2020

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

COUNCIL'S REPORT

The Council hereby present their report together with audited financial statements of the Society for the financial year ended 31 December, 2020.

PRINCIPAL OF ACTIVITY

The principal activity of the Society is to promote the advancement of the geological sciences in Malaysia. There has been no significant changes in the nature of this activity during the year.

RESULT

Net surplus for the year	RM5,134

There were no material transfer to or from reseves or provisions during the financial year.

In the opinion of the Council, the results of the operations of the Society during the year were not substantially affected by any item, transaction or event of a material and unusual nature.

COUNCIL MEMBERS

The names of the Council Members of Persatuan Geologi Malaysia in office since the date of the last report are:-

Abd Rasid Jaapar
Ahmad Nizam Hasan
Ahmad Tariq Ahmad Ziyad
Awg Mohd Faizal Awg Mohamad Hamssin
Farah Fazullah Abdullah
Joy Jacqueline Pereira
Lim Choun Sian
Mazlan Madon
Maryam Syazana Dzulkefli
Norazianti Asmari
Nur Iskandar Taib
Tan Boon Kong
Tan Chun Hock
Wan Hasiah Abdullah
Yunus Abdul Razak

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PERSATUAN GEOLOGI MALAYSIA
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COUNCIL'S BENEFITS

Neither at the end of the financial year, nor at any time during that year, did there subsist any arrangement to which the Society was a party, whereby the Council Members might acquire benefits by means of the acquisition of interest in the Society or any other body corporate.

Since the end of the previous financial year, no Council Member has received or become entitled to receive a benefit by reason of a contract made by the Society or a related corporation with any Council Member or with a firm which he is a member, or with a Company in which he has a substantial financial interest.

COUNCIL'S INTEREST

None of the Council Members in office since at the end of the financial year had any interest in the Council or its related corporations during the financial year.

COUNCIL'S REMUNERATION

None of the Council Members in office since at the end of the financial year had received any remunerations from the Society or its related corporations during the year.

OTHER STATUTORY INFORMATION

(I) AS AT THE END OF THE FINANCIAL YEAR

(a) Before the financial statements were made out, the Council Members took reasonable steps:-

(i) to ascertain that proper action had been taken in relation to the writing off of bad debts and satisfied themselves that there were no known bad debts and that no provision for doubtful debts was necessary; and

(ii) to ensure that any current assets which were unlikely to realise their values as shown in the accounting records in the ordinary course of business had been written down to an amount which they might be expected so to realise.

(b) At the date of this report, the Council are not aware of any circumstances not otherwise dealt with in this report or the financial statements of the Society which would render:

(i) it necessary to write off any bad debts or to make any provision for doubtful debts in respect of the financial statements of the society; and

(ii) the values attributed to current assets in the financial statements of the Society misleading.

PERSATUAN GEOLOGI MALAYSIA
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(c) As the date of this report, the Council Members are not aware of any circumstances which have arisen which would render adherence to the exiting method of valuation of assets or liabilities of the Society misleading or inappropriate.

(d) As the date of this report, the Council Members are not aware of any circumstances not otherwise dealt with in this report or to the financial statements of the Society which would render any amount stated in the financial statements misleading.

(e) As at the date of this report, there does not exist:

(i) any charge on the assets of the Society which as arisen since the end of the financial year which secures the liabilities of any other person; or

(ii) any contingent liability in respect of the Society which has arisen since the end of the financial year.

(f) In the opinion of the Council Members:

(i) no contingent liability or other liability has become enforceable, or is likely to become enforceable, within the period of twelve months after the end of the financial year which will or may affect the ability of the Society to meet its obligations as and when they fall due; and

(ii) no item, transaction or event of a material and usual nature has arisen in the internal between the end of the financial year and the date of this report which is likely to affect substantially the results of the Society for the financial year in which this report is made.

(II) SIGNIFICANT EVENT

The significant event during the year is disclosed in Note 15 to the financial statements.

PERSATUAN GEOLOGI MALAYSIA
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AUDITORS' AND AUDITORS' REMUNERATION

The auditors Messrs S.F. Lee & Co. have expressed their willingness to continue in office,

Auditors' remuneration of the Society for the financial year ended 31 December 2020 is RM1,500/-

Signed on behalf of the Council in accordance with a resolution of the Council dated 05 APR 2021

Abd Rasid Jaapar
President

Lim Choun Sian
Treasurer

Kuala Lumpur, Malaysia

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PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)
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STATEMENT BY COUNCIL PURSUANT TO SECTION 251(2) OF THE COMPANIES ACT, 2016

We, Abd Rasid Jaapar and Lim Choun Sian , being two of the Council Members of Persatuan Geologi Malaysia (Geological Society Of Malaysia), do hereby state that, in our opinion, the accompanying financial statements set out pages 9 to 21 are drawn up in accordance with Malaysian Private Entities Reporting Standard and the requirements of the Companies Act, 2016 in Malaysia 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 2020, and of the financial performance and cash flows of the Society for the year then ended.

Signed on behalf of the Board in accordance with a resolution of the Council dated
05 APR 2021

Abd Rasid Jaapar
President

Lim Choun Sian
Treasurer

Kuala Lumpur

STATUTORY DECLARATION PURSUANT TO SECTION 251(1)(b) OF THE COMPANIES ACT, 2016

I, Lim Choun Sian, being the officer primarily responsible for the financial management of Persatuan Geologi Malaysia (Geological Society Of Malaysia), do solemnly and sincerely declare that the accompanying financial statements set out on pages 9 to 21 are in my opinion correct, and I make this solemn declaration conscientiously believing the same to be by virtue of the provisions of the Statutory Declarations Act, 1960.

Subscribed and solemnly declared by abovenamed
Lim Choun Sian at Kuala Lumpur in Wilayah
Persekutuan on 05 APR 2021

Lim Choun Sian

Before me:

Kuala Lumpur

PESURUHJAYA SUMPAH
W 678
KAPT (B) AFFANDI
BIN AHMAD
1 JAN 2019 - 31 DIS 2021
MALAYSIA
No. 86, Jalan Putra
50350 Kuala Lumpur

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

No. 5-3, Jalan 1/64A,
Kompleks Udarama, Off Jalan Ipoh,
50350 Kuala Lumpur.
Tel : 03 - 4041 0540 / 546
Fax : 03 - 4041 0586
Email : sfleeco@yahoo.com.my

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

Report on the Financial Statements

Opinion

We have audited the financial statements of **Persatuan Geologi Malaysia (Geological Society Of Malaysia)**, which comprise the statement of financial position of the Society as at 31 December 2020, the statement of income and expenditure and statement of cash flows of the Society for the year then ended, and a summary of significant accounting policies and other explanatory notes, as set out on pages 9 to 21.

In our opinion, the accompanying financial statements give a true and fair view of the financial position of the Society as at 31 December 2020, and of its financial performance and its cash flows for the year then ended in accordance with Malaysian Private Entities Reporting Standard and the requirements of the Companies Act, 2016 in Malaysia.

Basis for opinion

We conducted our audit in accordance with approved standards on auditing in Malaysia and International Standards on Auditing. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Independence and Other Ethical Responsibilities

We are independent of the Society in accordance with the By-Laws (on Professional Ethics, Conduct and Practice) of the Malaysian Institute of Accountants ("By-Laws') and the International Ethics Standards Board for Accountants' Code of Ethics for Professional Accountants ("IESBA Code"), and we have fulfilled our other ethical responsibilities in accordance with the By-Laws and the IESBA Code.

Information Other than the Financial Statements and Auditors' Report Thereon

The council members of the Society are responsible for the other information. The other information comprises the Council's Report but does not include the financial statements of the Society and our auditors' report thereon.

Our opinion on the financial statements of the Society does not cover the Council's Report and we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial statements of the Society, our responsibility is to read the Council's Report and, in doing so, consider whether the Council's Report is materially inconsistent with the financial statements of the Society or our knowledge obtained in the audit or otherwise appears to be materially misstated.

If, based on the work we have performed, we conclude that there is a material misstatement of the Council's Report, we are required to report that fact. We have nothing to report in this regard.

Branch add : G - 23A, Jalan SP 5/5, Seksyen 5,
Taman Serdang Perdana, 43300 Seri Kembangan,
Selangor Darul Ehsan.
Tel : 603-8938 1870 Fax : 603-8943 4901

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

PERSATUAN GEOLOGI MALAYSIA
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Responsibilities of the Council for the Financial Statements

The Council of the Society are responsible for the preparation of financial statements of the Society that give a true and fair view in accordance with Malaysian Private Entities Reporting Standard and the requirements of the Companies Act, 2016 in Malaysia. The Council are also responsible for such internal control as council determine is necessary to enable the preparation of financial statements of the Society that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements of the Society, the council are responsible for assessing the Society's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the council either intend to liquidate the Society or to cease operations, or have no realistic alternative but to do so.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements of the Society as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditors' report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with approved standards on auditing in Malaysia and International Standards on Auditing will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with approved standards on auditing in Malaysia and International Standards on Auditing, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

(a) Identify and assess the risks of material misstatement of the financial statements of the Society, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

(b) Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Society's internal control.

(c) Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the council.

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

PERSATUAN GEOLOGI MALAYSIA
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(d) Conclude on the appropriateness of the council's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Society's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditors' report to the related disclosures in the financial statements of the Society or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditors' report. However, future events or conditions may cause the Society to

(e) cease to continue as a going concern.

(f) Evaluate the overall presentation, structure and content of the financial statements of the Society, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with the council regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Other Matter

This report is made solely to the members of the Society, as a body, in accordance with Section 266 of the Companies Act, 2016 in Malaysia and for no other purpose. We do not assume responsibility to any other person for the content of this report.

S.F. LEE & CO.
AF 0670
CHARTERED ACCOUNTANTS

LEE SIEW FATT
01179/09/2022 (J)
CHARTERED ACCOUNTANT

Kuala Lumpur
Dated: 05 APR 2021

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

STATEMENT OF FINANCIAL POSITION
As at 31 December 2020

	Note	2020 RM	2019 RM
FUND ACCOUNTS			
GENERAL FUND	4	916,659	911,525
ENDOWMENT FUND	5	1,802,094	1,737,653
STUDENT LOAN FUND		1,755	1,755
YOUNG GEOSCIENTIST AWARD FUND		3,143	3,143
AAPG-UM STUDENT CHAPTER FUND	6	13,142	11,276
DRCKL FUND	7	-	11,727
IDRC-UKM FUND	8	316,105	-
ATOSICE	9	22,244	-
		3,075,142	2,677,079
Represented by:			
NON-CURRENT ASSETS			
PROPERTY, PLANT AND EQUIPMENT	10	3,961	12,727
CURRENT ASSETS			
Deposits		600	600
Fixed deposits with licensed bank	11	2,229,701	2,229,701
Cash and bank balances		894,114	481,312
		3,124,415	2,711,613
CURRENT LIABILITIES			
Other payables		53,103	47,129
Current tax liabilities		131	132
		53,234	47,261
NET CURRENT ASSETS		3,071,181	2,664,352
		3,075,142	2,677,079

The annexed notes form an integral part of the financial statements.
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INCOME	Note	2020 RM	2019 RM
Transfer from endowment fund		-	50,000
Advanced seminar on economic geology		3,754	12,129
Entrance fee		800	1,400
Fixed deposits interest income		13,075	18,194
Subscription		16,211	17,585
Sales of publications		30	34,781
Geology of Peninsular Malaysia		-	9,650
National Geoscience Conference		2,451	-
Sales of bulletin and warta Geologi		41,030	-
SEGRM-GSM forum		-	14,373
Geological Evolution of Southeast Asia		13	3,580
Fieldtrip - hotsprings		-	280
		77,364	161,972
EXPENDITURE			
Annual dinner		-	2,326
Audit fee		1,590	1,590
Bank charges		55	128
Depreciation on property, plant and equipment		715	1,622
Department of geology		12,000	12,000
Geology of Peninsular Malaysia (GPM)		955	-
GSM-SEGRM		151	-
Honorarium		24,100	24,740
National Geoscience Conference		-	6,008
Postages		316	1,748
Photocopy		315	-
Printing and Stationery			
- Warta Geologi		6,200	19,625
- Bulletin		7,175	22,800
- Stationery		2,075	-
Professional fee		800	800
Property, plant and equipment written-off		8,051	-
Refreshment		905	1,061
Speakers' account		424	729
Sponsorship for student's activities		1,000	9,521
Student's award		1,000	1,000
Souvenirs		325	1,526
Telephone and fax		955	-
Miscellaneous expenses		418	3,507
Information Teknologi		2,574	5,718
Field trip - sungai lembing		-	33
Working group		-	933
IGM - GSM workshop		-	1,697
		72,099	119,112
Surplus before tax		5,265	42,860
Income tax expense	12	(131)	(272)
Net surplus for the year		5,134	42,588

The accompanying notes are an integral part of the financial statements

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PERSATUAN GEOLOGI MALAYSIA
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STATEMENT OF CASH FLOWS
For the year ended 31 December 2020

	2020 RM	2019 RM
Cash flows from operating activities		
Surplus of income over expenditure for the year	5,265	42,860
Adjustments for:-		
Depreciation on property, plant & equipment	715	1,622
Property, plant & equipment written off	8,051	-
Interest income	(13,075)	(18,194)
Surplus before working capital changes	956	26,288
Increase in IDRC-UICM Fund	316,105	-
Increase in student loan fund	-	800
Increase in Endowment Fund	64,441	8,414
Increase in AAPG-UM Student Chapter Fund	1,866	497
Increase / (Decrease) in other payables	16,491	(54,454)
Cash generated from / (used in) operations	399,859	(18,455)
Tax paid	(132)	(141)
Interest income	13,075	18,194
Net cash generated from / (used in) / generated from operating activities	412,802	(402)
Net increase / (decrease) in cash and cash equivalents	412,802	(402)
Cash and cash equivalents at beginning of the year	2,711,013	2,711,415
Cash and cash equivalents at end of the year	3,123,815	2,711,013

Cash and cash equivalents comprised of:	2020 RM	2019 RM
Deposits held with licensed banks	2,229,701	2,229,701
Cash and bank balances	894,114	481,312
	3,123,815	2,711,013

The accompanying notes are an integral part of the financial statements

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PERSATUAN GEOLOGI MALAYSIA
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(Registered in Malaysia)
S.F. LEE & CO (AF : 0670)

NOTES TO THE FINANCIAL STATEMENTS –31 DECEMBER 2020

1. CORPORATE INFORMATION

The principal activity of the Society is to promote the advancement of the geological sciences in Malaysia. There has been no significant changes in the nature of this activity during the year.

The Society is registered in Malaysia. The registered office of the Society is located at University Malaya, 59100 Kuala Lumpur.

The financial statements were authorised for issue in accordance with a resolution by the Council on 05 APR 2021

2. SIGNIFICANT ACCOUNTING PILICIES

(a) Statement of compliance

The financial statements of the Society have been prepared in accordance with Malaysian Private Entities Reporting Standard ("MPERS") and the requirements of Companies Act, 2016 in Malaysia.

(b) Basis of measurement

The financial statements have been prepared on the historical cost basis except as otherwise stated in the financial statements.

(c) Functional and presentation currency

These financial statements are presented in Ringgit Malaysia ("RM"), which is the Society's functional currency.

(d) Significant accounting estimates and judgements

The preparation of the financial statements in conformity with MPERS requires the use of certain accounting estimates and exercise of judgements. Estimates and judgements are continuously evaluated and are based on past experience, reasonable expectations of future events and other factors.

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The Council are the opinion that there are no key assumptions concerning the future and other key sources of estimation uncertainty at the reporting date, that have a significant risk of causing material adjustment to the carrying amounts of assets and liabilities within next financial year.

3. SUMMARY OF ACCOUNTING POLICIES

(a) Property, plant and equipment and depreciation

All items of property, plant and equipment are initially recorded at cost. The cost of an item of property, plant and equipment is recognised an asset if, and only if, it is probable that future economic benefits associated with the item will flow to the Society and the cost of the item can be measured reliably.

Subsequent to recognition, property, plant and equipment are measured at cost less accumulated depreciation and accumulated impairment losses. Repair and maintenance costs are recognised in statement of income and expenditure as incurred.

Depreciation on property, plant and equipment is computed on a reducing balance basis to write-off the cost to its residual value over the estimated useful lives of the assets at following annual rate:-

Information of technology equipments	20%
Office equipment	10%

The carrying values of property, plant and equipment are reviewed for impairment when events or changes in circumstances indicate that the carrying value may not be recoverable.

The residual value, useful life and depreciation method are reviewed at each year-end, and adjusted prospectively, if appropriate.

An item of property, plant and equipment is derecognised upon disposal or when no future economic benefits are expected from its use or disposal. Any gain or loss on derecognition of the asset is included in the statement of income and expenditure in the year the asset is derecognised.

(b) Impairment of non-financial assets

The carrying amounts of non-financial assets are reviewed at the end of each reporting period to determine whether there is any indication of impairment. If any such indication exists, then the asset's recoverable amount is estimated.

For the purpose of impairment testing, assets are grouped together into the smallest group of assets that generated cash inflows from continuing use that are largely independent of the cash inflows from other assets or cash-generating units.

The recoverable amount of an asset or cash-generating unit is the higher of its fair value less costs to sell and its value in use. In assessing value in use, the estimated future cash flows are discounted to their present value using a pre-tax discount rate that reflects current market assessments of the time value of money and the risks specific to the asset or cash-generating unit

An impairment loss is recognised if the carrying amount of an asset or its related cash-generating unit exceeds its estimated recoverable amount.

Impairment losses are recognised in income and expenditure statement. Impairment losses recognised in respect of cash-generating units are allocated first to reduce the carrying amount of any goodwill allocated to the cash-generating unit (group of cash-generating units) and then to reduce the carrying amounts of the other assets in the cash-generating unit (group of cash-generating units) on a pro rata basis.

Impairment losses recognised in prior periods are assessed at the end of each reporting period for any indications that the loss has decreased or no longer exists. An impairment loss is reversed if there has been a change in the estimates used to determine the recoverable amount since the last impairment loss was recognised. An impairment loss is reversed only to the extent that the assets's carrying amount does not exceed the carrying amount that would have been determined, net of depreciation or amortisation, if no impairment loss had been recognised. Reversals of impairment losses are credited to statement of income and expenditure in the financial year in which the reversals are recognised.

(c) Financial instruments

(i) Initial recognition and measurement

A financial asset or financial liability is recognised in the statement of financial position when, and only when, the Society becomes a party to the contractual provisions of the instrument.

A financial instrument is recognised initially at the transaction price unless the arrangement constitutes, in effect, a financing transaction. If the arrangement constitutes a financing transaction, the financial asset or financial liability is measured at the present value of the future payments discounted at a market rate of interest for a similar debt instrument.

(ii) Subsequent measurement

Debt instruments that meet the following conditions are measured at amortised cost using the effective interest method:

(a) returns to the holder are determinable, e.g. a fixed amount and/or variable rate of return benchmark against a quoted or observable interest rate;

(b) there is no contractual provision that could result in the holder losing the principal amount or any interest attributable to the current or prior periods;

(c) prepayment option, if any, is not contingent on future events.

Debt instruments that are classified as current assets or current liabilities are measured at the undiscounted amount of the cash or other consideration expected to be paid or received unless the arrangement constitutes, in effect, a financing transaction.

Financial assets or financial liabilities not measured at amortised at cost or cost less impairment are measured at fair value changes recognised in statement of income and expenditure.

All financial assets are assessed at each reporting date whether there is any objective evidence of impairment. An impairment loss is measured as follows:

(i) For an instrument measured at amortised cost, the impairment loss is the difference between the asset's carrying amount and the present value of estimated cash flows discounted at the asset's original effective interest rate.

(ii) For an instrument measured at cost less impairment, the impairment loss is the difference between the asset's carrying amount and the best estimate of the amount that would be received for the asset if it were to be sold at the reporting date.

(iii) Derecognition

A financial asset or part of it is derecognised when, and only when, the contractual rights to the cash flows from the financial asset expired or are settled, or control of the asset is not retained or substantially all of the risks and rewards of ownership of the financial asset are transferred to another party. On derecognition of a financial asset, the difference between the carrying amount of the financial asset derecognised and the consideration received, including any newly created rights and obligations, is recognised in statement of income and expenditure.

A financial liability or part of it is derecognised when, and only when, the obligation specified in the contract is discharged, cancelled or expires. On derecognition of a financial liability, the difference between carrying amount of the financial liability extinguished or transferred to another party and the consideration paid, including any non-cash assets transferred or liabilities assumed, is recognised in statement of income and expenditure.

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4. GENERAL FUND

	2020 RM	2019 RM
At 1 January	911,525	868,937
Surplus for the year	5,134	42,588
At 31 December	916,659	911,525

5. ENDOWMENT FUND

	2020 RM	2019 RM
At 1 January	1,737,653	1,729,239
Add : Fixed deposits interest income	64,441	58,414
	1,802,094	1,787,653
Less : Transfer to general fund	-	(50,000)
At 31 December	1,802,094	1,737,653

6. AAPG-UM STUDENT CHAPTER FUND

	2020 RM	2019 RM
At 1 January	11,276	10,779
Donation	2,042	1,989
	13,318	12,768
Less : Refreshment	150	1,492
Souvenir	26	-
At 31 December	13,142	11,276

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7. DISASTER RESILIENT CITIES KUALA LUMPUR (DRCKL) FUND

	2020 RM	2019 RM
At 1 January	11,727	27,099
Add : Grants received	-	231,503
Transfer from National Geoscience Conference	-	2,061
	11,727	260,663
Less : Honorarium	-	56,500
Printing	-	29,280
Workshop	-	155,678
Office expenses	-	3,574
Postage	-	2,077
Refreshment	-	1,827
Miscellaneous expenses	(11,727)	-
At 31 December	-	11,727

8. INTERNATIONAL DEVELOPMENT RESEARCH CENTRE – UNIVERSITI KEBANGSAAN MALAYSIA (IDRC-UKM)

	2020 RM	2019 RM
At 1 January	-	-
Add : Grants received	438,251	-
	438,251	-
Less : Honorarium	24,600	-
Allowance	54,000	-
Workshop	38,579	-
Miscellaneous expenses	4,967	-
At 31 December	316,105	-

9. OFFSHORE PROFESSIONALS SDN. BHD. (ATOSICE)

	2020 RM	2019 RM
At 1 January	-	-
Add : Grants received	98,494	-
	98,494	-
Less : Workshop	76,250	-
At 31 December	22,244	-

10. PROPERTY, PLANT AND EQUIPMENT

	Information technology equipment	Office equipment	Total
	RM	RM	RM
Cost			
At 1 January 2020	7,831	133,375	141,206
Additions	-	-	-
Disposal and deletion	(2,596)	(114,549)	(117,145)
At 31 December 2020	5,235	18,826	24,061
Accumulated depreciation and impairment losses			
At 1 January 2020	6,332	122,147	128,479
Charge for the year	279	436	715
Disposal and deletion	(2,493)	(106,601)	(109,094)
At 31 December 2020	4,118	15,982	20,100
Carrying amounts at 1 January 2020	1,499	11,228	12,727
Carrying amounts at 1 December 2020	1,117	2,844	3,961

11. FIXED DEPOSITS WITH LICENSED BANK

The fixed deposits with licensed bank have a maturity of between 6 to 15 months (2019 : 6 to 15 months). Interest rates for the deposits ranged from 2.85% to 2.95% (2019 : 2.85% to 2.95%) per annum.

12. TAX EXPENSE

Income tax is provided for investment income and on surplus arising from transactions with non-members. The current tax expense consists of:-

	2020	2019
	RM	RM
Current tax:		
On result for the year	131	132
Overprovision in prior year	-	140
	131	272

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13. RELATED PARTY DISCLOSURES

(a) Identities of related parties

Parties are considered to be related to the Society if the Society has the ability, directly or indirectly, to control the party or exercise significant influence over the party in making financial and operating decisions, or vice versa, or where the Society and the party are subject to common control or common significant influence. Related parties could be individuals or other parties.

There were no related party transactions during the year.

(b) Compensation of key management personnel

Key management personnel are those persons having the authority and responsibility for planning, directing and controlling the activities of the entity, directly and indirectly, including any Council (whether executive or otherwise) of the Society.

(c) There were no compensation paid to key management personnel during the year.

14. FINANCIAL INSTRUMENTS

The financial instruments of the Society are categorised into the following classes:

	2020 RM	2019 RM
Financial assets measured at amortised cost less impairment		
Deposits	600	600
Deposits with licensed bank	2,229,701	2,229,701
Cash and bank balances	894,113	481,312
	3,124,414	2,711,613
Financial liabilities carried at amortised cost		
Other payables	53,103	47,129

15. SIGNIFICANT EVENT

On 11 March 2020, the World Health Organisation declared the Coronovirues ("COVID-19") outbreak as a pandemic in recognition of its rapid spread across the globe. On 16 March 2020, the Malaysia Government imposed the Movement Control Order ("MCO") starting from 18 March 2020 to curb the spread of COVID-19 outbreak in Malaysia. The COVID-19 outbreak also resulted in travel restriction, lockdown, social distancing and other precautionary measures imposed in various countries. The emergence of the COVID-19 outbreak since early 2020 has brought significant economic uncertainties in Malaysia.

The Society has performed assessments on the overall impact of the situation on the Society's operations and financial implications, including the recoverability of the carrying amounts of assets and subrequent measurement of assets and liabilities, and concluded that there was no material adverse effect on the financial statements for the year ended 31 December 2020.

Given the evolving nature of the COVID-19 pandemic, it is currently not possible to ascertain the full financial impact it may have on the financial results and performance of the Society for the year ended 31 December 2021.

GSM ENDOWMENT FUND REPORT

GSM ENDOWMENT FUND: BOARD OF TRUSTEES REPORT FOR THE 55th ANNUAL GENERAL MEETING OF THE GEOLOGICAL SOCIETY OF MALAYSIA
30 April 2021

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.

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 GSM President, Immediate Past President, Secretary, Treasurer, Editor and at least three independent Full Members "in good standing", to be appointed at the AGM in 2017, 2020, 2023, 2026, 2029, 2032 etc.

3. The 53rd AGM in 2019 was informed that the GSM Council undertook a search on the website of "Lembaga Hasil Dalam Negeri" (LHDN) and found that GSM is listed as an organisation that is approved to collect donations under Subsection 44(6) since the year 1967. The GSM has "tax deductible" status that allows individuals and organizations to obtain tax exemption for their donations.

4. Items arising out of the 54th AGM held online on 26 June 2020 are as follows:

   i. The In-Coming GSM Council is requested to make every effort to transfer some of the fixed deposits in the GSM operating account to the Endowment Fund to increase the principal amount, so as to obtain a higher interest;

   ii. The In-Coming GSM Council is requested to develop an appropriate procedure for issuance of receipts for tax exemption and to inform LHDN for donations of RM 5,000 and above.

Report of the Board of Trustees

1. This report covers the period from 1 January 2020 to 31 December 2020. The Board of Trustees met virtually via zoom on 16 April 2021 (Friday) to scrutinise the administration of the GSM Endowment Fund. The meeting was moderated by Datuk Fateh Chand. Members in attendance were the Immediate Past President, Dr. Mazlan Madon; President, Abd Rasid Jaapar; Secretary, Farah Fazulah Abdullah; Treasurer, Dr. Lim Choun Sian; Editor, Prof. Wan Hasiah Abdullah; and GSM Members Dato' Yunus Abdul Razak, Prof. Joy Jacqueline Pereira and Dr. Lee Chai Peng.

2. The principal amount, in the form of Fixed Deposits with the United Overseas Bank Malaysia (UOBM) is currently RM 1,691,999.99.

3. A special operating account is also maintained with UOBM to receive the interest accrued from the principal amount. The interest is kept in this GSM current account at UOBM (which is separate from the operational account of GSM at the Standard Chartered Bank Bhd.). The total interest accrued in 2020 is RM 64,440.66. The total accumulated interest of the Endowment Fund is RM 210,093.56 as of 31 December 2020. The total balance according to the GSM Auditors Report for 2020 amounting to RM 1,802,094 differs from the balance calculated from the UOBM statement, which totals up to RM 1,902,093.55 (Appendix A).

4. A sum of RM 50,000.00 has been requested by the GSM Council for publications for the year 2021.

5. The GSM Council has developed a procedure for issuance of receipts for tax exemption and to inform LHDN for donations of RM 5,000 and above.

Recommendations to the 55th AGM of the GSM

The Board of Trustees of the GSM Endowment Fund makes the following recommendations for consideration at the 55th AGM of the GSM to be held on 30 April 2021:

(i) The In-Coming GSM Council is requested to make every effort to transfer some of the fixed deposits in the GSM operating account to the Endowment Fund to increase the principal amount, so that more funds will be available from the interest portion accrued, to be used to meet expenses incurred in the implementation of programmes run by the Society.

(ii) The In-Coming GSM Council is requested to look into the difference in the balance reported in the GSM Auditors Report for 2020 amounting to RM 1,802,094 compared to the UOBM statement (Appendix A), which totals up to RM 1,902,093.55.

(iii) The In-Coming GSM Council is requested to explore the possibility of earning interest on the RM 210,093.56 in the UOBM current account.

(iv) The In-Coming GSM Council is requested to set up a research grant for economic geology from the accumulated interest earned from the contribution of RM 50,000.00 by Dato' Sia Hok Kiang to the GSM Endowment Fund in 2014.

(v) The AGM is recommended to approve the sum of RM 50,000.00 that was requested by the GSM Council for publications for the year 2021 (Appendix B).

(vi) The AGM is requested to appoint the Chair and at least three independent Full Members "in good standing" to serve in the "Board of Trustees of the GSM Endowment Fund" until 2023.

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 55th AGM of the GSM.

Datuk Fateh Chand
Chairman
Board of Trustees of the GSM Endowment Fund
Geological Society of Malaysia
16 April 2021

Announcement of New Council for 2021/2022

GSM COUNCIL ELECTIONS FOR THE TERM 2021/2022: REPORT BY THE ELECTIONS OFFICER

This report contains the results of the election of Council members for the term 2021/2022.

At the end of the nomination period on 30 September 2020, nominations were received for all posts. Only a single nomination was received for all posts except for the four 2-year councillor posts, for which 5 nominations were received. (see Report of Nominations Committee, dated 18 October 2020).

The Council decided to conduct email balloting for the four (4) council members for the 2- year posts that will be vacated at the end of the term in April 2021.

On 10th November, ballot forms were sent out to members with the profile of all 5 candidates for selection by email ballots.

At the closing of balloting on 15 December 2020, the following votes were counted and verified by the Elections Officer Dr Mazlan Madon and two Scrutineers, Prof. Azman A. Ghani and Dr Muhammad Hatta Roselee, who were appointed by the Council.

The ballot count is as follows:

1. **Joy Jacqueline Pereira (66 votes)**
2. **Amie Norsyazan Amir (61 votes)**
3. **Nur Iskandar Taib (60 votes)**
4. **Abdul Halim Abdul Latiff (57 votes)**
5. Tan Boon Kong (36 votes)

Candidates with the 4 highest votes (above names in bold) shall be elected to the Council for the two-year term (2021/2022 – 2022/2023) at the forthcoming 55th AGM in April 2021.

With the above results, the Council for the term 2021/2022 shall be filled as follows:

President – Ahmad Nizam Hasan
Immediate Past President – Abd Rasid Jaapar
Vice-President – Mohd Hariri Arifin
Treasurer – Lim Choun Sian
Editor – Wan Hasiah Abdullah
Secretary – Farah Fazulah Abdullah
Assistant Secretary – Norazianti Asmari

Councillors (for the remaining 1-year of their term) [2021/2022]

- Ahmad Tariq Ahmad Ziyad
- Awg Mohd Faizal Awg Mohamad Hamssin
- Maryam Syazana Dzulkifli
- Tan Chun Hock

Councillors (for 2-year term) [2021/22- 2022/23]

- Abdul Halim Abdul Latiff
- Amie Norsyazan Amir
- Joy Jacqueline Pereira
- Nur Iskandar Taib

GSM 2021/22 PRESIDENTIAL SPEECH

Thank you, Miss Secretary. Thank you also Dr. Mazlan Madon as election chairman of GSM election 2021/22.

Honourable former Mr. President, Mr. Abd Rasid, now the Immediate Past President, my fellow council members, congratulations on your new or renewed appointment, please work with me!

Dato'-dato', ladies, and gentlemen,

Assalamualaikum Warahmatullahi Wabarakatuh and Salam Sejahtera.

It has been more than a decade since I began my service to GSM, then being the 'financial caretaker' treasurer, serving various misters, Dato' and Madam Presidents. It was a big and heavy task then, with less than one hundred thousand ringgit, we were able to attain cost plus income from conferences, to doubling or even tripling the gross worth through relentless effort over the years. Until now, sitting comfortably with a million ringgit worth of cash assets. Taking an utmost risk, a bold move, uplifting organising events such as PGCE from national level to become an international premier conference. Even though the tradition was held up, I, for one, am a firm believer that we can do all of this again, crafting new similarly prestigious conferences in due time. YES, WE CAN!

Thank you Mr. Abdul Rasid, former president, for setting the bar high with a myriad of great achievements. Your spirit in transforming, shaping GSM to be a champion and to be recognised internationally, primarily in the southeast Asian region is very much appreciated! Our task now is to make sure that the commitment and dedication remains for many years to come, especially with the formalisation of AFGEO recently. Glad you are still around sir!

Dato'-dato', ladies and gentlemen,

GSM has never been about who holds the title of President, or who the council members are. Instead, it focuses on what we could do as a team and how we could contribute to the geoscience community.

As Prophet Muhammad (pbuh) quote in alhadis Al-Bukhari;

"FAITHFUL BELIEVERS ARE TO EACH OTHER AS THE BRICKS OF A WALL, SUPPORTING AND REINFORCING EACH OTHER"

Looking at the new norm, where our livelihoods have experienced a 360-degree turn, where we began to miss the traditional or conventional get together, face to face seminars or conferences, and worst of all in our case, no field excursion has been able to be conducted for almost two years now.

This chain reaction could lead to another challenge, hopefully manageable and short term, as there has been limited or no fieldworks conducted due to restriction in mobility or travel restrictions. Fieldwork is the backbone to any geoscience related research, and so researchers all around are experiencing a major setback. Therefore, GSM shall play its role to aggressively promote and encourage any journals/papers of quality to be produced in this short coming, as well as uplift the standard of our very own Bulletin and Warta Geologi, elevating them to a higher echelon, with an aim to elevate them even higher to become prominent publications. The ultimate aim of this endeavor is that, once globally recognized, international researchers, of their own accord, would race for the chance to have their research papers published in our Bulletin/Warta Geologi. To realise this, under the guidance of our editor-in-chief, Dr. Wan Hasiah and the Editorial Board, all efforts and our full and utmost support will be given, especially in terms of funding.

The new challenge has on the bright side, pushed the Council team, including our editor-in-chief and editorial team, to be more creative and innovative on how to mitigate or adapt to the current scenario.

As of 2022 and 2023, IGM and GSM were given a mandate to conduct webinars/talks virtually and/or hybrid programs (face to face and virtual) in order to execute the CPD hours initiative for professional geologists all over Malaysia to renew their professional practicing license by the Board of Geologist (BOG). The task and responsibility is to facilitate professional geologists from all over our country, Malaysia. Therefore, it is imperative for us to be fully prepared systematically and structurally in the execution of the programs and the GSM and IGM joint committee

needs to plan and to strengthen and to coordinate a year-to-year program to avoid any sort of redundancies, putting emphasis on quality, as well as quantity to accommodate the demand!

In order to be prepared, GSM must first be sufficiently equipped, in particular the IT infrastructure, of our main office located in University Malaya. Therefore, an addition and a proper lounge HAVE TO BE READY as a form of facility to be used by both council members and members that would be highly beneficial and, perhaps one day, could serve as a hub for our international guests to convene, allowing a smoother process for our programs. These improvements are crucial for us to achieve our goals. As such, this term newly appointed council members will be looking into that in due time and will be one of the main focus areas for 2021 and 2022.

Dato'-dato', ladies and gentlemen,

With the introduction of my motto, "GSM Care, GSM Prihatin", I would like to express that we at GSM empathise with the current obstacles that the new generation of our Geoscience community, especially our B40 category undergraduates, which have been further exacerbated by the Covid19 pandemic. Being at the mercy of this disease, most students are forced to continue their lessons VIRTUALLY despite having very limited resources. Cik Azianti, our assistant secretary, lit a spark in my thoughts and we successfully initiated an immediate programme of providing laptops to B40 undergraduates under our Promotion and Young Geoscientists working groups, whereby GSM, individuals and geology companies, hand in hand, were able to provide these students with laptops which will hopefully slightly ease their burden. AND WE ARE NOT STOPPING THERE. It should be a theme of our main agenda… GIVING BACK! Since this initiative, it has been my aspiration to see GSM closing the gap, to be more in touch with our UNDERGRADUATE students. THEY ARE OUR FUTURE SUCCESSORS. One way we can start working towards this is through the increase of funds to be allocated for GSM geological student clubs or chapters in universities in order to organise and conduct their activities under our flagship. In addition, aside from their own respective Geology departments, GSM could act as a support to become a place where they can express their thoughts or ideas and be heard, via our Young Geoscience Working Group.

The pre launching by our former president during NGC 2020/21 of our next international event, NGC 2022, which will be in collaboration with IGM Symposium Geoscience 2022 and GEOSEA 2022 to be held in Miri Sarawak, will also be a great task. It will provide a very big challenge ahead as it is our OLYMPICS OF GEOLOGY CONFERENCES that crucially need an ultimate COLLABRATIVE EFFORT BY ALL GEOSCIENCE FRATERNITIES. Therefore, the organizing team will comprise of members and individuals from GSM-IGM-MyGeo and it is vital that we start the necessary work as soon as possible to avoid any unforeseen circumstances and to ensure its success.

Dato'-dato', ladies and gentlemen,

It is mentioned in the Noble Quran, "HOLD FIRMLY ALL TOGETHER THE ROPE WHICH ALLAH SWT HAS STRETCHED OUT FOR YOU AND BE NOT DIVIDED AMONG YOURSELVES" (Al-Imran, 3:103). IT SHOWS THE GUIDANCE WAS GIVEN AND A LOT OF GOOD CAN COME OUT OF HANGING ON TOGETHER AND HELPING EACH OTHER OUT IN TIMES OF DIFFICULTIES.

Thus, in the spirit of GEOLOGIST FOR UNITY TO COMMUNITY, we need to *`rapatkan saf'*! I would like to suggest the congregation of all the prominent veterans with vast experience in academia, as well as industry, to form together a structured and coordinative organisation aptly named as the GSM FELLOWSHIP OF ELDERS or THE GSM ELDERS. They would primarily serve as our check and balance, providing neutral perspectives, focusing more on the technical programme contents that we have crafted. Pioneers and legends such as Prof. Ibrahim Komoo, Dr. Samsuddin Hj. Taib, Prof. Rahim, Prof. Dr. John Kuna Raj, Prof. Dr. Teh Guan Hoe, Dr. Yeap Ee Beng, Dr. Abd. Ghani Rafek, Prof. Dr. Hamzah Mohamad, Prof. Lee Chai Peng, despite not being as active as they once were, I am sure that for GSM where they have made their mark, hopefully they would be willing to contribute where they can. It would truly be an honor if we could materialize this into reality and insyaAllah my fellow team of council will be working tirelessly towards it.

To bring this speech to a close, as the newly appointed President, I, with the support of my fellow council members, take all of this as an obligation, that we, with the culmination of all our experiences and knowledge, to provide a brighter future for the many generations to come…. INSYAALLAH.

WASSALAMUALAIKUM WARAHMATULLAH HIWABARAKATUH….
SALAM RAMADAN and SELAMAT HARI RAYA, MAAF ZAHIR BATIN

Thank you.
P.Geol Ahmad Nizam Hasan F.I.G.M
President

CERAMAH TEKNIK TECHNICAL TALK

INTRODUCTION TO RESERVOIR MODELLING & CHARACTERIZATION: THEORY & PRACTICE

Mr. Jairo Antonio Plata Torres
Date: 15 June 2021
Platform: Microsoft Teams

A technical talk by Mr. Jairo Antonio Plata Torres from PETRONAS was held via Microsoft Teams Platform on 15 June 2021. The talk was attended by more than 30 participants with topic of Introduction to Reservoir Modelling & Characterization: Theory & Practice. The geophysics working group of GSM is organising more technical talks related to geophysical exploration and basic understanding of oil and gas exploration.

Summary of talk:

The talk started at 6.30 p.m. with the welcoming remarks and introduction on the topic by the speaker. Mr Jairo's talk primarily focused on the basic understanding of the reservoir modeling technique that currently being used in the oil and gas industry for mathematically representing reservoir characteristics. It allows multidisciplinary teams to perform a wide variety of tasks from volume calculation to optimized strategies for field development. The 120 minutes long talk had successfully provide an introduction on reservoir modeling and characterization, its basic theoretical concepts including the assumptions behind it and some real case examples of its application. The talk was concluded at 8.30 p.m. with question and answer session between the speaker with the participants.

Some of the participants of the talk.

CERAMAH TEKNIK TECHNICAL TALK

SLOPE STABILITY: INPUT FROM GEOSCIENTISTS

Date: 14 July 2021
Platform: Microsoft Teams

A technical talk with a title 'Slope Stability: Input from Geoscientist' was held on 14th July 2021.

The event is a collaboration between Fraser's Hill Research Centre (Pusat Penyelidikan Bukit Fraser, Universiti Kebangsaan Malaysia), the Geological Society of Malaysia (GSM) and Alumni UKM.

Three speakers were invited, and they were:

Speaker 1: P.Geol. Gs. Hairil Azwan Razak from Geotechnica Sdn. Bhd., with his topic Geo-Trio: Integration of Geology, Geotechnics and Geospatial in Geohazard and Risk Assessment.

Speaker 2: P.Geol. Ahmad Zulqurnain Ghazalli from Geoventure Solution Sdn. Bhd. His presentation title was The junction between Geophysics and Geology for Geohazard Assessment.

Speaker 3: P.Geol. Ir. Ts. Dr. Goh Thian Lay from the Geology Department of UKM, who presented his observation during the last monsoon season on impacts of hill top development to hill bottom households, entitled Field observation at Taman Bukit Koman, Raub, Pahang.

Summary of talks:

In the monsoon-dominated and tropical regions, landslides often occur in areas characterized by steep hillslopes, high rainfall intensities, seasonally dry periods, unstable slopes and also under forests. With this set of climate conditions combined with the inherent geological conditions, landslides often cause extensive damage to infrastructures and involved many casualties. As slopes behave differently to one another, an assessment program will be a value in managing slope hazards and it can provide information for design of rectification work as well as to gauge the integrity of a slope or to determine the performance/effectiveness of a designed slope.

Nowadays, geohazard and risk maps are often used to identify area of either existing or potential landslide or slope instability, either localized or on a global scale. Geohazard and risk analysis are also carried out to understand the likely mechanism which triggers potential occurrence of a landslide via a geoforensic study. However, conventional landslide mapping techniques have limitations especially in a forested mountainous environment and large areas. As digitalization, artificial intelligence and machine learning has become the essential elements and are the primary use in today's world, the utilization of remote sensing technology such as LiDAR is one of the tools that improves the method of hazard and risk mapping programme. LiDAR (Light Detection and Ranging) is an active optical technology that uses pulses of laser light to strike the surface of the earth and measures the time of each pulse return to derive an accurate elevation to obtain ground surface information such as the topography, gradient, slope height, slope aspect, hydrological condition etc.

In general, geohazard and risk maps can be developed in several ways, ranging from simple qualitative to varying degrees of site mapping and geoscientific analyses involving statistical and other numeric quantitative approaches such as (i) Geotechnical method, (ii) Direct method, and (iii) Indirect method. However, in formulating the geohazard and risk model, the causative and triggering factors need to be identified upfront. There are many factors which contribute to geohazard, either as causative factors or triggering factors which requires a collaboration of multi-disciplinary approach like Geology, Geotechnical Engineering and Geospatial; as different types and mechanisms of landslides may occur, depending on the characteristics, geology and temporal factors.

Using the GIS platform, a comprehensive Geohazard and Risk Map can be developed by taking into consideration aspects of multi-disciplinary approach in predicting a landslide before it happens. The map will help the government or local authorities with their development programme, especially in making decisions regarding potential safety measures to be taken such as avoidance, prevention or mitigation and it will also enable one to holistically manage disaster risks in a dynamic environment.

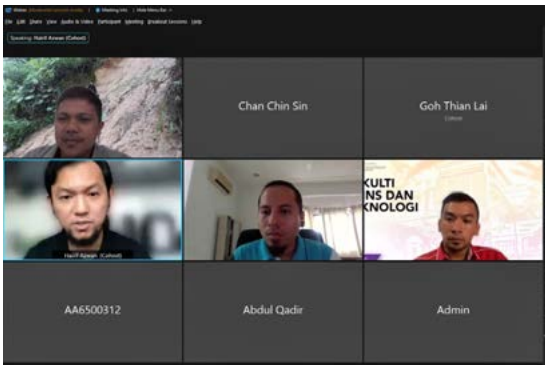


Photo 1: Mr. Hairil presenting his topic on the integration of geology, geotechnics and geospatial.

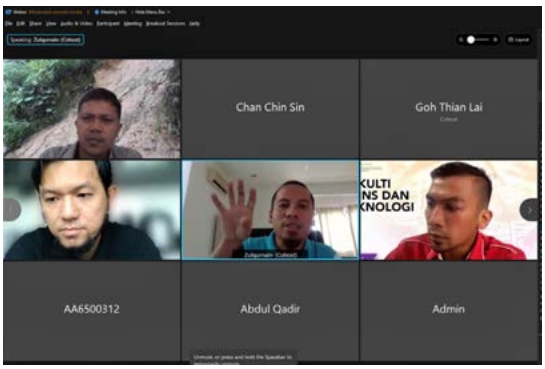


Photo 2: Mr. Zulqurnain presenting his expertise in geohazard works.

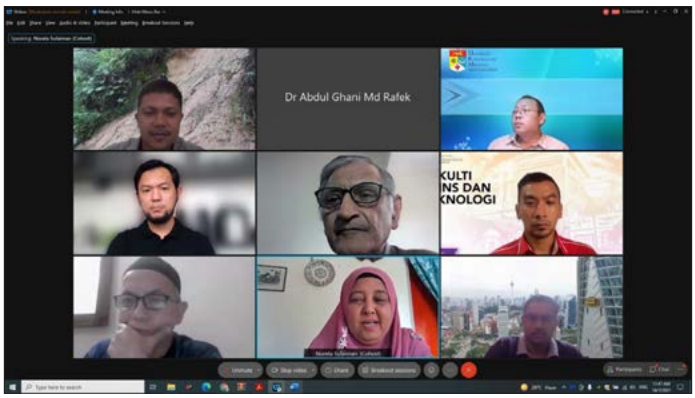


Photo 3: Closing remarks by Assoc. Prof. Dr. Norela Sulaiman.

Photo 4: Some of the participants who attended the session.

The recorded material can be viewed at: https://fb.watch/v/4d4XYWwXJ/

Report prepared by:
Mohd Hariri Arifin & Norazianti Asmari

CERAMAH TEKNIK TECHNICAL TALK

ELECTROMAGNETIC METHOD FOR INVESTIGATING ANTARCTIC ICE-SHEET STABILITY

Dr. Muhammad Hafeez Jeofry
Date: 15 July 2021
Platform: Microsoft Teams

A technical talk by Gs. Dr. Muhammad Hafeez Jeofry from UMT was held via Microsoft Teams Platform on 15 July 2021. The talk was attended by more than 50 participants with the topic of "Electromagnetic method for investigating Antarctic ice-sheet stability". The GSM Geophysics Working Group with Centre for Subsurface Imaging, UTP organised the technical talk related to geophysical exploration and basic understanding of oil and gas exploration.

Summary of talk:

The talk started at 2.30 p.m. with the welcoming remarks and introduction on the topic by the speaker. Dr Hafeez's talk primarily focused on the marine ice-sheet instability within the Antartica region. The presentation by the speaker touched on the numerical modelling of the ice sheet, validated with present day conditions, and quantify the future stability of these regions. Dr Hafeez's experience and expertise in Antartica exploration had provide a good insight of the influence of climate and ocean warming on ice-sheet stability. The talk was concluded at 4.30 p.m. with question and answer session between the speaker with the participants.

Gs. Dr. Muhammad Hafeez Jeofry (L) and the moderator.

A screenshot of some of the participants.

LAPORAN PROGRAM SEPETANG BERSAMA

SEPETANG BERSAMA PRESIDEN PERSATUAN GEOLOGI MALAYSIA

Tarikh: 8 Jun 2021

Program Sepetang Bersama Presiden Persatuan Geologi Malaysia telah berlangsung secara maya di facebook GSM pada 8 Jun 2021. Program ini bertujuan untuk memperkenalkan kepimpinan baharu GSM yang diketuai oleh Tuan Ahmad Nizam Hasan.

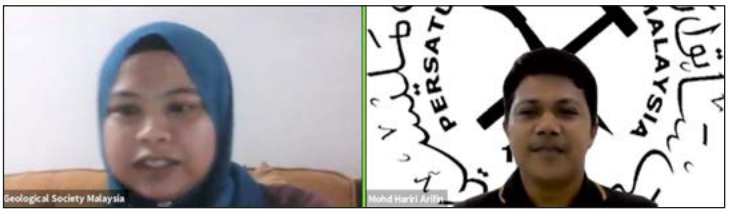
Program yang telah dicadangkan oleh Dr. Mohd Hariri ini telah mendapat sambutan yang menggalakkan daripada ahli dan bukan ahli GSM. Dengan penglibatan secara maya mencecah 700 tontonan semasa dan selepas program, ini menunjukkan komuniti geologi di Malaysia ingin bersama-sama mengenali GSM dan bersama GSM untuk menambahbaik persatuan. Presiden telah berkongsi visi baharu persatuan iaitu 'GSM CARE, GSM PRIHATIN' untuk menyatakan kesungguhan GSM untuk komuniti geologi Malaysia.

Gambar menunjukkan program secara maya yang berlangsung. Rakaman masih boleh ditonton di facebook Geological Society of Malaysia.

SEPETANG BERSAMA TIMB. PRESIDEN PERSATUAN GEOLOGI MALAYSIA

Tarikh: 17 Jun 2021

Sepetang Bersama Timbalan Presiden Persatuan Geologi Malaysia merupakan program kedua selepas sesi Sepetang Bersama Presiden. Program ini dijalankan pada 17 Jun 2021 menggunakan media Live Facebook Persatuan Geologi Malaysia. Sesi ini merupakan kesinambungan hasrat persatuan untuk memperkenalkan barisan kepimpinan baharu Persatuan Geologi Malaysia.



Sesi Sepetang Bersama Timbalan Presiden yang diuruskan oleh unit korperat GSM. Sesi dikendalikan oleh Cik Norazianti Asmari. Rakaman sesi ini boleh dicapai menggunakan media FB Live pada pautan berikut: https://fb.watch/v/t06ia-W2/.

Jawatan timbalan presiden untuk sesi 2021/2022 digalas oleh Dr. Mohd Hariri Arifin. Beliau merupakan pensyarah dari Program Geologi, Jabatan Sains Bumi dan Alam Sekitar, Universiti Kebangsaan Malaysia. Beliau pernah memegang jawatan ahli majlis GSM pada sesi 2019/2020. Beliau juga menganggotai Institut Geologi Malaysia dan menjadi ahli majlis bagi sesi 2020/2021.

Menurut Timbalan Presiden, pelbagai program utama untuk persatuan telah dirangka. Antara agenda utama yang bakal dibawa oleh beliau adalah meningkatkan kembali penerbitan buku baharu di bawah aktiviti persatuan. Selain daripada ceramah teknik yang diadakan dengan kerjasama Program Geologi UKM, beliau juga menegaskan untuk menggerakkan lebih banyak program lain secara dalam talian. Antaranya ialah bicara santai bersama orang lama / pesara dalam bidang geologi serta memperkenalkan syarikat-syarikat sedia ada yang terlibat dengan bidang geologi. Ini merupakan langkah untuk mempromosikan syarikat-syarikat mereka, tanda perjuangan bersama persatuan dan sokongan kepada pertumbuhan syarikat dalam bidang geologi. Visi dan misi beliau akan tertumpu untuk menggalakkan lebih ramai belia geologi untuk melibatkan diri dengan aktif berpersatuan dan bersedia menjadi pelapis pada masa akan datang.

Disediakan oleh:
Norazianti Asmari & Dr. Mohd Hariri Arifin
Unit Promosi, GSM 2021/2022

* Jika anda mempunyai cadangan program Live Facebook, sila emel cadangan kepada noraziantiasmari@gmail.com

TEA TALK

RESUME IN THE EYES OF THE EMPLOYER

Date: 2 July 2021
Time: 2.30 p.m. - 4.30 p.m.
Aim: To help fresh graduates prepare a quality resume for a job

The Tea Talk Series is one of Academy GEX's initiatives and it is supported by the Promotion Working Group GSM to provide a forum for our recent graduates to discuss their concerns, particularly regarding their career prospects in the midst of the Covid-19 pandemic. The inaugural Academy Tea Talk Series is on resume in the employer's eyes, held on 2 July 2021. The event guest speaker is P. Geol. Ahmad Nizam Hasan F.I.G.M., Principal Geologist and CEO of Geo Solution Resources. He is also the President of the Geological Society of Malaysia. The event was live broadcasted on ZOOM and GSM Facebook page.

The aim of this tea talk is to provide an employer's perspective on a candidate's resume. The attendees contributed significantly during the live event and interacted with the speaker, as this session afforded them the opportunity to obtain sound advice from an employer.

BELIA GEOLOGI: CABARAN SYARIKAT GEOLOGI DI MALAYSIA

Date: 7 July 2021
Time: 3.00 p.m. - 4.30 p.m.
Aim: To share the challenges faced by geological companies in Malaysia

Academy GEX, in collaboration with the Geological Society of Malaysia (GSM) Promotion Working Group, conducted a talk on the topic Challenges Faced by the Geological Companies in Malaysia on 7 July 2021. The session was moderated by Ms. Norazianti Asmari (Managing Director of Geo Expert Sdn. Bhd.), with featured speakers Mr. Mohamad Anuri (Managing Director of Geomag Geological Sdn. Bhd.) and Mr. Ahmad Zulhilmy Ahmad Yusry (Director of Geoprobe Solutions Sdn. Bhd.). The one and a half hours session was streamed live via the GSM facebook. During the session, the speakers talked about challenges faced by geological companies, and made some suggestions on how to survive through this trying times due to the Covid-19 pandemic. The speakers also explained about their company operations. Finally, the participants were also given advice on how to prepare themselves for a job as geologists.

TEA TALK

ACADEMIC BURNOUT, WAYS TO OVERCOME IT

Date: 9 July 2021
Time: 10.00 a.m. - 12.00 p.m.
Aim: To provide advice and ideas to students who are experiencing academic burnout

A talk entitled Academic Burnout: Ways to Overcome which was presented by Dr. Khaira Ismail, a Senior Lecturer at Universiti Malaysia Terengganu on 9 July, 2021, was another live event presented by Academy GEX in collaboration with the GSM Promotion Working Group. The live session was attended by nearly 70 people via Facebook and Zoom platform. Many students are experiencing stress as a result of distance education, termed as Open Distance Learning (ODL) which has been undertaken by universities since the Covid-19 pandemic break-out. This session was an initiative to help students who are facing academic burnout overcome the problem. The participants benefited from all the tips provided by the speaker during this session.

DILEMMA AS A FRESH GRADUATE: MASTER DEGREE OR WORKING?

Date: 12 July 2021
Time: 4.00 p.m. - 5.00 p.m.
Aim: To give ideas and tips to recent graduates for making decision on whether to pursue a higher degree or seek employment

A talk entitled 'Master's Degree or Working: Which One Is Better?' was presented by Mr. Jim Danial Mohamad, a design engineer and a master's student of the Geotechnical Engineering faculty at UTM. The talk provided information for undergraduates and particularly recent graduates who are uncertain about the next move after their graduation. Graduating in the midst of the Covid-19 pandemic must have presented them with a dilemma on deciding whether to pursue a further education or seek employment. Mr. Jim Danial has working experience and at the same time is a master's student; thus, the session was an ideal platform for the graduates to obtain some information. This event marks the continuation of Academy Gex's successful collaboration with the GSM Promotion Working Group.

Tea Talk reports prepared by:
Norazianti binti Asmari
Chairman,
Promotion Working Group
GSM 2021/2022

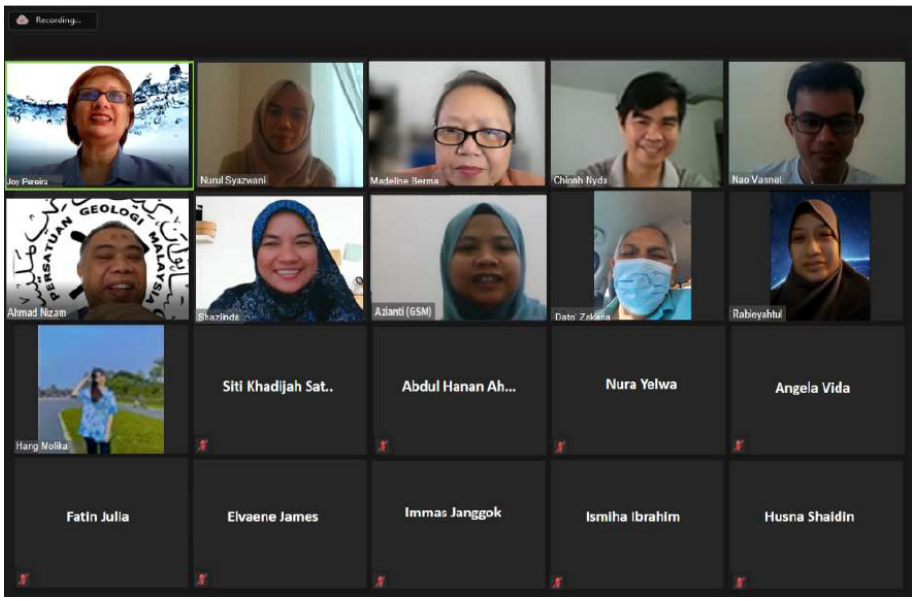
Training Of Trainers - Social Entrepreneurship for Disaster Risk Reduction (DRR)

Date: 26 June 2021
Time: 9.00 a.m. – 5.00 p.m.
Aim: To empower young geoscientists to become social entrepreneurs by developing disaster resilience plans with support from a geographical information system and crowd-sourcing technology for long-term community resilience to climate disasters

The training of trainers was part of the key activities under the International Development Research Center (IDRC) Canada-funded project on "Promotion of Social Entrepreneurship in Disaster Risk Reduction to Build Community Resilience" led by SEADPRI-UKM. The event began with an opening remarks by the Project Leader, Prof. Joy Jacqueline Pereira, to brief on the background of the project and contextualize it with the event. The training session was delivered by Dato Dr. Madeline Berma from the Academy of Sciences Malaysia (ASM) and Puan Shazlinda Md Yusof from the School of Management, University Kebangsaan Malaysia (UKM) to members of the Geological Society of Malaysia (GSM) who are interested in venturing into social entrepreneurship for DRR. The training was attended by over 20 participants from various geosciences backgrounds; they had the opportunity to learn the background and different models of social entrepreneurship including some examples of the practices in Malaysia. The participants found the training to be very beneficial in providing information about social entrepreneurship and had catalyzed the discussion on how geoscientists would, in moving forward, build their own social enterprises to contribute to disaster risk reduction.

It was a pleasure working with both of the trainers.

Prepared by:
Norazianti binti Asmari
Representative
GSM-IGM Flagship in DRR



A screen capture of the training on Zoom led by Dato Dr. Madeline Berma (first row, middle) and Ms. Shazlinda Md Yusof (second row, second left). The training was also attended by Mr. Mohd Nizam Hasan, President of GSM (second row, first left) who delivered the closing remarks.

Participants

1 Abd Hanan B Ahmad Nadzeri
2 Abdulmumini Nura Yelwa
3 Angela Vidda Chuwat
4 Dato' Zakaria
5 Dr. Chinnh Nyda
6 Dr. Nao Vannet
7 Dr. Nurfashareena Muhamad
8 Dr. Rabieahtul Binti Abu Bakar
9 Elvaene James
10 Hang Molika
11 Husna Shaidin
12 Immas Janggok
13 Intan Irwani Mohamad Zin
14 Karthigeyan AL. Ramanathan
15 Mohammad Muqtada Ali Khan
16 Navakanesh M. Batmanathan
17 Norazianti Asmari
18 Nur Fatin Julia Maznan
19 Nur Ismiha Binti Ibrahim
20 Nurul Syazwani Yahaya
21 Siti Hasniza Muh Arshad
22 Siti Khadijah Satari
23 Zaitul Zahira Ghazali

WEBINAR

WOMEN IN GEOSCIENCE

Date: 19 June 2021
Time: 10.00 a.m. - 12.30 p.m.
Aim: To share with undergraduates and fresh graduates the opportunities and challenges faced by women in their geoscience career in Malaysia

The `Women in Geoscience' webinar was organized by Academy GEX with support from partners including Geoxpert Sdn Bhd (GEX), Universiti Kebangsaan Malaysia, IDRC, SEADPRI-UKM and Geological Society of Malaysia (GSM). The webinar was attended by over 100 participants, mostly comprising female geoscience undergraduates and fresh graduates. There were six invited speakers from various geoscience career paths. Topics covered by the speakers include 'Challenges for Women as a Geophysicist" by Ms. Zulaika Farhani, "Challenges for Women in the Mining Sector" by Ms. Nurul Naqiah Hanny, "SEADPRI-IDRC Project for Social Entrepreneurship in Disaster Risk Reduction" by Ms. Norazianti Binti Asmari, "Challenges for Women in the Oil and Gas Industry" by Ts. Hijreen Ismail, "Challenges for Women Geologists as Academicians" by Dr. Azrin Binti Azmi and "Challenges for Women in the Engineering Sector" by Ms. Hanis Ainnul Hisham.

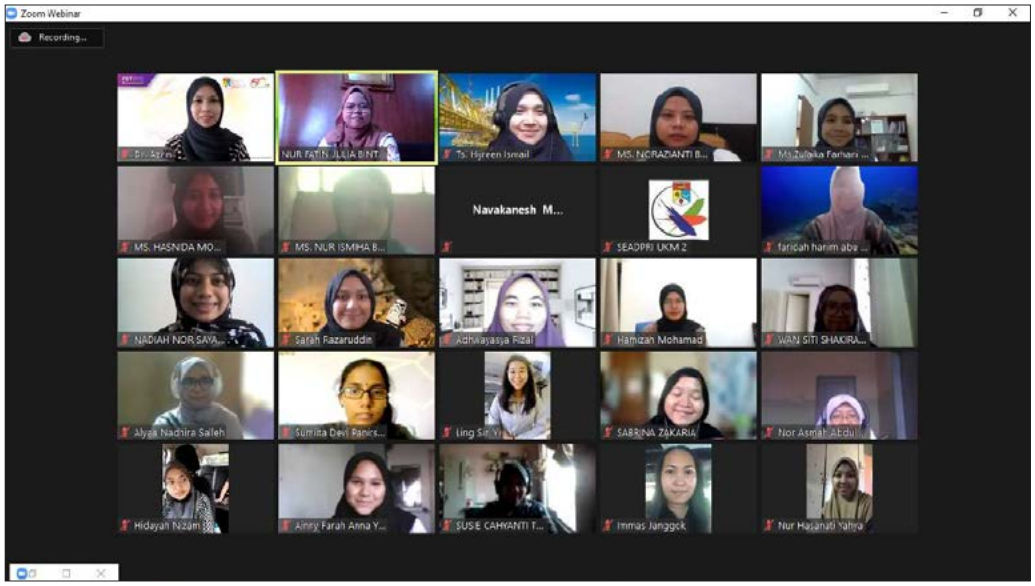
Based on the discussion, female geoscientists working in various sectors in Malaysia have been given equal opportunities and treatment as their male counterparts throughout all stages of their careers. From their experience, the speakers agreed that fresh female graduates are given equal opportunities to join the industries during job recruitment, mostly based on their academic achievements. On the other hand, fresh female graduates often have less confidence in seeking opportunities and applying for jobs with the various industries. There are much fewer female graduates applying for jobs in geoscience compared to males, even though the number of fresh female graduates far surpasses the number of fresh male graduates in the geosciences programs at universities. Upon entry into the industries, the women are also treated the same way as the men; they are expected to perform similar levels of tasks and the salary is given based on the same tenet (such as key performance index and years of experience). At the start of their careers, the women shared that they found it quite challenging to adapt socially as the workplaces are mostly dominated by men. But the awkward stage usually wears off as they get used to the environment. Some speakers also pointed out that overcoming the situation had even allowed them to grow and be more confident and

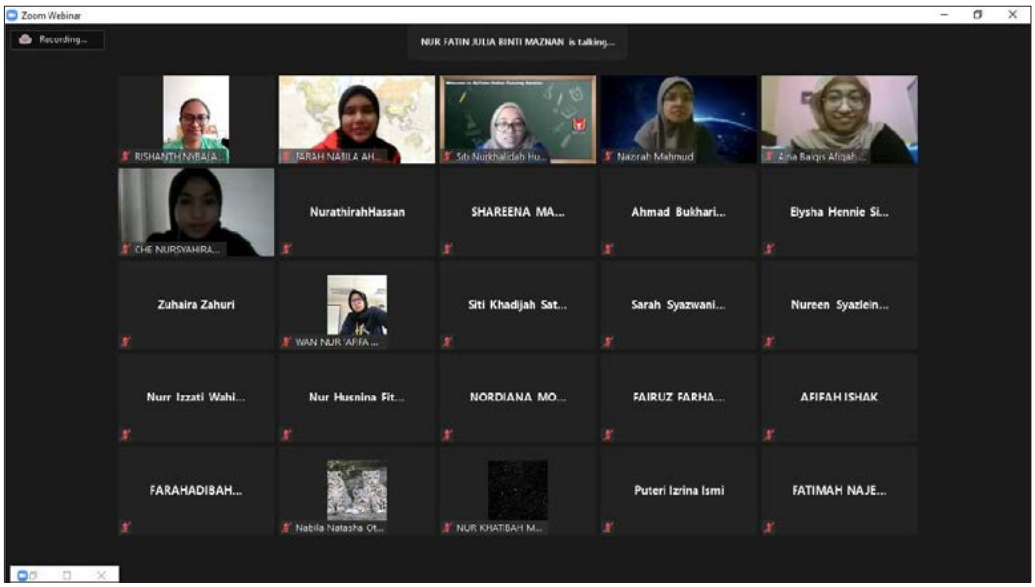
assertive; female geoscientists are a rare sight, and they do often stand out from the crowd. However, it would also be understandable if they find it a struggle to keep up at the earlier part of their careers, as they are expected to perform similarly demanding tasks as men at the workplace. This includes going to remote places for fieldwork, operating machinery, and keeping up with data analyzing tools and software, among others. Although in some workplaces, women have been given special treatment; the men would often take care of the more physically demanding tasks, and women were looked after, or not be assigned to conduct fieldwork in risky environments. Later in their careers, the usual setbacks for women to advance in their career in comparison to men commonly occur when some women choose to prioritize family life. As a result, they no longer give the same commitment to their professional life as the men in the same career path. It is also not rare for women geoscientists in Malaysia to eventually leave their careers of their own free will to focus on family life.

In essence, the discussion during the webinar revealed that in Malaysia, female geoscientists have not experienced gender-based issues at work and are given the same treatment and opportunities as male geoscientists throughout their careers. In most cases, the career success of the women mostly depends on personal choices and grit. Still, it was also noted from the discussion that the female fresh graduates in geoscience need more empowerment for them to increase their confidence and move forward in their careers.

Prepared by:
Nurul Syazwani Yahaya
Project Manager
IDRC-funded Project on Promotion of Social Entrepreneurship in DRR
GSM-IGM Flagship in DRR

A poster of the event circulated via Academy GEX Facebook page and IDRC-funded project website, featuring all the invited speakers for the webinar.





Screenshots of the group at the end of the webinar attended by female undergraduates and fresh graduates in geosciences.

WEBINAR

SUNDALAND – THE CRADLE OF CIVILIZATION

Date: 15 July 2021
Time: 10.00 a.m.

This webinar was organised by the Quaternary and Marine Geology Working Group which is chaired by Mr. Abdullah Sulaiman. For this event, Pak DhaniIrwanto from Indonesia Hydro Consult was invited to give a talk entitled Sundaland: The Cradle of Civilization.

The opening speech was made by the President of the Geological Society of Malaysia. The webinar has received more than 1800 views on social media. Following is the text of the President's speech.

Bismillahhirrahmanirrahim
Assalamualaikum warahmatullahi wabarakatuh

Yang saya hormati tuan pengerusi majlis, sahabat saya, Pak Abdullah, merangkap pengerusi 'Working Group Quaternary And Marine Geology' Persatuan Geologi Malaysia atau GSM dan saya Ahmad Nizam Hasan selaku Presiden Persatuan Geologi Malaysia, mengalu-alukan saudara serumpun kita, yang dihormati, yang dikagumi, luarbiasa hasil karyanya, Pak DhaniIrwanto. Terima kasih banyak pak kerana sudi memenuhi undangan pihak GSM dalam acara webinar yang cukup bersejarah ini; Sundaland - The Cradle Of Civilization.
Selamat datang ke arena webinar Persatuan Geologi Malaysia Pak Dhani!
Ini adalah program Pak Dhani yang kedua saya hadiri selepas minggu sudah di webinar di Indonesia yang cukup informatif dan menghiburkan sehingga lewat malam, dalam suasana yang cukup santai tapi tetap serius, begitu esplicit dan tuntas perbincangannya. Semoga hari ini sidang hadirin peserta di arena Malaysia juga diharap memberi suasana yang seumpamanya pada hari ini, kita raikan Pak Dhani dengan soalan-soalan dan pertanyaan yang bisa kita sama-sama merungkai sebuah rahsia dari masterpiece Pak Dhani.
Saya sebagai Presiden Persatuan Geologi Malaysia juga mengalu-alukan kehadiran tetamu kehormat kita pada hari ini. Untuk pengetahuan semua, acara hari ini juga disokong oleh rakan institusi akrab kita iaitu Institut Geologi Malaysia, yang merupakan kembar seperjuangan menjaga kepentingan industri ahli-ahli profesional geologi di Malaysia. Terima kasih kepada Presiden dan barisan ahli majlis IGM yang sentiasa berkerjasama erat dalam program memartabatkan bidang geologi di Malaysia kini.

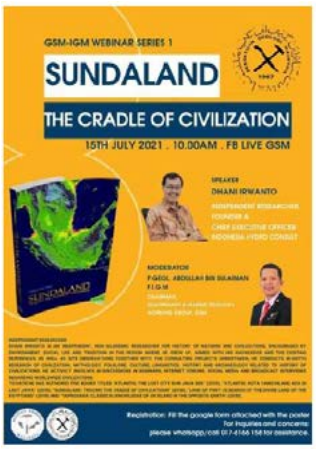
Pak Dhani, Dato'-Dato', tuan-tuan dan puan-puan sekalian.
Sebagai persatuan yang sudah melampaui separuh abad, GSM sekarang dalam fasa transformasi kearah lebih mampan, dinamik dan menjadikan agenda ir4.0 sebagai landasan untuk terus relevan. Suntikan semangat baru daripada ahli-ahli geologis muda sebagai ahli-ahli majlis GSM antara langkah merealisasikan agenda transformasi ini. Justeru itu saya amat mengharapkan sokongan padu dan tidak berbelah bagi daripada semua peserta ahli geologi, bersama-sama menggembeling tenaga dan sumbangan buah fikiran agar GSM akan terus gah dengan legasinya untuk 50 tahun akan datang…insyaAllah.

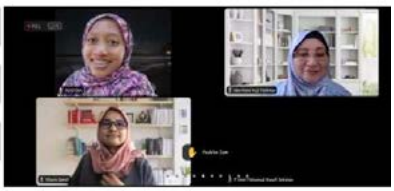
Dato'-Dato', tuan-tuan dan puan-puan yang saya hormati,
Saya berharap program hari ini antara suntikan dan pemangkin kepada banyak lagi program berbentuk antarabangsa yang akan dianjurkan oleh samada GSM atau IGM di masa akan datang.
Kita belum menang, kita masih dibelenggu dengan cengkaman pandemik Covid-19, namun yakinlah, Allah Taala tidak akan menguji hambaNya dengan ujian yang tidak bisa ditanggung hambaNya! Bersabar dan bermuhasabahlah kita bersama, insyaAllah sinar bakal menjelma kembali.
Namun begitu, antara positifnya, dunia kita semakin kecil dan rapat kini, acara-acara seminar, perbincangan dan konferen kita lebih mesra dan mudah kini. Kita bagaikan suatu pangea, sesuai dengan wacana oleh Pak Dhani hari ini, kita bagaikan satu Sundaland kini. Kita semua semakin akrab dengan manusia dari pelbagai pelusuk dunia dalam acara norma baharu, webinar. Dan program hari ini kita dapat rasai natijahnya! New norma ini bakal menjadi budaya norma baharu dalam melinia ini.
Akhir kata saya sebagai Presiden Persatuan Geologi Malaysia sekali lagi mengucapkan jutaan terima kasih kepada Pak Dhani yang sudi dicuri masa untuk bersama kita. Dan semua hadirin yang hadir, mohon maaf jika tidak berkesempatan melayari melalui platform Zoom yang 'over limit subscribe', tapi masih bisa bersama di maya FB

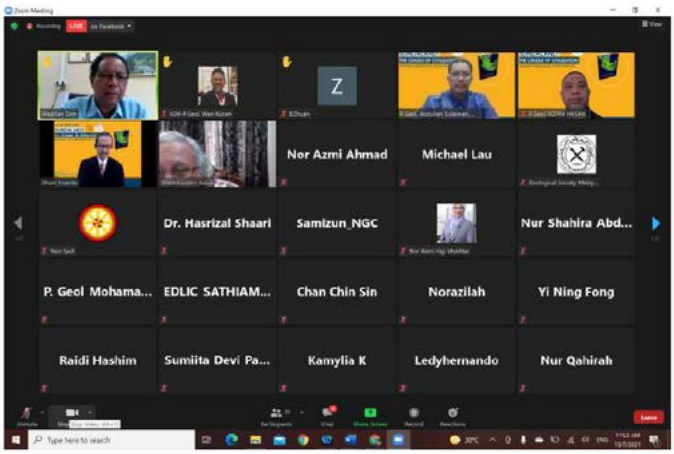
live. Luarbiasa sekali sambutannya! InsyaAllah pihak kami akan memperbaiki kelemahan kami ini di masa akan datang. Mohon maaf semua.
Semoga semua selamat menikmati suatu pelayaran Sundaland…the cradle of civilization bersama nara sumber Pak Dhaniirwanto!

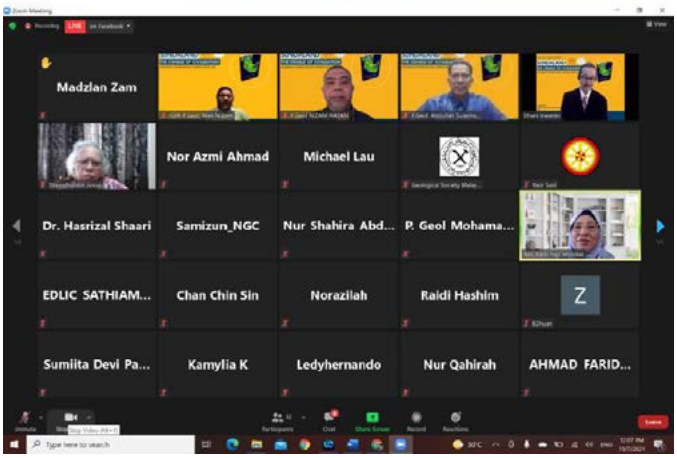
Sekian, terima kasih.

Ucapan pembukaan dari:
Presiden GSM 2021/2022









Prepared by:
P.Geol Abdullah bin Sulaiman
Chairman Quaternary & Marine Geology Working Group
GSM 2021/2022

LAPORAN TAKLIMAT PELUANG MENYAMBUNG PENGAJIAN

Satu taklimat peluang menyambung pengajian di peringkat sarjana dan doktor falsafah di universiti tempatan telah dijalankan dalam talian pada 30 Jun 2021 melalui pelantar Zoom dan Live Facebook Persatuan Geologi Malaysia. Taklimat ini disampaikan oleh 7 wakil universiti yang mengambil bahagian iaitu Universiti Malaya, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, Universiti Malaysia Kelantan, Universiti Malaysia Terengganu, Universiti Teknologi PETRONAS dan Universiti Malaysia Sabah.

Bagi yang tidak berkesempatan menyertai taklimat tersebut, bolehlah melayari pautan berikut bagi sesi rakaman yang telah dilakukan: https://fb.watch/v/3nQw-Az0o/

Berikut merupakan beberapa foto tangkap layar yang sempat dirakam semasa program tersebut berjalan:

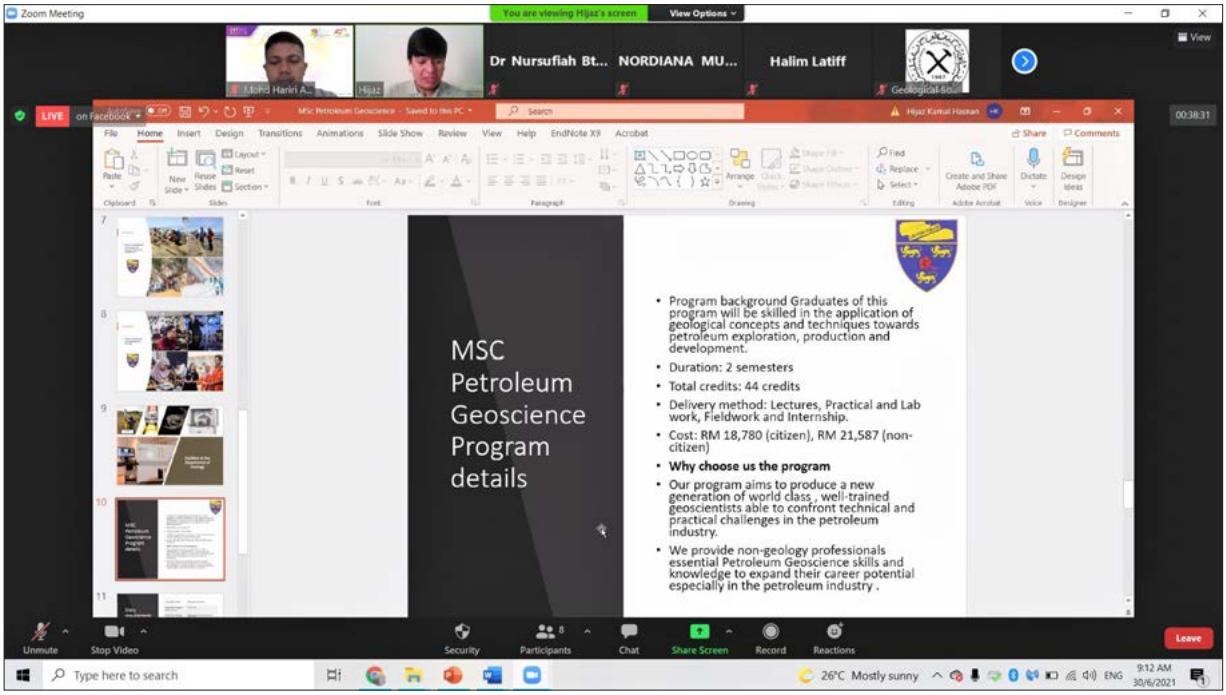


Foto 1: Taklimat oleh Dr. Hijaz Kamal Hasnan yang mewakili Universiti Malaya.

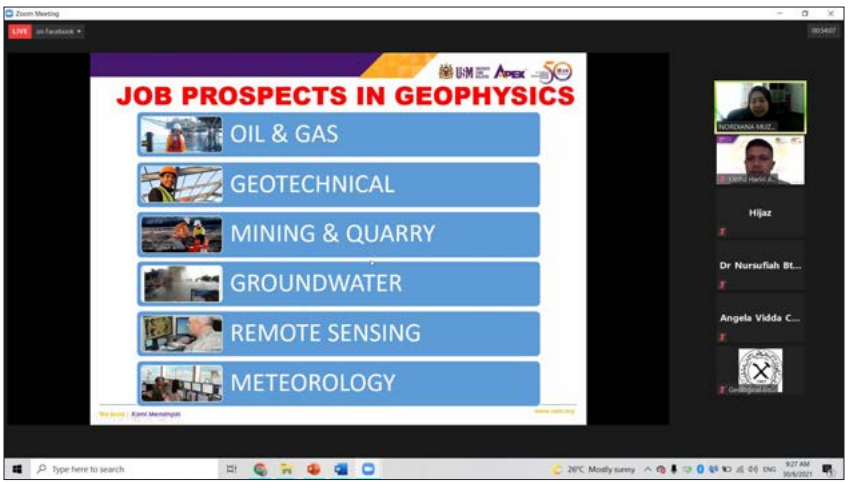


Foto 2: Taklimat oleh Dr. Nordiana Mohd Muztaza yang mewakili Universiti Sains Malaysia.

Foto 3: Taklimat disampaikan daripada wakil Universiti Teknologi PETRONAS iaitu Dr. Abdul Halim Abdul Latiff.

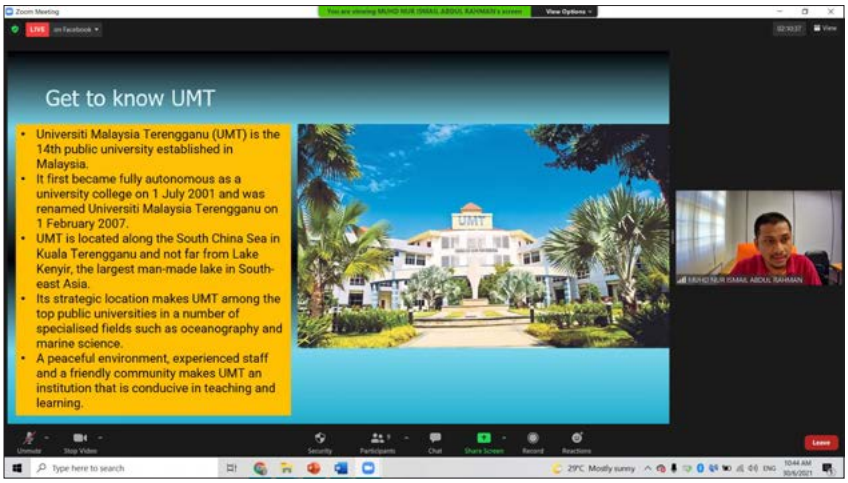


Foto 4: Universiti Malaysia Terengganu (UMT) diwakili oleh Dr. Muhd Nur Ismail Abdul Rahman.

Foto 5: Sesi bergambar bersama; dari atas kiri: Dr. Zulherry Isnain (UMS), Dr. Mohd Hariri Arifin (moderator/UKM), Dr. Hijaz Kamal Hasnan (UM), Dr. Nordiana Mohd Muztaza (USM), Dr. Abdul Halim Abdul Latiff (UTP), Dr. Nursufiah Sulaiman (UMK) dan Dr. Muhd Nur Ismail Abdul Rahman (UMT).

Laporan disediakan oleh:
Mohd Hariri Arifin

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1. Abdalmajed Melad Hasan Shlof
2. Aida Farisah Mohd Hasnizul
3. Aina Zulaikha Md Khirun Solehudin
4. Aisyah Azhar
5. Ajab Singh
6. Aliff Imran Nor Azham
7. Arda Anasha Jamil
8. Athirah Tariq Umar
9. Ayu Nur Shafieqa Ismail
10. Azwani Amira Hamzah
11. Chong Seng Long
12. Chua Pei Si
13. Earl Jason Jamanius
14. Eric Justin
15. Esther Ligit Tingang
16. Fan Jun Xiang
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19. Georvie Avender Thomas Jinwin
20. Hani Emylia Jamaluddin
21. Hanis Zulaikha Zulkifli
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23. Imran Danial Rizalpahlavy
24. Intan Auni Syahidah Mustaffa
25. Izzah Aqilah Isa
26. Jeyamalar Jayamany
27. Kavilasini Sevapragsam
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30. Ku Azeem Ku Zen
31. Lee Kok Yuan
32. Lim Yan Ying
33. Lim, Joey
34. Luqman Hakim Asraf
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36. Mazlina Razali
37. Mohamad Aqil Azmi Mohd Rasedi
38. Mohamad Fahmi Mat Daud
39. Mohamad Fairus Mohamad Talhah
40. Mohamad Fairus Mohamad Talhah
41. Mohamed Hadhry Haslimi
42. Mohd Shafi Saiful Mansor
43. Muhamad Arif Mohd Zukri
44. Muhamad Ngafifi Md Lahuri
45. Muhammad Adib Omar
46. Muhammad Afio Zikri U'Mar
47. Muhammad Akmal Mohd Basri
48. Muhammad Al Hakim Nazri
49. Muhammad Alsyafiq Jamal
50. Muhammad Fahmi Danial Zulkefli
51. Muhammad Fakharuddin Naim Fadli
52. Muhammad Hafizuddin Hisham
53. Muhammad Naim Ranizam
54. Nabila Zulkifly
55. Nadirah Mohd Aiyob
56. Neeran Niraj Suresh
57. Noor Afina Hafizha Hasmuni
58. Noor Anis Syuhada Ahmad
59. Nor Adila Rozad
60. Nor Aini Khairiyah Mat Daud
61. Nor Amalina Hamdan
62. Nor Farah Wahida Dzulkifli
63. Nor Zuliani Mohd Rizal
64. Norazizan Ramli
65. Norsyafiqah Shaira Mulyadi
66. Novlen Jessfin Tubang
67. Nur Ammyliza Salim
68. Nur Hadayatun'najjwa Azlan
69. Nur Izzah Sabarin
70. Nur Kamilia Abdul Halim
71. Nur Khaleeda Muhamad Adzrill
72. Nur Khatibah Md Yunos
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74. Nur Syaza Nazaruddin
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79. Nurul Izati Abd Jalil
80. Nurul Suaidah Khairol Anwar
81. Putri Fazira Natasha Azaman
82. Ramabarathi Ramasamy
83. Rashmikaa Ravikumar
84. Raul de Perrera Banaran
85. Rozlianah Jopius
86. Sabrina Alia Mohd Emran
87. Shafiq Jamaludin
88. Shamini Kannan
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90. Siti Maisarah Mohd Asri
91. Siti Merissa Mikail
92. Siti Nurhafizah Azmee
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95. Tan Poh Tee, Bernice Nerissa
96. Trecyline Mahat
97. Wan Nur Syafiqa Wan Hazimi
98. Wong Yee Huey
99. Zulkarnain Zainuddin

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2. Amir Huzairy Yahya
3. Asren Sonia
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17. Nur Ismiha Ibrahim
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20. Wan Mohamed Nizam Wan Isa
21. Zaitul Zahira Ghali @ Ghazali

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2. Chan Lek Keat
3. Noorasyikin Mohammad Noh

From Student To Full Membership

1. Afifi Fahmi Ahmadol
2. Ainyyafiatty Arifin
3. Angela Vidda Chuwat
4. Kong Sher-Rine
5. Muhamad Zarif Adib Mohamed Shah
6. Muhammad Fuad Razali
7. Muhammad Hazmi Abdul Malik
8. Nik Muhammad Adib Ramiz Yaaziz
9. Siti Hasha Abd Jamal

From Full To Life Membership

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2. Hamka Istamar
3. Mo Kwai Leong
4. Noorzamzarina Sulaiman
5. Normala Dawar
6. Wan Muhammad Wan Ab Ghaffar

Resigned

1. Nurul Farah Atika Safran – dropped Geology

Christian-Albrechts-Universität zu Kiel (CAU) & Universiti Malaysia Terengganu (UMT): On-line Scientific Talks

Hosts:
Prof. Dr. Sebastian Krastel
Institute of Geoscience, CAU
email: sebastian.krastel@ifg.uni-kiel.de

AP Dr. Edlic Sathiamurthy
Marine Geoscience Program,
Faculty of Science and Marine Environment, UMT
email: edlic@umt.edu.my

Date: 29 September 2020 to 3 November 2020 (every Tuesday)

Introduction

These scientific talks were organized under an MOU between UMT and CAU on marine geoscience. The talks sought to exchange scientific knowledge on marine geoscience between both institution and participants. Moreover, it also provided an opportunity to introduce the recently established Marine Geoscience Program of UMT to the geoscience community here in Malaysia and also in Europe. Geological Society of Malaysia had given a strong support for this activity and we are so thankful for that. This report gives a summary of the scientific talks.

Summary of talks

Table 1: List of talk topics and speakers.

Date	Speaker	Topic
29/9/2020	Dr. Christoph Böttner CAU	Natural and anthropogenic fluid migration pathways in marine sediments
6/10/2020	Dr. Fatin Izzati Minhat UMT	Tiny microfossils as indicators of past sea level change
13/10/2020	Dr. Felix Gross CAU	Integrative natural hazard analysis at the Center for Ocean and Society at Kiel Marine Science: An example from Southern Italy
20/10/2020	Dr. Jens Schneider von Deimling CAU	New directions in habitat mapping
27/10/2020	Dr. Khaira Ismail UMT	Mining the Earth's last frontier: The deep sea
3/11/2020	Mr. Arne Lohrberg CAU	Buried ice-marginal landforms in the southeastern North Sea imaged by high-resolution seismic

1st Talk: Dr. Christoph Böttner - Natural and anthropogenic fluid migration pathways in marine sediments

Anthropogenic greenhouse gas emissions and consequent global warming are one of the grand challenges of the 21st century. A key technology for mitigating the consequences of climate change is the active removal of carbon dioxide from the atmosphere (carbon dioxide capture and storage = CCS) to meet the greenhouse gas emission reduction formulated by the IPCC and UN's SDGs. However, it is important to accurately assess the risks of potential leakage to ensure that long-term storage is efficient and safe, as well as achieving societal acceptance. Here, I show examples of natural and anthropogenic fluid migration pathways, which are further investigated as they may act as potential leakage pathways from storage formations. Natural fluid migration pathways such as vertical fluid conduits may

manifest in seismic data as chimneys or pipes. Although, their nature and physical properties are poorly constrained they likely represent fluidized sediments or fracture networks that connect deeper strata to the seafloor. At the seafloor, the released fluids may form pockmarks, as shown by the example in the Witch Ground Basin. Anthropogenic fluid migration pathways may form where drilling activities have fractured the surrounding of the well or where faulty/ corroded well barriers permit vertical flow of fluids. A case study from the North Sea shows that the leakage from abandoned wells is likely linked to drilling induced fractures and can be assesed by the well's proximity to shallow gas, which is visible in seismic data as bright spots with polarity reversals. The released gas is likely of biogenic origin and contributes to the methane budget of the North Sea. Both case studies show that an integrated study of ancient complex fluid flow systems is necessary to understand their present behavior and predict their future**.**

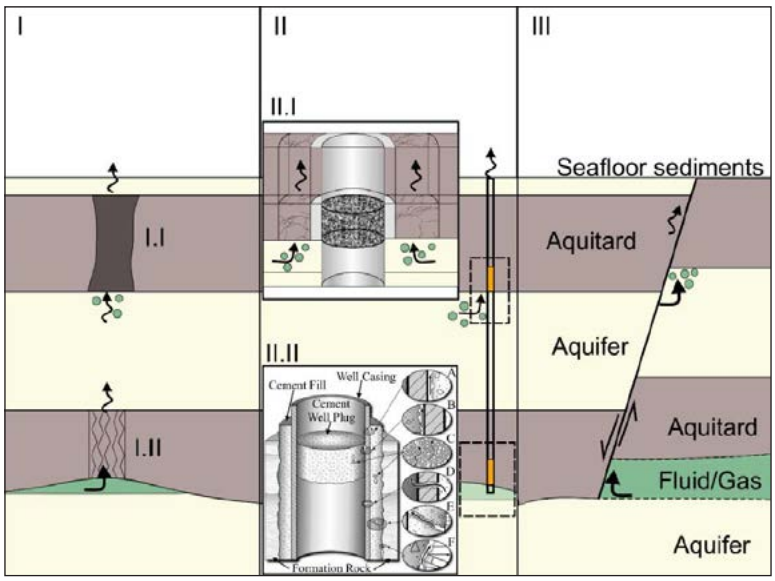

Figure 1: Schematic sketch of fluid migration pathways in marine sediments. (I) Vertical fluid conduits which manifest in seismic data as amplitude anomalies (Seismic pipes & chimneys). These structures are known from sediment basins around the world and are interpreted as the seismic image of (I.II) gas filled fracture networks or as (I.II) injections of fluids or fluidized sediments. (II) Wells from hydrocarbon exploration and other subsurface operations. Leakage may occur either (II.I) through the fractured surrounding of the borehole and/or (II.II) through faulty casings and/or annuli of the well: (A) Between casing and cement; (B) between cement plug and casing; (C) through the cement pore space as a result of cement degradation; (D) through casing as a result of corrosion; (E) through fractures in cement; and (F) between cement and rock (modified after Gasda *et al*., 2004). (III) Structure-controlled flow along faults and fractured zones in the subsurface.

2nd Talk: Dr. Fatin Izzati Minhat – Tiny microfossils as indicator of past sea-level changes

The accelerating global sea-level rise is predicted to have significant impact on the world's coastal zone and geomorphology. Since the timing and magnitude of sea-level rise is far from uniform, local sea-level predictions are important to help validate or improve sea level models. Paleo sea level records with appropriate bio-geo indicator proxy indicators could help us to develop better mitigation strategies against current or future sea-level rise scenarios. Recent studies in Sulawesi and Western Borneo have indicated that the mid-Holocene sea level was much lower than previously suggested. This study utilised benthic foraminifera as sea level proxy in order to reconstruct continuous high-resolution sea level curve in Sunda Shelf during Holocene. The sea level data from Sunda Shelf, Malaysia waters shows two sea level high-stands, the first during ~7900 cal BP (+3 m) and the second during ~5200 cal BP (+2 m). The record has indicated that the sea level on Southern South China Sea has not reached or go beyond 5 m as suggested by several geophysical models previously. Comparison made to the regional models of glacial-isostatic adjustment (GIA) suggested that the sea level pattern produced by this study falls between ICE-5G and ANICE-SELEN ice-sheet models.

3rd Talk: Dr. Felix Gross - Integrative natural hazard analysis at the Center for Ocean and Society at Kiel Marine Science: An example from Southern Italy

Coastal areas are experiencing significant growth in population and infrastructure, and are therefore increasingly vulnerable to disasters originating from the ocean, as well as associated cascade effects. To better cope with hazards and risk, the UN's Sendai Framework for Disaster Risk Reduction (2015-2030) has laid out global priorities for disaster risk reduction (DRR). In April 2020, the OECD defined common ground between the Sendai Framework of Disaster Risk Reduction and the Paris Agreement, making DRR a major priority in the management of climate change and the UN's sustainable development goals. In order to tackle the challenges arising from the Sendai Framework's Priority 1 (understanding disaster risk) and Priority 2 (strengthening disaster risk governance to manage disaster risk), we are using a workflow from hazard discovery over hazard understanding and hazard assessment towards economically practical, societal acceptable and politically implementable solutions (Figure 2). As hazard and impact assessment is a regional rather than global challenge, case study areas or living lab approaches are key to understand hazards, exposure and risk. Southern Italy is one of the most geologically active regions in the world and was struck by several devastating earthquakes and tsunamis over the last few centuries. Furthermore, Mt. Etna, Europe's largest active volcano, is located in this region. Mt Etna is known for its frequent small scaled eruptions and a prominent instability of its eastern flank. The combination of a densely populated and eroding coast, critical infrastructure, and economic relevance make this region a key study site for (marine) geohazards and in the Mediterranean. Over the past decade, an international team mostly led by Kiel based scientists collected several datasets across the region which show the major tectonic fault systems, as well as areas overprinted by gravitational movements and collapses. Especially Mt. Etna, and its eastern submerged flank and adjacent continental margin was intensively surveyed. During these surveys, we *discovered* unknown fault lines, which connect to onshore-mapped zones of weakness and creeping of the entire eastern flank. Based on this discovery, we deployed a marine geodetic network to prove and *understand*, if and how the flank's instability and creeping also extents into the offshore realm. During a slow-slip (a-seismic) event in May 2017 the instruments recorded a 4 cm slip at the southern boundary of the continental margin offshore the volcano edifice, proving our initial interpretation of a coupled volcano edifice and continental margin instability. To elaborate and interpret these findings, numerical modelling and scenario generations will lead to a holistic *assessment* of the hazard potential of the area. From our first observations, the margin is not prone for a large volume failure but rather fractures into small blocks, which are toppling downslope or disintegrate entirely during failure. This affect may produce small scale, near-field tsunami waves with run-up heights of less than 3 m, but runout-times of less than 5 minutes. This short period between a failure and the inundation of a potential tsunami wave shows, that *solutions* are needed for the area, which do not include a classical tsunami early warning system (which is not established in the Mediterranean so far). These solutions should include measures to increase the awareness and preparedness of coastal communities and tourists. As the hazard potential of the entire area is rather high, it is paramount to reduce the exposure and vulnerability of the area in order to minimize the risk of human and economic loss. Measures like education, communication, construction requirements/regulations and scenario-based disaster drills may eventually lead to a disaster risk reduction.

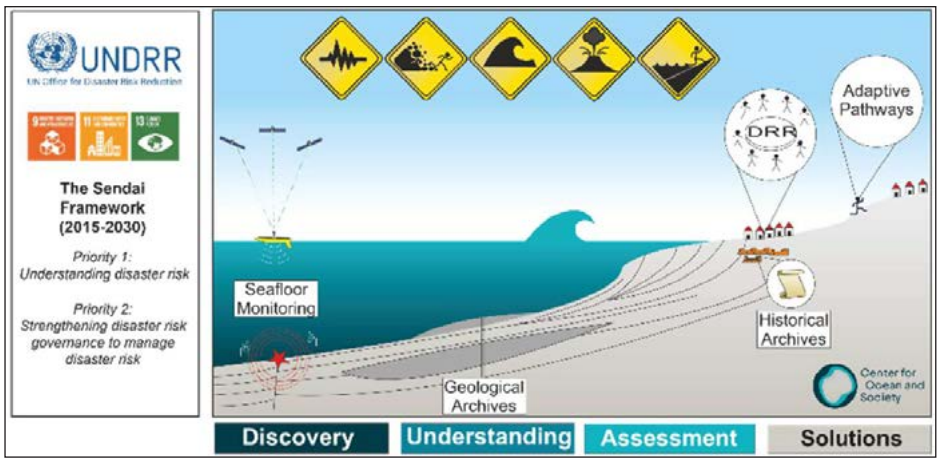

Figure 2: Visualization of the workflow from hazard discovery over hazard understanding and hazard assessment towards solutions. All measures should be implemented according the UN's SDGs and the UNDRR's (UN Office for Disaster Risk Reduction) Sendai Framework (2015-2030).

4th Talk: Dr. Jens Schneider von Deimling – New directions in habitat mapping

Our presented habitat mapping activities and procedures demonstrated how to shed light and sound into the shallow coastal 'white ribbon' areas in the Baltic Sea. We showcased the potentials of latest seabed surveying and data processing techniques. In the terrestrial realm, researchers, authorities and policy makers dealing with spatial management and environmental protection are used to drawing decisions based on a strong data base derived from space born remote sensing. Such maps and procedures are often missing in the marine realm. To overcome this problem, we aimed to find the most suitable sensing method and to understand the physics of interaction for the specific habitat-sensor setup while developing and employing state-of-the-art technology. We concentrated on key habitats such as biologically active reefs of stones and/or mussels, burrowing fauna, sand bars and banks, and seagrass meadows.

Our project ECOMAP (www.bonus-ecomap.eu) envisaged sophisticated procedures, data analyses techniques, and implementing computer code to achieve its designated goals. The techniques comprise multispectral multibeam acoustics, point cloud multibeam data evaluation, and data fusion between airborne and ship born opto-acoustic data with special focus on much improved area-wide mapping of seagrass meadows with unprecedented accuracy using modern multibeam echosounder technology. We also envisaged and provide convincing case studies that marine habitat mapping can be pushed forward through the integration of artificial intelligence techniques in postprocessing, data analyses, and habitat assessments.

ECOMAP researched and developed prototype remote sensing techniques. Now and in the near future we aim to push forward to make them applicable to the end user, a process that requires standardized procedures and user-friendly software applications We are in direct contact with local authorities and discuss which measurements, gained knowledge about remote sensing, and procedures could improve ongoing and future habitat mapping and monitoring strategies.

In the meantime, ECOMAP technology was requested from abroad (Spain, Israel and Canada), e.g. to remotely sense other habitats such as black corals or tropical seagrass species. Several projects already funded or under preparation resulted from or are supported through knowledge gained within ECOMAP and serve to test the procedures outside of the Baltic Sea after the project has ended.

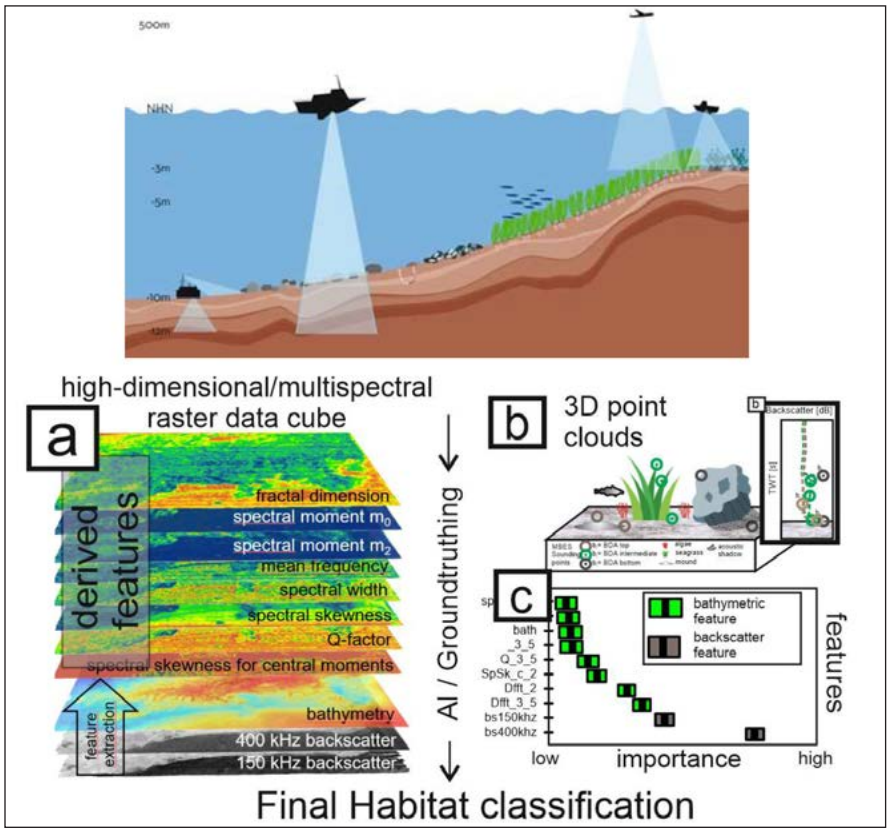

Figure 3: (a) from bottom to top: digital raster data of corrected backscatter at 150 kHz, 400 kHz, followed by bathymetry, and its spectral/spatial derivatives above, (b) Sketch showing complex acoustic 3D echo point clouds especially present at seagrass meadows, (c) plot showing the importance of features ranked with the most important being 400 kHz backscatter, followed by 150 kHz, immediately followed by several spectral derivatives of bathymetry, and bathymetry itsself (y-axis 'bath'). Note that this is not a generic feature table being valid for all habitats, but it is a specific one.

5th Talk: Dr. Khaira Ismail – Mining the Earth's last frontier: The deep sea

The deep-sea accounts for 95% of the ocean's volume and is the largest habitat on Earth. The dark, extremely high-pressure area is lush with unique, unusual species, habitat, and ecosystem and lacks human understanding of their function. Three habitats in the deep-sea, the abyssal plain, hydrothermal vents, and seamounts, have been an exploration area for deep-sea mining interest to extract various mineral deposited within these habitats. The extraction, however, is yet to happen within the high seas, and International Seabed Authority (ISA) regulates it. Their purpose is not to prevent mining on the seafloor but to mitigate its damage—selecting locations where extraction will be permitted, issuing licenses to mining companies, and drafting the technical and environmental standards of an underwater Mining Code.

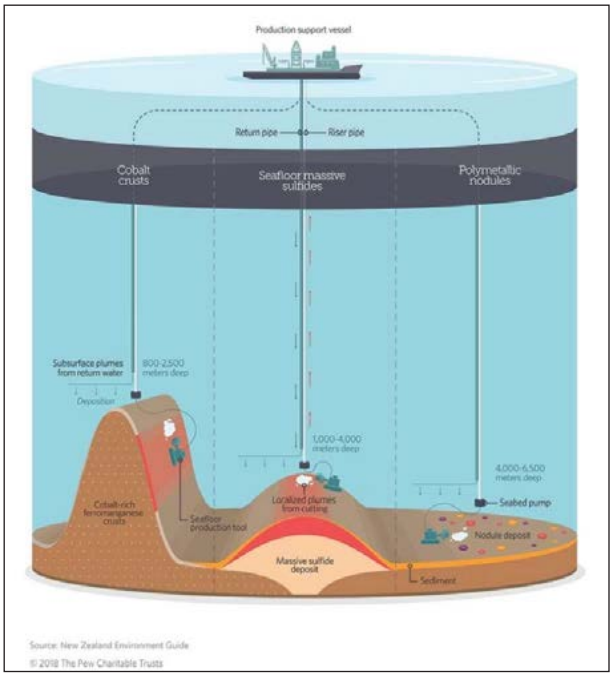

Figure 4: Types of deep-sea mining for particular mineral types, photo courtesy from The Pew Charitable Trusts factsheet on Deep Sea Mining: The Basics (https://www.pewtrusts.org/en/research-and-analysis/fact-sheets/2017/02/deep-sea-mining-the-basics).

The deep-sea is the last frontier on our planet. Much of this challenging environment is still unexplored and unknown to human knowledge. Yet, the deep sea is no longer free from anthropogenic impacts. The ocean is subjected to human activities and increasingly progressing into the deepest part of the ocean. The general outlook on deep-sea mining by a different group of people are as follows: an environmental activist will view it is the destruction towards the ecosystem; for a scientist, it will uncover new exciting species and seafloor features; to the minds of stakeholders, it is a new risk-return trade-off investment, and for the authority will view it as an area that requires rules and regulations.

As a state-party of the United Nations Convention on the Law of the Sea 1982 (UNCLOS) and Convention of Biological Diversity 1994 (CBD), Malaysia has yet to develop policies, regulations, and laws related to seabed mining to mitigate its effect on the marine environment. Therefore, Malaysia participation and active involvement with the International Seabed Authority has never been more urgent. Awareness, information, and knowledge of the seabed minerals and the mineral extraction effect need to be delivered to more Malaysia's expansive community.

6th Talk: Arne Lohrberg - Buried ice-marginal landforms in the southeastern North Sea imaged by high-resolution seismic

In northwestern Europe, the landscapes have been shaped by ice sheets during the major glaciations of the Pleistocene and modified to its present state during the Holocene. A better understanding of Pleistocene deposits is essential for the assessment of constructions sites, groundwater resources, geohazards and coastal protection. It also facilitates the quantification of methane seepage, which is essential for future climate models.

The analyses of 2D reflection seismic data in the southeastern North Sea between Amrum and Helgoland shows that buried glacial landforms dominate the shallow subsurface. Large tunnel valley systems and a glaciotectonic complex made from a series of thrust faults and thrust sheets has been identified. The formation of tunnel valleys is explained by high hydraulic heads below ice sheets during the Elsterian glaciation. The orientation of these glacial landforms is used to outline several ice margins in the study area. Cross-cutting relationships as well as cut-and-fill structures indicate that at least five major ice margins were present in the study area during the Pleistocene, which contradicts the traditional model of ice advances into the North Sea limited to the major glaciations of the Elster and Saale glaciations.

A novel survey strategy with highly reduced survey speeds allowed to show that gaseous methane seepage by single gas bubbles can reach 1,900 µmol m^{-2} d^{-1} in the Eckernförde Bay, Baltic Sea. The ebullition of single gas

bubbles is not limited to geological structures and the gas bubbles likely reach the sea surface with approximately 50% of the initial methane content. This widespread seepage of single gas bubbles thus provides an efficient transport mechanism of marine seabed methane into the atmosphere. Such gas seepage is likely to occur in larger regions of the Baltic Sea, possibly on a global scale where shallow gas is present. As a result, methane seepage by single gas bubbles in shallow seas is probably a highly underestimated source for the release of marine methane to the atmosphere.

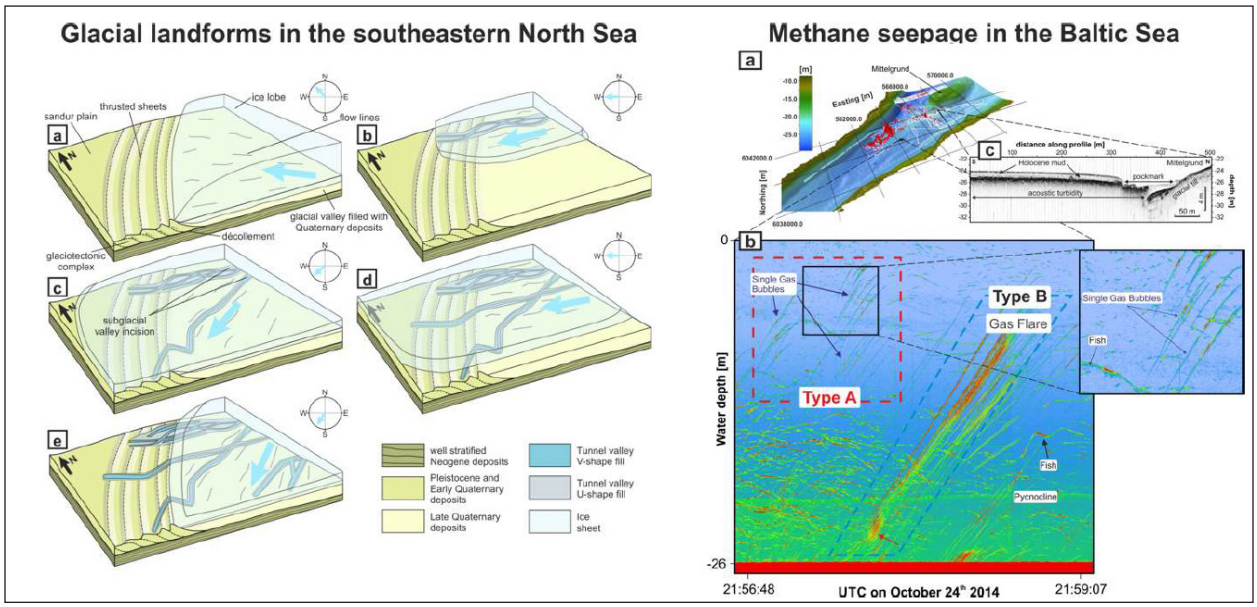

Figure 5: Glacial landforms and methane seepage.

Acknowledgement

CAU and UMT would like to thank the Geological Society of Malaysia for its support both in promoting the talks and also for the publication of this report.

UPCOMING EVENTS

September 14-16, 2021: Virtual 2021 IADC/SPE Managed Pressure Driling & Underbalanced Operations Conference & Exhibition. Event URL: https://www.iadc.org/event/iadc-managed-pressure-2021-conference-exhibition/.

September 21-23, 2021: SPE Annual Technical Conference and Exhibition (ATCE); Dubai, United Arab Emirates (In-person and virtually). For general enquiries, please contact: mchopra@spe.org.

September 26-October 1, 2021: IMAGE '21 (SEG and AAPG joint annual meeting); Denver, Colorado and Online. Visit event website https://imageevent.org/2021 for more details.

September 27-29, 2021: Integrated Process-Based Geological Modeling in Exploration and Production; Abu Dhabi, United Arab Emirates. Visit https://www.aapg.org/global/middleeast/events to obtain more details about the event.

October 4-7, 2021: 14th Middle East Geosciences Conference and Exhibition; Bahrain. To find out more, visit website at https://geo-expo.com/conference/, or contact Mr. Abeer Al Zubaidi via email aapgme@aapg.org.

October 5-6, 2021: The Stratigraphy of Sundaland: Current Perspectives and Future of the Science. Virtual Workshop via Zoom (Singapore, Singapore time). For details, please check event website, at https://www.aapg.org/global/asiapacific/events/virtual/articleid/59741/the-stratigraphy-of-sundaland-current-perspectives-and-future-of-the-science#pricing.

October 12-13, 2021: EAGE Conference on Seismic Interpretation using AI Methods - Going Beyond Machine Learning (Online). For further information and enquiries about the workshop, please contact EAGE Asia Pacific: Tel.: + 60 3 2722 0140, E-mail: asiapacific@eage.org / registrations@eage.org.

October 12-14, 2021: SPE/IATMI Asia Pacific Oil & Gas Conference and Exhibition (Virtual). Check out https://www.spe.org/events/en/2021/conference/21apog/asia-pacific-oil-and-gas-conference-and-exhibition.html for further information.

October 18-21, 2021: 82nd EAGE Conference & Exhibition (In-person and virtually), Amsterdam, The Netherlands. Visit https://www.spe.org/events/en/2021/conference/21euro/spe-europec-featured-82nd-eage-conference-exhibition.html.

October 24-27, 2021: AAPG 2021 International Conference & Exhibition (ICE); Muscat, Oman. Further details will be made available, visit https://www.aapg.org/events/conferences/ice.

October 26-31, 2021: The International Symposium on Deep Earth Exploration and Practices (DEEP-2021) (Virtual). Visit http://2021.sinoprobe.org/default.html for further details.

November 10-11, 2021: AAPG Latin America and Caribbean Region Energy Opportunities 2021 Virtual Conference. Visit https://energyopportunities.info/2021for further details.

November 16-18, 2021: Asia Pacific Unconventional Resources Technology (Asia Pacific URTeC) 2021 (virtual event). More details at https://www.spe.org/events/en/2021/conference/21apur/about.html.

November 23-24, 2021: High CO_2, High Contaminant Challenging Fields and Alternative Energy - Impact and Monetization. Virtual Workshop via Zoom (Singapore, Singapore time). Visit https://store.aapg.org/events/registration.aspx?event=S7329000 for event details.

November 28-30, 2021: RECSO EnviroSpill 2021 Conference and Exhibition; Kingdom of Bahrain. For enquiries, contact : Kiran Gulzar Ahmed, info@rescoenvirospill.org; webpage: www.rescoenvirospill.org.

December 5-9, 2021: 23rd World Petroleum Congress; Houston, TX. Details can be obtained at https://www.23wpchouston.com/program/program-overview/.

December 6-7, 2021: SPE International Conference on Oilfield Chemistry (In-person and online); The Woodlands, Texas, USA. Details at https://www.spe.org/events/en/2021/conference/21occ/oilfield-chemistry-international-conference.html.

December 6-8, 2021: Virtual GEOSEA 2021. Visit website https://geosea2021.xperto.org/ for further information.

February 21-23, 2022: International Petroleum Technology Conference (IPTC) 2022; Dahran, Saudi Arabia. Event webpage: https://2022.iptcnet.org/.

March 14-16, 2022: MEDiNA Technical Conference and Exhibition (AAPG/EAGE Mediterranean and North African Conference and Exhibition); Tunis, Tunisia. Check out the details at https://medinace.aapg.org/2022/.

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