

**GEOLOGICAL HERITAGE MAPPING PROGRAMME IN
MALAYSIA**

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SUMMARY

The programme on mapping of geological heritage resources for individual states for the whole country commenced early 2000. At the initial stages efforts were focused on refining the mapping approach and capacity building. The development of the mapping technique concentrated on consolidating the understanding of the mapping elements, i.e. inventory, characterization, classification, evaluation and ranking. Efforts to build capacity were initiated by convening a series of training activities for field geologists on the approach to mapping. Several states, in particular Selangor, Kelantan, Terengganu and Sabah, have achieved satisfactory progress.

**PRELIMINARY MAPPING OF GEOLOGICAL HERITAGE
RESOURCES IN SELANGOR AND WILAYAH PERSEKUTUAN
KUALA LUMPUR**

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SUMMARY

Research on geological heritage in Selangor and Federal Territory of Kuala Lumpur show many potential geosites to be promoted as the states or national geological heritage. The breathtaking quartz ridges, limestone hills with complex network of caves and unique formation of hot springs, each have its own allure. To date, 33 geosites have been identified and grouped as 2 quartz reef, 3 limestone hill 3 ex-mining pond, 10 hot spring and 6 waterfall geosites. This report explains those geosites in brief.

**PRELIMINARY MAPPING OF GEOLOGICAL HERITAGE
RESOURCES IN KELANTAN**

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SUMMARY

Preliminary Mapping of Geological Heritage Resources in Kelantan Systematic mapping of Kelantan for geological heritage sites is still in the early stage. Up to know, 23 localities were identified as a potential geosite and most of them are located at Gua Musang and Kuala Krai province. Detailed characterization of the geology and landscape was just started for two potential geosites, namely Gunung Stong Migmatite Complex and Lojing Hot Spring.

**PRELIMINARY MAPPING OF GEOLOGICAL HERITAGE
RESOURCES IN TERENGGANU**

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SUMMARY

A systematic mapping for geological heritage of Terengganu was started since early 2000. At least 21 potential geosites were recognized and the basic information was gathered, including a geological data and the beauty of the rock formation and their morphologies. The details study for 9 geosites was carried out, and some of them already done.

**PRELIMINARY MAPPING OF GEOLOGICAL HERITAGE
RESOURCES IN SABAH**

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SUMMARY

The mapping of geological heritage resources in Sabah has identified several sites, which has heritage, scientific and recreational values. To date 10 sites have been or are in the process of detailed mapping, while 9 sites and geological features have been identified for further study. Consultation with local geoscientists to identify other geological sites will be intensified.

**PRELIMINARY MAPPING OF GEOLOGICAL HERITAGE
RESOURCES IN PAHANG**

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SUMMARY

Geological heritage resource mapping in Pahang was started in early 2000. Up till now, more than 34 potential geosites have been listed for Pahang. Mapping works have been carried out on 15 geosites, some of which have been completed and published in this volume. Basic data on geological and landscape diversities have been gathered during this mapping. Also collected are information on the natural value related with the landscape features, and the recreational potential of the mapped geosites.

**PROGRESS REPORT ON GEOLOGICAL HERITAGE RESOURCES
MAPPING IN KEDAH, PERLIS, PULAU PINANG, NEGERI
SEMBILAN, MELAKA, PERAK AND JOHOR**

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SUMMARY

This progress report of Geological Heritage Resource mapping was based on research study that was done by the Minerals and Geoscience Department Malaysia (JMGM) on various states such as Kedah, Perlis, Pulau Pinang, Negeri Sembilan, Melaka and Johor. 7 geosites had been listed for Perlis, 3 geosites for Pulau Pinang, 20 geosites for Langkawi and 7 geosites for Kedah. Where else JMGM of Negeri Sembilan and Melaka states had listed 10 geosites for the former and 6 geosites for the latter. The JMGM of Johor state had listed 24 geosites and state of Perak led listed 28 geosites. Most of the identified geosites are still in the inventory stage.

IDENTIFICATION OF GEOLOGICAL HERITAGE RESOURCES IN 8

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SUMMARY

Most of the geological heritage resources in Kelantan have been identified and can be classified into geological and landscape diversity categories. Geological diversity consists of variety in rocks and minerals. Meanwhile, landscape diversity is classified into mountain, hill plain and coastal landscapes. Twenty two potential geosites have been identified, nineteen of them under the landscape diversity category.

GEOSITE AND PROPOSED GEOTOPE IN THE ENDAU-MERSING AREA, JOHOR

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SUMMARY

The stretch along the Eastern Coast of Johore comprises various interesting geological and landscape features which can be potentially developed for geotourism resources. This is evident by the occurrence of a number of tourist attraction and holiday destinations area. These attractive geological and landscape heritage, with highly extrinsic and intrinsic values should be made aware to the public so that they can be maintained and fully benefited. The Endau-Mersing area is part of the stretch of the Eastern Coast of Johore. Five localities have been studied to describe their natural heritage values in term of geology and landscape, namely: 1) Tg. Kempit, 2) Tg. Penyabong, 3) Tg. Resang, 4) Mersing Beach (Batu Chawang), and 5) Tg. Leman. All the locality has their own distinct heritage value and can be adequately categorised as geosites for the state of Johore and the nation. The small Batu Chawang island, is a sea-stack landform with the unique and rye-catching landscape, may be suitably nominated as a geotope at the state and national levels. These geosites and geotope candidates are fairly well-preserved as they are, except for Tg. Kempit and Mersing Coast which is under burial threat natural coastal sedimentation, and indiscriminate garbage disposal by the visitors and domestic sewerage, respectively. There are many more capes and beaches along the Eastern Coast of Johore, which are believed to be of high heritage value that to be treasured. However, due to remoteness and lack of communication system in these areas, their existence are somewhat ignored.

**PRELIMINARY MAPPING OF LOJING HOT SPRING, GUA MUSANG,
KELANTAN**

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SUMMARY

Hot spring sites have a good potential to attract a large number of tourists to visit the area. Five locations of hot springs were found around Lojing. The objective of this study was to identify the potential of Lojing Hot Spring, whether to be commercially developed for tourism purposes. Lojing hot springs are located within the Main Range Granite body, and closely associated with fracture or fault zones oriented at 220°.

**THE ABRASIONAL PLATFORMS OF ULAR ISLANDS, LANGKAWI,
KEDAH**

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SUMMARY

Geomorphological mapping of Ular Island was conducted to characterise and classify the landscape and geological diversity for the assessment of its heritage value. Erosion by ancient wave action has crafted the island landscape since 5000 years ago forming three residual hills, which are now connected by abrasional platforms. These hills, together with five sets of elevated ancient abrasional platforms with heights approximately +5m, +4m, + 3m, +2m & +1.5m above present low water tide, have produced a spectacular geological landscape. Based on scientific evaluation, this island ranks as an outstanding landscape heritage and it is being recommended as a National Geological Monument.

**GEOLOGICAL HERITAGE AND GEOTOURISM POTENTIAL OF
GUA BOMA GEOSITE, KUALA LIPIS, PAHANG**

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SUMMARY

Gua Boma possesses several interesting geological features including both the transitional and erosional boundaries between shale and limestone, the tuff interval in limestone, as well as the various types of limestones and fossils. Karstic hill cave and karstic features of erosional solutional and depositional origin dominate the landscape of Gua Boma. Beside these natural landscape beauties, Gua Boma also inherited cultural heritages such as the myth of Bujang Boma and the long history of the development of the neighbouring villages. Gua Boma also has its own biological diversity. Gua Boma is a suitable location for recreational activities, which has great potential to be developed as a centre for extreme-sport activities

BOUNDARY OF MAHANG FORMATION GEOSITE IN KEDAH

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SUMMARY

Several outcrops of earth quarries in Kedah expose two rock formations i.e. the Mahang and the Kubang Pasu Formations. The characters of the formations are distinct and can easily be differentiated in the field. The Mahang Formation is conformably overlain by the Kubang Pasu Formation. The normal contact of the formations is exposed at an outcrop near Pokok Sena. However, the outcrop at Bukit Jabi, Bukit Kerangan and Bukit Tunjang exhibit the Mahang Formation overlies the Kubang Pasu Formation. The change in position was caused by a thrust fault. The fault zone is characterised by oblique lateral faults and mylonites. These geosites are very important for stratigraphic study and should be conserved as natural heritage.

IMPACT STRUCTURES IN MALAYSIA: RECOGNITION AND IMPLICATIONS

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SUMMARY

Study of satellite and synthetic aperture radar images, aerial photographs, geological and topographic maps complemented by fieldwork in certain areas and laboratory observation of rock samples has recorded over 60 circular features in Malaysia. Fifteen of these may be products of impact by extraterrestrial objects. The rest appears to represent structural basins and domes, igneous intrusions, subvolcanic bodies or a caldera. Shock metamorphic phenomena such as cleavage and planar deformation features (PDFs) in quartz have been discovered and described earlier from a single locality near Kuantan, Pahang. The quartz is in granitic soil overlain by Quaternary basalt lava. Unusual breccia resembling tuff breccia at Bukit Lebam, Desaru, southeast Johar, may be suevite. A 3.5 km wide rounded depression, the so-called Paloh Ring, astride the Pahang-Terengganu border in the Kuantan area may also represent an impact crater and is perhaps associated with the PDFs found nearby. On the North American continent, impact structures have ridged over a billion barrels of petroleum and gas. The Sudbury, Canada, nickel deposit is now considered the result of upper-man de magma activation by a meteorite impact. The present review aims to determine and to document impact structures in Malaysia. The study may also contribute to the world database of impact structures which may prove useful in formulating mitigation measures against future collision with extra terrestrial objects. Apart from possible economic aspects, the recognition of impact structures in Malaysia is to serve scientific studies, to initiate conservation measures and generate widespread interest in a rare phenomenon.

CASE STUDY FOR SOME GEOSITES AROUND KUANTAN, PAHANG

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SUMMARY

Location of geological resources that are known for their scientific, aesthetic, recreational and natural values are also known as geosites. Numerous locations become tourist attraction because of natural landscape and breathtaking surroundings. A great numbers of tourist locations also have scientific (geological) values but have not been highlighted of its importance and uniqueness. In accordance to this, the potential to include geological aspects in tourism industries or better known as geotourism is therefore very high. Three geosites case studies have been carried out at Pantai Batu Hitam, Bukit Charas and Air Terjun Sungai Pandan around Kuantan area in the effort to collect and document geological information for its values, characteristics, uniqueness and importance. By this way, the planning for conservation and development of these geosites will be better and more orderly to make sure that these sites are not just been visited for its natural attraction factors bill also for their geological uniqueness and values. The geological heritage resources can be conserved and the society can appreciate and benefited from them without destruction.

CONSERVATION GEOLOGY AND PROPOSED GEOLOGICAL PARK AT SURROUNDING ISLANDS OF TERENGGANU

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SUMMARY

Isles offshore Terengganu, which are made of rock of various ages ranging from carboniferous to the present day, provide diverse natural resources which can be turned into excellent sites for tourism, education and conservation. Pulau Perhentian, Pulau Lang Tengah, Pulau Redang and Pulau Kapas collectively provide various geological resources including various rock types, morphologies, landscapes and unique/rare features related to the present day erosional and weathering processes. Their lithologies are represented by igneous, metamorphic and sedimentary rocks that can be found in a relatively small area. The diversity and the uniqueness of the resources, should be protected and utilised sustainably for the benefit of the public besides its potential to boost the economy and to enhance the general knowledge of the public. Thus, it is highly recommended that the entire area be declared as one of Geological Park in this country.

**CONSERVATION AND TOURISM GEOLOGY OF NORTHERN
TERENGGANU AREA**

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SUMMARY

The northern Terengganu area has so many beautiful and interesting places for tourism purposes as well as for the conservation programs. Bukit Buchu, Bukit Keluang, Bukit Puteri and Lata Tembakah can offer an extensive range of activity ranging from marine based to jungle based on top of that the area also has many unique natural resources such as fossils, seascapes, waterfalls. Some of these resources are very rare and cannot be found elsewhere. These natural resources need to be taken care of and the public need to be educated in order to appreciate the importance of scientific values of the resources.

**MALAYSIAN FOSIL AS PART OF NATIONAL GEOLOGICAL
HERITAGE: A CASE STUDY OF PERMIAN - TRIASSIC MATERIAL
FROM PAHANG**

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SUMMARY

In Malaysia, palaeontological study has traditionally been carried out as part of geology. Fossils can provide much fascinating information about the evolutionary history of mother Earth, and they now appear to be very significant for the geological history of Malaysia. We herein present some excellently preserved marine fossils, namely brachiopods, trilobites and ammonoids, which were recently found in Pahang. The three fossil groups have experienced distinct biotic changes in diversity and abundance through the Permian-Triassic (Late Palaeozoic-Early Mesozoic) period, which are symbolised most remarkably by the greatest mass-extinction event of Earth history. The Malaysian fossils in this paper well reflect such a global environmental transitional period of the past, and is of some international importance. Arguments are advanced for the necessity of establishing of a large national 'natural history' museum.

MALAYSIA'S LARGEST CEPHALOPOD FOSSIL FAUNA AND ITS FASCINATING GLOBAL PALAEOBIOGEOGRAPHY

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SUMMARY

In zoo-geographic distribution, cephalopods have a distinctive nature of marine ecological distribution in conjunction with post-mortem transport owing to their ecology and shell structure. Recently, Malaysia's largest cephalopod fossil fauna was discovered by the authors in the Bera South area, Pahang. It contains six informative species including one new species, *Bamyaniceras orientale*. In particular, another form *Tauroceras scrobiculatum* (Gemmellaro) is an index species of the Middle Permian Wordian Stage, and represents important evidence for climatic! geographic relationships between proto-Malaysia and other areas of the world. *T. scrobiculatum* have been found in several regions reflecting the southern margin of the ancient ocean "Tethys". With respect to the inferred oceanic current pattern, this reveals eastward migration (including possible post-mortem transport) along the faunal seaway, and indicates possible sub-tropical climates for the ecological habitat of the species. The result of this study well appeals international geological significance of the Malaysian fossils, the nominees of national geological heritages.

UNIQUENESS OF GEOLOGICAL RESOURCES AND MYTH OF BUKIT PUTRI, BESUT TERENGGANU

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SUMMARY

Bukit Putri which is located in the Besut District, Terengganu has its own legend and spiritually governed by Princess Bunian. The local population have experienced many mysterious happenings that cannot be explained scientifically. The hill possesses high scientific value and geoscientists will certainly want to study its uniqueness. The 188-m high Bukit Putri consists of a very thick sequence of unconsolidated gravel. The clasts of various rock types are mainly subrounded to rounded gravel with diameters in the 5 to 60 cm range and floating in a groundmass of sand and pebbles. There are various primary structures and distinct bedding strike 290° and dipping 30° towards SSW. The sediment is probably of late Cenozoic age. Bukit Putri is located within the Terengganu fault zone and was probably raised to its current position as a diapir by during the isostatic uplift of the Boundary Range Granitoid. The arcuate northern portion of Bukit Putri may be a product of a large meteorite impact. The mystery on the existence of Bukit Putri deserves a more comprehensive study.

SEVERAL GEOSITES IN COASTAL AREA OF THE CENTRAL TERENGGANU

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SUMMARY

In the central part along the coastal area of Negeri Terengganu, there are a number of rock exposures, which exhibit interesting geological features. Some of the exposures are highly potential geosites since they exhibit quite unique geological features and possess high scientific values. Furthermore the sites could be considered to have local or national heritage value. Among the interesting sites are Bukit Cendering, Kuala Abang, Tanjung Labohan and Kuala Kemasik. Other than their geological interest, most of these sites are also very attractive to visitors because of their panoramic views. Therefore it is suggested that all of these sites be protected from any activities that could damage the features of high scientific values. The uniqueness of the geological features at each site and their scientific values should be made known to the public as this adds value to the sites and will attract more visitors.

INTRINSIC GEOLOGICAL RESOURCES OF PULAU LABUAN

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SUMMARY

Labuan Island, which consists of two major sedimentary rock units, the Setap Formation and the Belait Formation exhibits a variety of interesting sedimentary structures, sedimentary facies, depositional processes and depositional environments. At Tanjung Punei, the Setap Formation sediment shows a slumping process on a continental slope and a turbidite depositional process in a deep-water environment. At Tanjung Layang-layangan and Tanjung Kubong the Belait Formation sediment shows depositional processes on a shelf, tidal delta and fluvial environments.

MUD VOLCANO OF TINGKAYU AND TABIN, LAHAD DATU, SABAH

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SUMMARY

The mud volcanic activity in the Tingkayu and Tabin areas exhibits interesting features in terms of its process and product. The gentle extrusion of mud (mixed with water and sand) has brought along various types of igneous and sedimentary blocks and rock fragments to produce a cone of about 13 metres in height covering an area of about 400-2500 nr.

**BUKIT BIWAH AND BUKIT TAAT GEOSITES: LIMESTONES
HERITAGE OF TERENGGANU**

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SUMMARY

Bukit Biwah and Bukit Taat are the only limestone hills in Terengganu. Based on the fossils found in the limestone, it is believed that these rocks were deposited during the Middle Permian time. Karst topography, caves, fossils such as coral gastropod and fusulinid, as well as an archeological sites in Bukit Biwah and Bukit Taat make these hills interesting sites for heritages. These heritage values, especially scientific, recreational and cultural values must be preserved and developed for the interest of the public and for the future generation.

**PRESERVING OUR KEY GEOLOGICAL EXPOSURESEXPLORING
THE REALM OF GEOTOURISM**

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SUMMARY

Miri Town is the locality of Malaysia's first commercial oilfield, discovered in 1910. It is also a locality rich in geological exposures that exhibit a wide range of features. This paper summarises efforts to date made by a group of volunteers to preserve a selected number of these exposures as permanent geological exhibits that also support educational and eco-/geotourism efforts. The Airport Road Outcrop in Miri, located about two kilometers from the town center along the way to Miri Airport, is one of the most outstanding geological exposures in the region. In particular, it has been hailed by some as one of the best outcrops in the world for the observation of faults in three dimensions. Many geological field trips to the site have been made by the various petroleum companies operating in the area. In addition, the site has attracted scholars from Universities in the region and from Europe. Its location on one of the highest points in Miri town also offers visitors a panoramic view of Miri and its surroundings. In pursuing logistics aspects, linkage to development aspirations of the community and the Government has been a key area of focus as is maintenance of the exhibit over time. Early efforts have therefore been made to present results of the effort to local dignitaries and the Miri Council and to secure support which has proven to be extremely positive. This paper focusses on some of the aspects that were important to bringing the effort to a successful start (not conclusion!) and then discusses some of the plans we have for developing it further.

UNIQUE OUTCROP AT JERAM BESU AS AESTHETIC AND INTRINSIC RESOURCES

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SUMMARY

Jeram Besu has a very impressive outcrop. The outcrop, within an area of 800 square meter, contains five different rock types with existing sequence that is quite complex. The more interesting part is that the occurrences of outcrop with five different rock types are only found in Jeram Besu and the former JKR quarry, Benta, Pahang; which represent the Pahang Benta Complex. These five rock types have a very unique esthetic value. All these rock types have a well define border and can show an age relation sequence in the field. A part from the well defined rocks borders, certain rocks contain other rock fragments (xenolith) which are relatively older than the rock that contain it. There are rocks that showed secondary mineralization characteristic with almost vertical dip. Other than the unique esthetic rocks, the unique esthetic fault and joint structures are obvious in Jeram Besu. These esthetic value can be developed into intrinsic value so that visitors would return again. The explanation regarding the intrinsic value should be stressed on the aspects such as the origin and history of rock formation, rock forming sequence and also the age of the rocks. Thus, it serves not only as an academic outcrop, but also as a tourist attraction with high esthetic value. The revelation towards the society about the unique esthetic and intrinsic value of rock outcrop in Jeram Besu need to be done to ensure that the area will be preserve.

**THE BEAUTY OF NATURAL LANDSCAPE, THE GEOLOGICAL
SIGNIFICANCE AND THE MYTHS OF THE GUNUNG SENYUM
GEOSITE, PAHANG**

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SUMMARY

Gunung Senyum has more than hundred caves, some of them are dark, some naturally lighted, while some others have been transformed into dolinas. These caves are developed at different levels and majority of them, are connected to one another. Stalactites of various sizes and shapes are well developed at the roof of the caves. However, some stalagmites on the floor of the caves and dolinas, are most amazing in terms of their design and art. The myth of Gunung Senyum, about the love story between a fairy princess and her local prince charming namely Tok Long is also very interesting. Gunung Senyum has great potential to be developed as a centre for recreational and extreme sport activities. With careful planning, the Gunung Senyum can potentially be developed as a leading nature tourism centre with many different attractions.

**LANGKAWI ISLANDS - THE MALAYSIAN CANDIDATE FOR A
FUTURE GEOPARK***

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SUMMARY

These paper is about proposing Langkawi Islands as the First Geopark in Malaysia. The proposal is based on the strong support from the scientific and political perspective. Besides that, a preliminary framework for the development of Geoconservation and Geotourism activities are also proposed.

**GEOLOGICAL LANDSCAPES: DEFINITION AND
CHARACTERISATION FOR CONSERVATION**

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SUMMARY

The geological landscape concept is introduced to enable the process of characterisation, classification and assessment of the natural landscape to be carried out in a systematic manner based on geological knowledge. Various intrinsic landform values, namely geological terrain, endogenic and exogenic processes, temporal evolution and special geological and geomorphological features, are set forth as basic elements for characterising the geological landscape. This approach facilitates the differentiation and ranking of landscapes, making it easier for planners and landscape managers to strategise and implement the plan for the conservation of landform diversity resources.

**BEACHES OF THE LANGKAWI: AN APPROACH FOR
CHARACTERIZATION AND ASSESSMENT**

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SUMMARY

Beaches are the most popular landscape resource for tourism and recreational activities in the Langkawi Island. Almost all of the sandy beaches with a good view have been developed for tourism purposes. This preliminary study introduces a framework for characterizing and assessing beaches based on the aspects of geological and landscape resources. The results can be utilized for integrated management of beaches as well as promotion of conservation and sustainable ecotourism.

**THE SPELEOLOGICAL STUDIES IN KINTA VALLEY AND
LENGGONG AREA AND ITS IMPORTANCE TO CONSERVATION**

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SUMMARY

The preservation of important data in caves is made possible by the nature of cave environment of the capability to preserve its material compared to surface deposit. Speleological studies have contributed major findings in many fields such as geology and archaeology. Lack of understanding on the importance of caves has led to damages to our cave environment. It is important to educate the general public to realise the importance to preserve our caves and its significance to many fields.