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Some unique and imaginative geological features (mimetoliths) in selected limestone sites in Malaysia: Study on their formational processes and geotourism potentials

Dony Adriansyah Nazaruddin*, Hafzan Eva Mansor &
Mohammad Muqtada Ali Khan

Department of Geoscience, Faculty of Earth Sciences, Universiti Malaysia Kelantan (UMK) Jeli Campus,
Locked Bag No. 100, 17600 Jeli, Kelantan
*Corresponding author email address: dony_geology@yahoo.com.my

Abstract: This paper presents some unique and imaginative geological features at five limestone sites/features in Malaysia and study on their formational processes and geotourism potentials. Field works were organized from 2013 to 2015 to investigate the recent situation of these features. Some examples of unique and imaginative geological features (mimetoliths) in limestone sites in Malaysia have been identified for this purpose. In Peninsular Malaysia, some features in Langkawi Islands (in the state of Kedah) have been investigated such as a "turtle" atop a limestone hill and a "shoe" in the Kasut Island, both are at the Kilim Karst Geoforest Park; and a "pregnant lady lying on her back" in the Dayang Bunting Island (part of the Dayang Bunting Marble Geoforest Park). A prominent mogote hill known as Gunung Reng in Jeli District, Kelantan seems like a "human face looking upward". Meanwhile, in East Malaysia, there is only one feature can be included for this study, it is the "Abraham Lincoln's face" in the Deer Cave, Gunung Mulu National Park, Sarawak. Detailed observation and interpretation showed that these features were formed by both endogenic and exogenic processes, such as tectonic uplift, weathering (including solution), erosion, and so on. This study will recommend that all these features should be conserved and developed for some purposes, such as research and education as well as geotourism development in Malaysia.

Keywords: limestone formation, mimetolith, endogenic process, exogenic process, geotourism

INTRODUCTION

Hornby (2005) in the Oxford Advanced Learner's Dictionary of Current English defines "unique" (adjective) as "very special and unusual" and "uniqueness" (noun) as "the quality of very special and unusual". Meanwhile, "imaginative" (adjective) has been defined as "having or showing new and exciting ideas" and "imagination" (noun) as "the ability to create pictures in the mind; and the part of the mind that does this". In addition, "imagination" is also defined in the dictionary as "something that we have imagined rather than something that exists". This paper generally defines a "unique and imaginative geological feature (mimetolith)" as any geological feature which is very special and unusual by which people will see and observe them by using their imagination.

The term "mimetolith" - from the Greek words *mimetes* (an imitator) and *lithos* (stone) - was developed by Dietrich (1989) to refer a natural topographic feature, rock outcrop, rock specimen, mineral specimen, or loose stone the shape of which resembles something else, or the surface pattern of which resembles something else such as a person, an animal, a flower, etc. Meanwhile, the psychological phenomenon in which the mind responds to a stimulus (an image or a sound) by perceiving a familiar pattern where none exists is called "pareidolia".

Geological features in limestone formations in some countries can be seen as unique and imaginative features, such as a "small elephant" in the Stone Forest, China's Shilin Geopark and a "big toad" in the Con Coc Islet in the Halong Bay, Vietnam (Figure 1). The Stone Forest is the forest made up of limestone with different shapes standing everywhere in a vast area. This forest is a part of the Shilin Geopark and renowned as a tourist destination. Visitors there can enjoy the beautiful scenery of tower karsts, waterfalls, and other features, explore the grottos or caves, and find a lot of vertebrate fossils there (Stone Forest, 2012). One of the strange and attractive features here is the elephant-liked rock atop one of its hills. Meanwhile, the Con Coc ("toad") Islet is a very small limestone island in the Halong Bay (a UNESCO World Heritage Site in northeast Vietnam), rising around 9-meters above the sea level. Viewed from a distance, this islet looks like a big toad seated to wait for the rain in the middle of the sea (Tours in Vietnam, 2010). Other than this islet, there are a lot of limestone hills and isles of various shapes and sizes in the Halong Bay. In

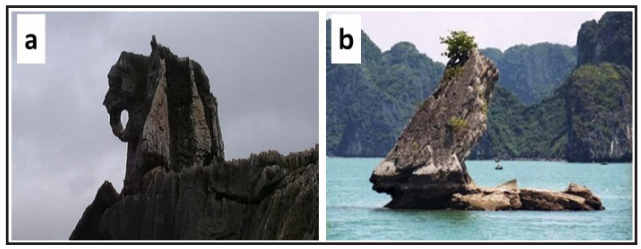

Figure 1: Some examples of unique and imaginative geological features in limestone formations in some countries or regions. (a) A "small elephant" in the Stone Forest, China (Stone Forest, 2012); and (b) A "big toad" in the Con Coc Islet, the Halong Bay, Vietnam (Tours in Vietnam, 2010).

the area, visitors can enjoy a couple of activities, such as enjoying amazing views of limestone bodies scattered in the Gulf of Tonkin, exploring the enormous beautiful grottos and caves, cruising the bay by boat, or kayaking.

In this study, some unique and imaginative geological features in selected limestone sites in the Langkawi Islands of Kedah, Gunung Reng in Kelantan, and Gunung Mulu in Sarawak have been investigated to study how they were formed and their potential in geotourism development in Malaysia.

GENERAL GEOLOGY

General geology of Langkawi Islands

Geologically, the Langkawi Islands are composed of four sedimentary rock formations, one granite formation, and alluvial deposits (Figure 2). These sedimentary rocks can be divided into, in ascending order, the Machinchang, Setul, Singa and Chuping Formations. These formations are generally younging to the east, but the presence of the Kisap Thrust Fault in the eastern part of Langkawi has disrupted the sequence (Mohd Shafeea Leman *et al.*, 2008).

In Langkawi Islands, there are two carbonate formations that form the distinctive and beautiful karst landscapes, i.e. the Setul Formation and the Chuping Formation. The Ordovician-Devonian Setul Formation represents the oldest carbonate formation in Peninsular Malaysia comprising impure limestone, dolomitic limestone, and two clastic members consisting of shale, highly silicous mudstone, siltstone, and chert. In the islands, this formation is distributed in the eastern part, from Tanjung Rhu in the north, to Kilim, Kisap, Langgun Island, Tanjung Dendang Island, Timun Island, to Tuba Island and Dayang Bunting Island in the south (Che Aziz Ali *et al.*, 2003). The Chuping Formation is younger than the Setul Formation and of Middle Permian to Upper Permian (270 – 250 mya) age. In the islands, this formation is distributed mainly in Dayang Bunting Island. The Kisap Fault has separated the Chuping Formation from the Setul Formation. The Chuping Formation consists of massive limestone with thick bedding as the character that differentiates this formation from the Setul Formation. The Chuping Formation can also be found in Perlis and Kedah (Ibrahim Abdullah & Marilah Sarman, 2003).

Langkawi Islands is the first global geopark in Malaysia and South East Asia where its conservation components are divided into Geoforest Parks, Geological Monuments, and Protected Sites. All these components have their own unique geological characteristics.

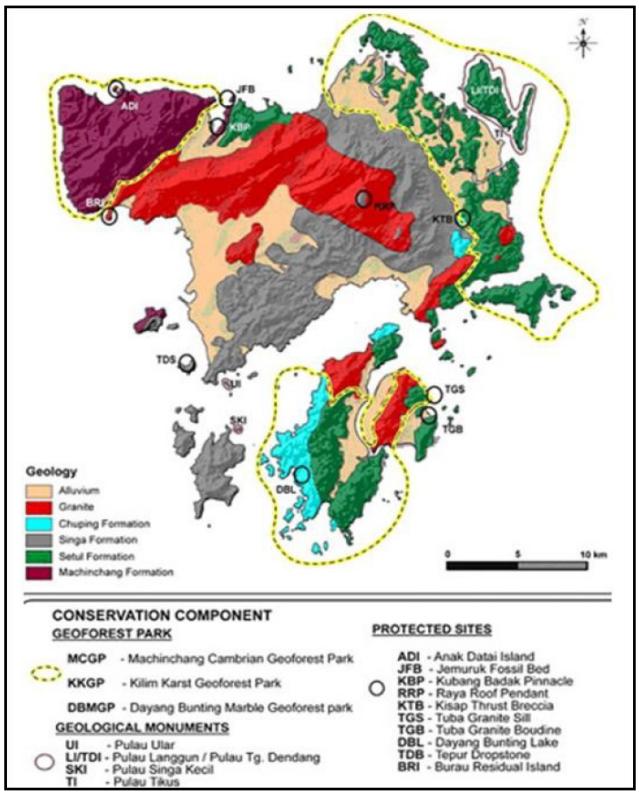

Figure 2: General geology of Langkawi Islands and distribution of Langkawi geoforest parks, geological monuments and some of the protected geosites within the Geopark (Mohd Shafeea Leman *et al.*, 2008).

General geology of Kelantan

According to the Department of Mineral and Geoscience Malaysia (2003), the geology of the state of Kelantan can be broadly classified as follows (from younger to older,

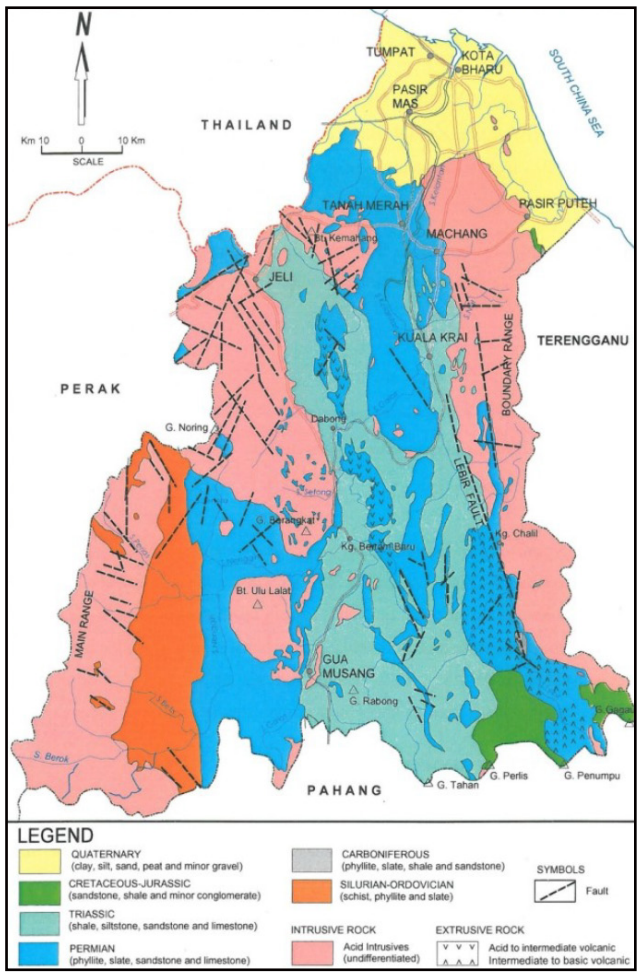

Figure 3: General geology of Kelantan (Department of Mineral and Geoscience Malaysia, 2003).

and their percentages): (a) unconsolidated sediments (6%); (b) extrusive/volcanic rocks (10%); (c) sedimentary/metasedimentary rocks (51%); and (d) granitic rocks (33%). Sedimentary/metasedimentary rocks occupy the north-south central portion of the state. They are bordered on the west and east by the granites of the Main Range and Boundary Range respectively, and are truncated to the north by unconsolidated sediments of the state's alluvial plain (Figure 3).

Sedimentary/metasedimentary rocks can be grouped according to their ages into: Silurian-Ordovician sedimentary rocks, Carboniferous sedimentary rocks, Permian sedimentary rocks (Gua Musang Formation), Triassic sedimentary rocks (Gunong Rabong Formation), and Creataceous-Jurassic sedimentary rocks (Gagau Formation). One of the sedimentary/metasedimentary rocks which contains a limestone formation and occurs extensively in the state is the Permian sedimentary rocks (in the Gua Musang Group). This formation consists of argillaceous rocks with major calcareous rocks. The calcareous rocks form an extensive limestone formation containing thin to thick beds of massive limestone. The limestone has been mostly recrystallized to marble. In the Jeli district, this limestone formation exists in two locations, Gunung Reng and Gua Setir-Gua Maka.

General geology of Sarawak

Sarawak is situated in the northwestern part of Borneo Island. Topographically, Sarawak's landscapes also consist of coastal plains, valleys, hills, and mountains. Meanwhile, this state is geologically composed of predominantly sedimentary rocks and only some small igneous bodies exist in some parts of the state (Hazebroek & Abang Kashim, 2006; Figure 4).

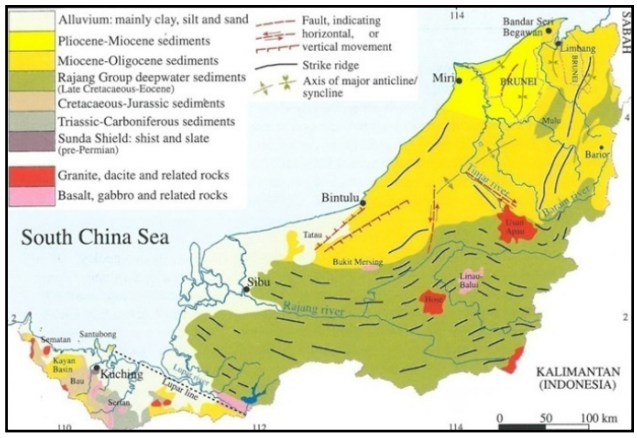

Figure 4: General geology of Sarawak (Hazebroek & Abang Kashim, 2006).

SOME UNIQUE AND IMAGINATIVE LIMESTONE FEATURES IN MALAYSIA

In this study, the authors explored some examples of unique and imaginative geological features in Malaysia by identifying the selected limestone formations. Other than by direct observations, some literatures were also used to support the description of these features. In addition, this study also discusses the interpretation of the development processes giving rise to each feature.

There are at least five (5) examples of limestone sites/features which are suitable for the purpose of this study. Most are located in Peninsular Malaysia such as in the Langkawi Islands, Kedah and the state of Kelantan. There is only one site in East Malaysia i.e. in Mulu, Sarawak that has been identified for this purpose. The locations of

Figure 5: Location map of unique and imaginative geological features in Malaysia (source of the map: GraphicMaps.com).

the features are shown in Figure 5. Descriptions of each of these geological features are as follow:

A "turtle" atop the limestone hill in the Kilim Geoforest Park, Langkawi Islands

Kilim is one of three geoforest parks in the northeastern part of the Langkawi Islands, from Tanjung Rhu to Timun Island, and bordered by the Kisap Thrust Fault in the west. The Setul Formation in the Kilim area forms a unique and fascinating morphology which can be considered as natural/ geological heritage. According to Kamal Roslan Mohamed *et al.* (2005), the topography of this area consists of undulating hills in the west and karstic hills and islands in the east such as Langgun Island, Tanjung Dendang Island, Timun Island and some other small islands.

Ibrahim Komoo & Tanot Unjah (2005) revealed that the formation of karst landscape in the area occurred slowly and took millions years of complex exogenic processes, mainly solution and erosion. Among the landforms that compose the Kilim karst are tower karst, cone-shaped karst, cone-shaped karst with plateau surrounded by polje, mogote, karst alluvium, doline, uvala, sinkhole etc. The dominant factors controlling the evolution of the Kilim karst are the type and texture of rock, structures (mainly fractures, faults, and beddings), rainfall, solution process, rockfalls, water and wave erosion, and sea level changes.

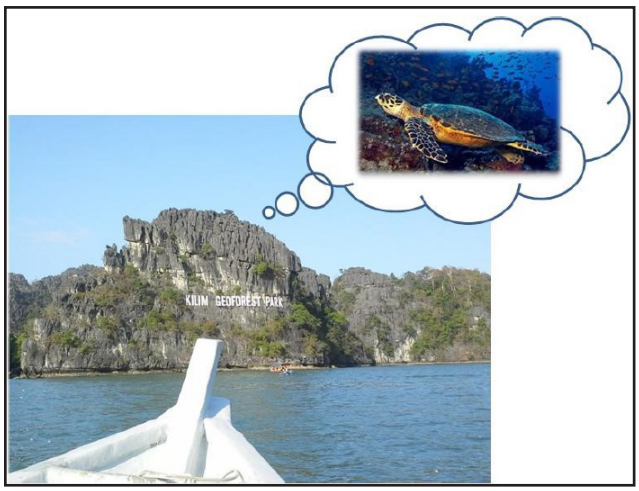

Figure 6: An imaginative object of a "turtle" on top of a limestone hill (Setul Fm.), in the Kilim Geoforest Park, Langkawi Geopark.

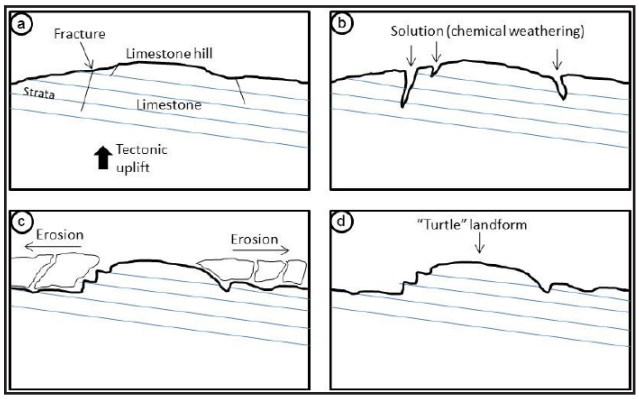

Figure 7: Interpretation of the development of the "turtle" landform in Kilim, Langkawi: (a) It was started since the bedded limestone was exposed to the surface because of the tectonic uplift; (b) Solution processes occurred mainly by rain water seeping into the main fractures, dissolving the limestone, and widening fractures; (c) Erosion (and perhaps rockfalls as well) by heavy tropical rainfall washed out the weathered rocks; and (d) The recent karst landform situated in the Kilim Geoforest Park, Langkawi shows a profile of a "turtle".

In theory, extensive areas of karst evolve in carbonate rocks (limestones and dolomites) in which solution is often the dominant process in such areas. This occurs because rainwater is slightly acidic, having dissolved some carbon dioxide (CO_2) in the atmosphere. The resulting weak carbonic acid (H_2CO_3) reacts with the limestone ($CaCO_3$) to produce soluble calcium bicarbonate ($CaHCO_3$), a solution process which may be associated with other chemical reactions (Hugget, 2007; Gregory, 2010).

The general interpretation of the karst landscape evolution in Langkawi has been studied by Ibrahim Komoo (1999). According to him, the formation of the Kilim karst had started since the limestone was exposed on the surface because of tectonic uplift around 200 mya. The solution of limestone proceeded along the main fractures to enlarge the fractures and finally form tower karst (mogote) and other karst landforms.

There is a unique feature on the top of the hill in the Kilim Geoforest Park which can be creatively interpreted using our imagination. This feature can be observed if we are travelling by sea to the site from the Malaka Strait. We can see a "turtle" landform on top of the hill (coordinates: N $6^0$27'33.29", E $99^0$50'37.53", elevation: 152 m; Figure 6). This imaginative feature is interpreted as the product of complex processes on the limestone in the Kilim area. After tectonic uplift assumed to have happened around 200 mya, chemical weathering by solution was dominant mainly in the fractures. This process dissolved the limestone and subsequent erosion washed out the rocks. All these processes have shaped an interesting and imaginative residual karst landform which shows a "turtle" atop the karst hill (Figure 7). The solution on the surface will also form another feature i.e. pinnacles on top of the hill.

Being part of the Langkawi Geopark, this area is very important for geological education and tourism in Malaysia. Geology students from local universities visit this area regularly every year for their field work, while tourists, both local and international, visit the area every day mainly for boating and photography tours.

A "shoe" in "Kasut Island", Kilim Geoforest Park, Langkawi Islands

According to Ibrahim Komoo & Tanot Unjah (2005), the karst landscape in the Kilim area comprises of a group of tropical karst landforms, unique islands, and scenic panorama in Langkawi. Several assemblages of karst hills and islands intersperse with mangrove forest, estuary, and marine systems produced an outstanding landscape which

Figure 8: A "shoe" can be seen through the imagination in the Kasut Island, a karst island in the Kilim Geoforest Park, Langkawi.

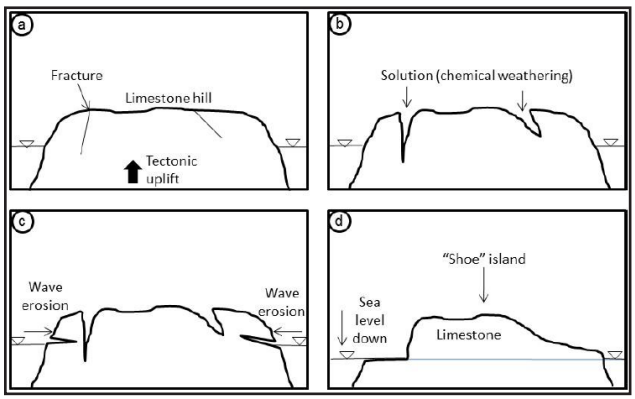

Figure 9: Interpretation of the formation of Kasut ("shoe") Island which is composed of Setul Formation limestone in the Kilim Geoforest Park, Langkawi: (a) A thick limestone deposit was exposed to the surface because of the tectonic uplift; (b) Fractures increased in size as further solution took place; (c) Waves eroded some weathered parts of the rock; and (d) Erosion and sea level dropped to expose more of this limestone resulting in the formation of the shoe-like island.

made the Kilim area distinguishable from other areas in Langkawi. Karst hills and islands are scattered randomly in the northeast and east of the islands. These hills and islands (composed of limestone of the Setul Formation) form positive topography which is different from the alluvial plain surrounding the area. This topography has experienced various processes such as solution, water and wave erosion, and rockfall which now form many isolated hills and islands with different sizes and elevations.

There are many karst islands in Kilim area such as Langgun Island, Tanjung Dendang Island, and some small islands in the area. Karst islands are very unique, beautiful and characterized by various shapes and have steep cliffs. One of them is the Kasut Island *(Pulau Kasut)* which forms a shoe-shaped island (Figure 8). The main factors controlling the formation of this island are fractures, solution process, wave erosion, and sea level change (Figure 9). Like other areas in Langkawi, visitors here can enjoy the scenic panorama and shoot photos while boating.

A "pregnant lady lying on her back" in Dayang Bunting Island, Dayang Bunting Marble Geoforest Park, Langkawi Islands

The profile of a pregnant lady can be seen in Dayang Bunting Island, Langkawi (Figure 10). This landscape (coordinates: N $6^0$13'17.50", E $99^0$47'54.00", elevation: 282 m) is composed of the limestone and marble of the Chuping Formation, and is interpreted as the result of differential weathering on the carbonate rocks in the island. The carbonate rocks will easily experience the solution process (chemical weathering) which is mostly controlled by the fracture system. As a consequence of this process, along with erosion, the limestone area forms a morphology which is different from terrains of other rocks (like granite and clastic rocks) such as karst towers, pinnacles, and sinkholes. Meanwhile, this process in the subsurface can cause the ceiling of a limestone cavern to collapse and form a doline. Some dolines are filled by water forming a lake like the famous legendary Dayang Bunting Lake (coordinates: N $6^0$12'24.26", E $99^0$47'10.30", elevation: 20 m). This lake is located in the Dayang Bunting Island, near

Figure 10: A profile of a "pregnant lady lying on her back" in the Dayang Bunting Island within the Dayang Bunting Marble Geoforest Park, Langkawi.

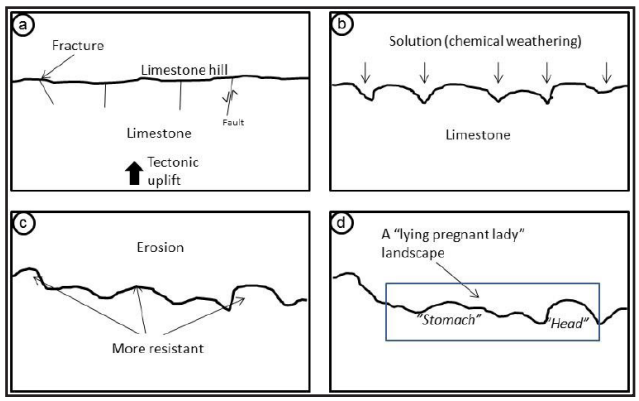

Figure 11: Interpretation of the development of a "pregnant lady lying on her back" landscape in the Dayang Bunting Island, Langkawi: (a) Tectonic uplift exposed the limestone to the surface and formed geological structures such as fractures (and faults); (b) Rain water (surface water) seeped into fractures, dissolved the limestone, and widened fractures; (c) The erosion process by surface water on the different resistance of the rock created a rugged landscape; and (d) The karst landscape eventually provides a profile of a "pregnant lady".

the contact between the Setul Formation and the Chuping Formation, cut by the Kisap Thrust Fault (Ibrahim Abdullah & Marilah Sarman, 2003; Kamal Roslan Mohamed, 2003; Jauhari Mat Akhir, 2003).

The Chuping Formation, which is predominantly composed of pure, light color, thick-bedded to massive limestone, overlies conformably the Singa Formation. This Permian formation has been also metamorphosed to become marble and exposed in the west of the island (Ibrahim Abdullah, 2003).

The formation of a "pregnant lady lying on her back" landscape in the Dayang Bunting Island is interpreted as the product of solution along the fractures (and probably faults) after the tectonic uplift exposing the limestone to the surface. Erosion (and possible rockfalls) on the different resistance of the rock finally results in the formation of karst landforms (such as mogote and cone karst) with the rugged topography providing an image of "the pregnant lady" (Figure 11).

This island is famous to both local and international tourists who visit this area for boating, photography and swimming in the lake.

A "human face looking upward" in Gunung Reng, Jeli district, Kelantan

Gunung Reng is not a true *'gunung'* (the Malay word for 'mountain'), but it is actually a mogote hill which is located in Kampung Gunong, Batu Melintang sub-district, in the district of Jeli, along the East-West Highway in the NW corner of the state of Kelantan (coordinates: N 5^{0}43'0", E 101^{0}44'38", elevation: 111 m). Geologically, this hill is a limestone and marble body sitting on a granite intrusion and surrounded by Quaternary alluvial deposits. This hill is about 200 m high and possesses some caves inside it. Its main cave has an entrance with the maximum width of 21 m and a maximum height of 12 m (Nazaruddin, 2017).

Based on the geological map generated by the Department of Mineral and Geoscience (2003), this area is composed of Permian sedimentary rock (Gua Musang Formation) which is made up of argillaceous rocks with some calcareous rocks. The calcareous bedding forms an extensive limestone member consisting of thin or thick beds or even massive limestone, typically compact and massively jointed. The limestone has been mostly recrystallised into marble.

In the hill, we can see a unique and imaginative feature, i.e. a "human face looking to the sky" (Figure 12). The development of this landform can be explained through some geological processes. Like other limestone hills (such as in Langkawi Islands), this hill also experiences solution process by running water before erosion and rockfall effectively shape this karst tower. The slightly acidic rain water percolates mainly through vertical fractures and dissolves calcium carbonate. The surface water finds its way underground and erodes the limestone continuously into the larger passage forming the cave. The solution process on different resistance of rock produces a rugged landform such as the profile of a human face looking upward on the top of Gunung Reng (Figure 13). The solution process also produced another interesting feature in this hill i.e. the pinnacles on top of the hill.

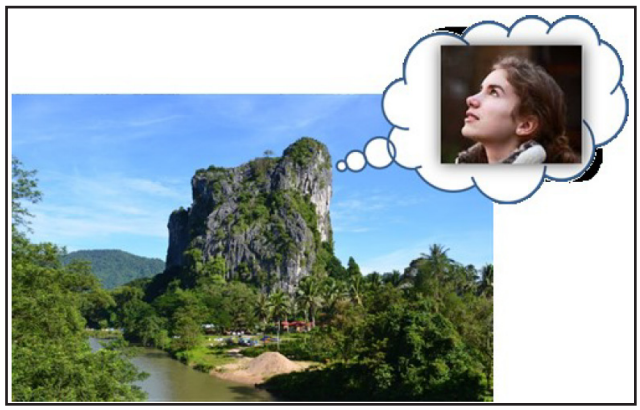

Figure 12: A mogote hill of Gunung Reng in Jeli, Kelantan can be seen through imagination as a "human face looking to the sky".

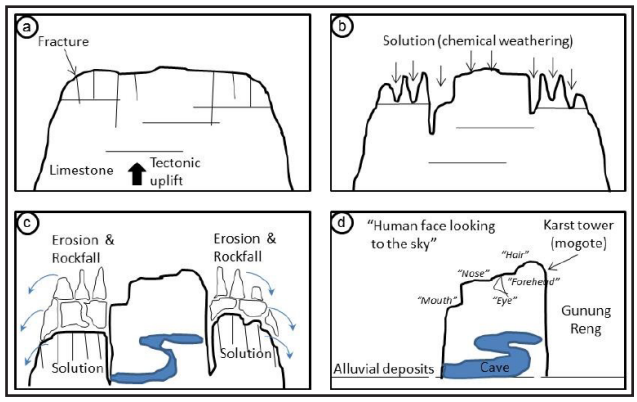

Figure 13: Interpretation of the development of a "human face looking to the sky" landform in Gunung Reng, Jeli district, Kelantan: (a) A thick and large body of limestone was exposed to the surface by tectonic uplift; (b) The surface water became the main agent of solution process which seeped into the fractures dissolving the limestone and enlarging the fractures; (c) Erosion and rockfalls removed the brittle rock, meanwhile the cave developed along the line of fractures; and (d) The hill eventually forms a rugged topography and the cave inside become bigger in size because of the continuous weathering process.

The Pergau River which is the main river in Jeli district, drains through the flat alluvial plain in the south of the hill and beautifies the area. Because of its beauty and uniqueness, Gunung Reng has always been a landmark for Jeli tourism. Visitors can enjoy not only the beauty of this area, but also explore the caves and climb the hill.

"Abraham Lincoln's face" in the Deer Cave, Gunung Mulu National Park, Sarawak

Gunung Mulu National Park is situated about 100 km east of Miri town and is a very important national park in Sarawak, Malaysia because of its high biodiversity and its tropical karst landscapes. It is among the most studied caves in the world. Gunung Mulu is characterized by varied geological formations dominated by a large sandstone mountain, i.e the 2,376-meter high Gunung Mulu, and

Figure 14: "The face of Abraham Lincoln" can be seen on the wall of the Deer Cave, Gunung Mulu National Park, Sarawak.

two limestone mountains: Gunung Api (1,710 meters) and Benarat (1,615 meters) (Hazebroek & Abang Kashim, 2006; ARCBC, 2012).

Among the most spectacular site in the Gunung Mulu National Park is the Deer Cave, the biggest cave in Malaysia and among the biggest caves in the world. The survey by the Mulu Cave Project (2009) revealed that the passage length is 4.1 kilometers and connected the Deer Cave System to Langs Cave within the park. The main entrance of the cave was measured at 146 m in width and the 'Garden of Eden' Entrance was measured to be 140 m in width. The northern passage has the maximum ceiling height at 148 m with a cross sectional width of 142 m. The southern passage is the greatest cross sectional area with the width of 169 m and the ceiling height of 125 m. The top of the roof passage was measured at 226 m above the main cave trail. The main chamber, which is 174 m wide and 122 m high, is partially lit by sunlight and is used as a shelter for deers so that the local Penan and Berawan people named the cave as the Deer Cave (Mulu National Park, 2014).

The Deer Cave is one of several caves in Mulu. Some others are Langs Cave, Lagang Cave, Wind Cave, and Clearwater Cave. These caves in Mulu are among the largest caves in the world. There are some factors involving the formation of the Mulu caves. According to Hazebroek & Abang Kashim (2006), the Gunung Mulu sandstone dips to the east to provide a steeply graded drainage pattern that goes through the limestone. This Melinau limestone is very massive and hard, so the cave's roof does not easily collapse. Different from the limestone which has many closely-spaced fractures, this limestone has relatively few, widely-spaced fractures which develop into fewer and larger caves. The tropical climate produces very high rainfall (up to 6,800 mm/year) in this area. The combination of the above factors provides an optimum environment for cave development and has resulted in Mulu's world class giant caves.

The Deer Cave is unique and interesting since it has a famous "profile of Abraham Lincoln" (ex-USA President) on its wall in the southern entrance (coordinates: N 3^{0}59'26.72", E 114^{0}52'39.12"; Figure 14). It can be interpreted that the formation of this limestone feature was started by the

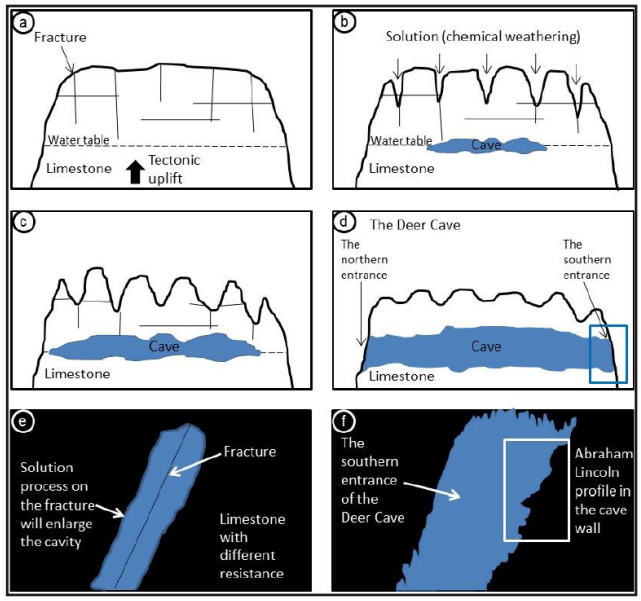

Figure 15: Interpretation of the formation of "Abraham Lincoln's face" in the Deer Cave: (a) A very thick and massive limestone was exposed to the surface; (b) Solution process occurred on the exposed body of limestone; (c) Solution dissolved the rock and widened the fractures into fissures and caves; (d) The cave developed along the water table and fractures; (e) For the case of the Deer Cave, the solution by groundwater on the fracture will enlarge the cavity; and (f) The different resistance of rock is one of the important factors affecting the formation of "Lincoln profile" on the cave wall.

tectonic uplift elevating the Borneo landform millions of years ago. Afterwards, according to Felix Tongkul (2005), the rain and groundwater seeped into the fractures of the limestone dissolving the rock and widening fractures into fissures and caves. Caves developed along the line of the water table and fractures. They increased in size as further weathering took place. A powerful underground river once flowed through this area, dissolving and eroding limestone constantly and thus has been slowly sculpted into a cave. This process often create some unique features inside the cave including an amazing "profile of Lincoln" on the wall of the Deer Cave's southern entrance (Figure 15). Among the favorite activities for visitors here are cave exploration and photography.

GEOTOURISM POTENTIAL

Other than for the purpose of research and education, these limestone features should be conserved and developed since they are geotourism attractions in Malaysia. Newsome & Dowling (2005) defined geotourism as a kind of tourism based on geological features. A better understanding of the Earth can be achieved through geotourism.

Some geological features identified for this study are parts of the Langkawi Geopark, and some others have different status of area, such as national park and recreational area. These sites can attract various target groups for geotourism development, such as amateur and professional geoscientists/geologists, academics and teachers, university and school students, as well as tourists both local and

Table 1: Summary of some unique and imaginative limestone features in Malaysia.

No.	Geological Feature	Imagination Object	Rock Unit/ Formation (Fm.)	Formational Process	Status of Area	Significance Level	Geotourism Potential	Potential Geotourism Activity
1.	Limestone hill in the Kilim Geoforest Park, Langkawi (Kedah)	A turtle	Setul Fm.	Tectonic uplift, solution, erosion, rockfall	Geopark	International	High potential for geotourism	Research and education, boating, sea cruise, photography, fossil hunting, rock climbing
2.	Kasut Island *(Pulau Kasut)*, Langkawi (Kedah)	A shoe	Setul Fm.	Tectonic uplift, solution, wave erosion, sea level change	Geopark	Local	Potential for geotourism	Research and education, boating, sea cruise, photography
3.	Dayang Bunting Island *(Pulau Dayang Bunting)*, Langkawi (Kedah)	A pregnant lady lying on her back	Chuping Fm.	Tectonic uplift, solution, erosion	Geopark	International	High potential for geotourism	Research and education, boating, sea cruise, swimming, photography, jungle trekking, rock climbing, fossil hunting
4.	Gunung Reng, Jeli District (Kelantan)	A human face looking upward	Permian sedimentary rocks (Gua Musang Fm.)	Tectonic uplift, solution, erosion, rockfall	Recreational area	Local	Potential for geotourism	Research and education, cave exploration, rock climbing, photography
5.	Deer Cave, Gunung Mulu National Park (Sarawak)	Abraham Lincoln profile	Melinau Limestone	Tectonic uplift, solution, erosion	National Park	International	High potential for geotourism	Research and education, cave exploration, photography

international. Some geotourism and recreational activities that can be carried out in these sites are rock climbing, photography, fossil hunting, sea cruise, boating, jungle trekking, cave exploration and so on. Table 1 contains the summary of all these sites and features along with their respective characters and potential geotourism activities.

The sites should also be provided with facilities and infrastructures to be able to support tourism and recreational programmes and activities. It has the potential to provide benefits to the local community, the state, and even the country. In addition, planning and management of these geological sites should be well prepared for their development.

CONCLUSION

This study has unraveled some unique and imaginative geological features in selected limestone sites in Malaysia with the interpretation of their formational processes and their geotourism potentials. Among the main factors controlling the development processes of these features are: (1) complex geological processes, both endogenic and exogenic, such as tectonic uplift, solution, and erosion that shaped the features; (2) types of rocks, mainly limestone (and other carbonate rocks); and (3) structure systems (fractures and so on). Some features in the limestone hills and islands in Langkawi Islands (in the state of Kedah) have been explored such as a "turtle" landform and a "shoe" island in the Kilim Geoforest Park, and a "pregnant lady lying on her back" in the Dayang Bunting Island. In the state of Kelantan, a "human face looking to the sky" atop the Gunung Reng in Jeli District is a good example. Meanwhile, the "Lincoln profile" on the wall of the Deer Cave in Gunung Mulu National Park, Sarawak is the only feature found in East Malaysia. This study also recommends that all these sites and features should be conserved and developed for geological research and education as well as for geotourism development in Malaysia.

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