

CHAPTER 2: DESCRIPTION OF STUDY AREA

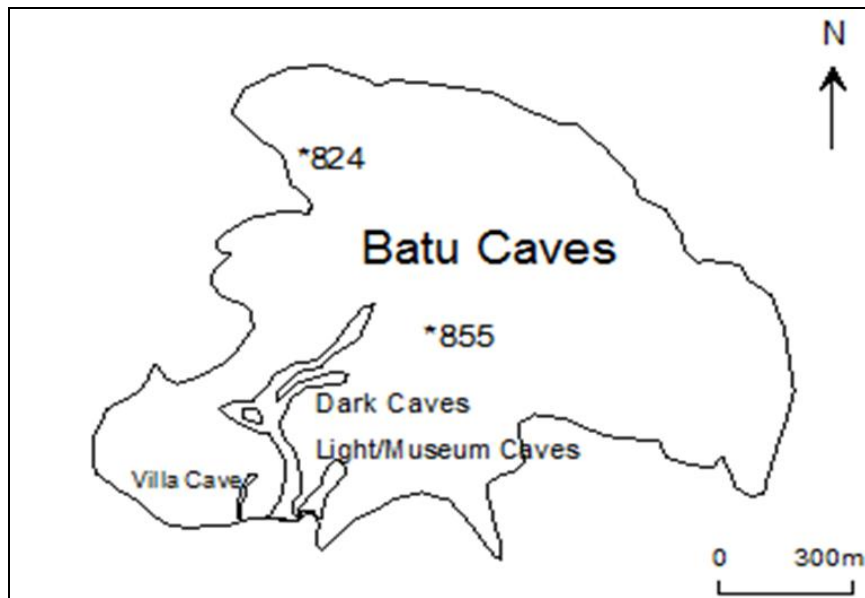
2.1 Batu Caves Hill, Selangor

Batu Caves hill lies on Kuala Lumpur Limestone which comprises of a series of caves and cave temples (Figure 2.1). Batu Caves illustrates as a tower karst that rise sharply and cliff-like surrounding, flat and karst edge plains in the tropics (Stauffer et al., 1971) and Wycherely, 1971). The caves are found at various levels on hillsides and are richly decorated with pillars and other ornaments. A petrography study determines the host rock of Batu Caves hill is a low grade calcitic marble Ng (2004) and Lekshaman (2008).

Villa Cave is situated at the foot of Batu Caves hill. The 50 m long cave is an accessible and open to the public (Lekshaman, 2008). The thickness of limestone covers approximately 750 m (Figure 2.2). The gallery cave exhibits a lot of statues and wall paintings showing scenes from the Hindu mythology and also consists of a small reptile museum. Generally, the cave exhibits an inactive formation such as a distinct and majestic notches and variety of scallop. Only few features of secondary deposits are observed in this cave such as stalactite and flowstone. All the features can be classified as young secondary deposits based on the size of formation.

On the other hand, Dark Cave located about 350 m above the base level and the thickness of limestone cover is approximately 400m (Salleh, 2008). The enclosed chamber of Dark Cave signifies for animal habitats such as bats, snakes and guano feeders.

a)



b)

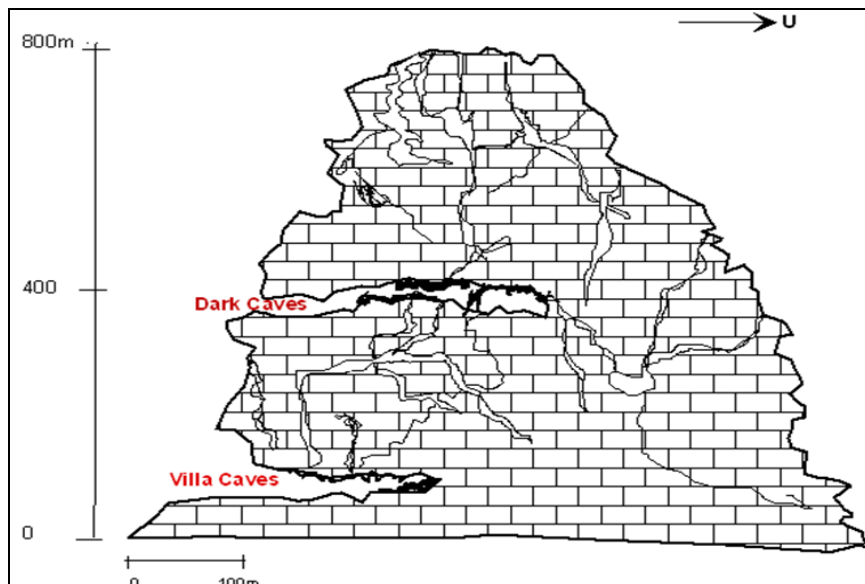


Figure 2.1: a) Location of Dark Cave and Villa Cave, Batu Caves
(modified from (Yong, 1989).

b) Hypothetical cross section of Batu Caves hill
(modified from Lekshaman, 2008).

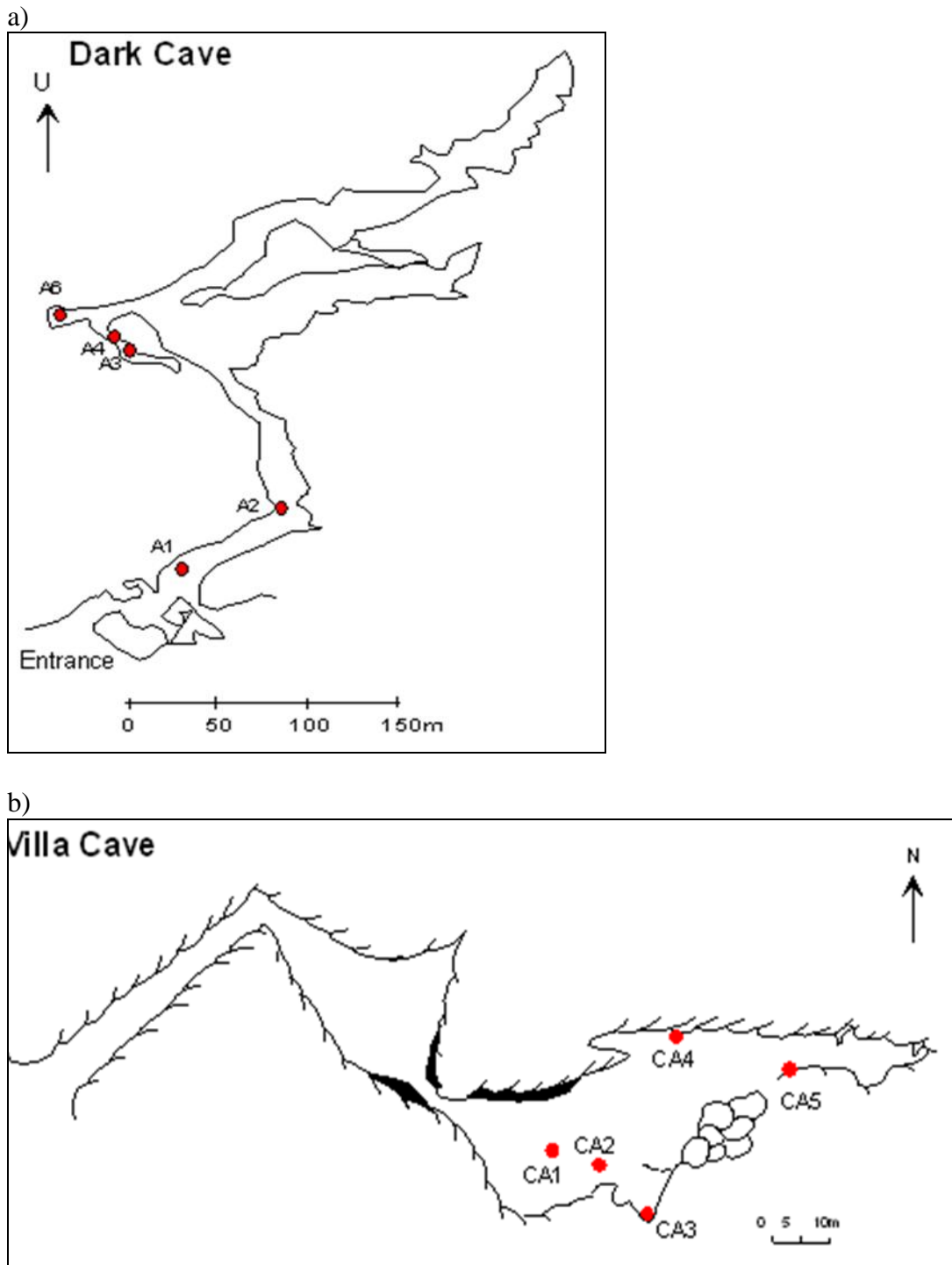


Figure 2.2: a) Map of Villa Cave and sampling sites (Wycherely, 1971)

b) Map of Dark Cave and sampling sites (Lekshaman, 2008)

Dark Cave illustrates an actively cave and wet environment (Wyherely, 1971). This cave exhibits a wide range of secondary deposited such as stalactites, pillar, columns, pond with pearls and stalagmite. This cave is managed by Malaysian Nature Society and the geomorphology is preserved.




Five sampling sites in Villa Cave are monitored at intervals over October 2007-December 2008 (Figure 2.2). However, reptile museum was being constructed starting the end of December 2007 until February 2008 and sampling sites have been disturbed. Only two suitable sites left for continuous sampling. On the other hand, five sampling sites in Dark Cave are monitored at intervals over March 2008 - May 2008 (Salleh, 2008). Drip sites consist of drip water which originates from cracks, stalactite and drapery. Descriptions of each drip site are given in Table 2.1.

2.2 Gunung Tempurung, Perak

Gua Tempurung is a massif cavern inside Gunung Tempurung standing at 497 meters high and extensively covered with speleothems (Figure 2.3). The cave system represents a bow shaped and the length is approximately 1200 m (Muhammad, 2003). Gua Tempurung is a one of famous tourist sites since 1995. This cave has been developed as a show cave since 1996 and parts of the cave is facilitated with electric lighting and walkways.

Gua Tempurung is- the Kinta Valley which has been dated as Silurian – Permian (Ighnam and Bradfrod, 1960) Husain (1997) determines that the host rock represent by white to dark grey limestone. Sungai Tempurung runs about 1.6 km through the cave inside

Table 2.1a: Description of sampling sites in Villa Cave

Sample ID	Description
CA1	
	<p>Type of water : Drip water The drip waters originate from small cracks from caves ceiling.</p>
CA2	
	<p>Type of water : Drip water The drip waters emanate from drips onto small stalagmites.</p>
CA3	
	<p>Type of water : Drip water The drips originates from small cracks and trackling through broken scallop</p>

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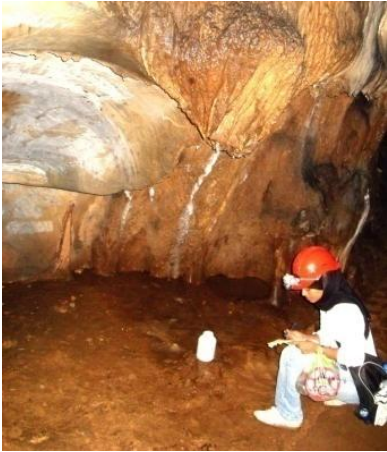
<p>CA4</p>		<p>Type of water: Drip water</p> <p>The drip waters emanate alluvium covered ceiling.</p>
<p>CA5</p>		<p>Type of water : Drip water</p> <p>Water flowing and trickling down from the wall covering.</p>

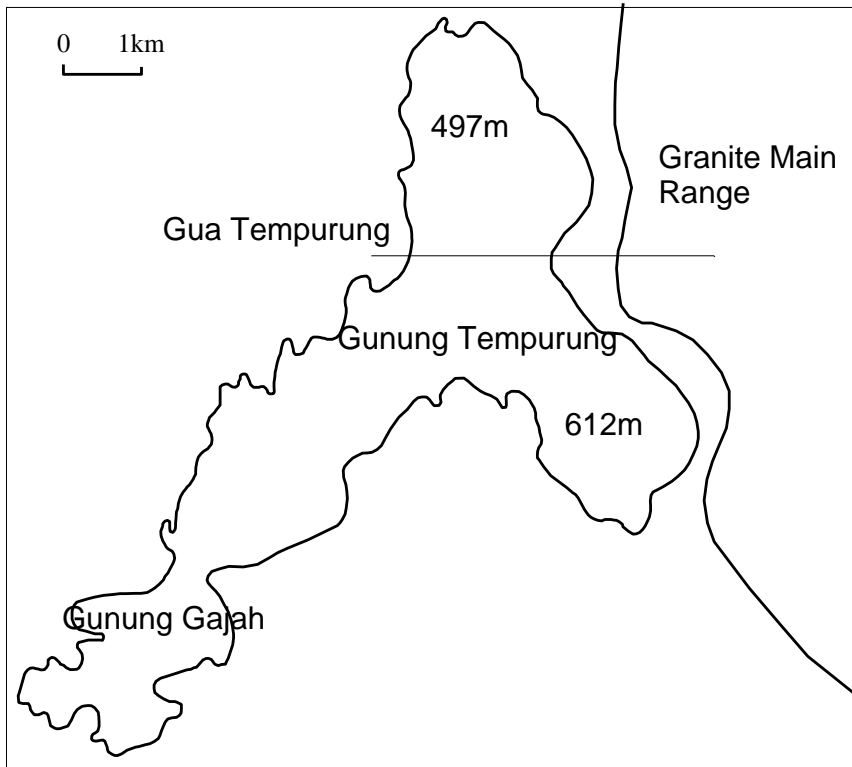
Table 2.1b: Description of sampling sites in Dark Cave

Sample ID	Description
A1	
	<p>Type of water : Drip water The drip waters originate from draperies and form flowstones.</p>
A2	
	<p>Type of water : Drip water The drip waters emanates from stalactite. Drips onto small stalagmite.</p>
A3	 <p>Type of water : Drip water The drips originate from drapery.</p>

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<p>A4</p>		<p>Type of water : Showerhead drip</p> <p>The drip originates from showerhead stalactite onto a pond.</p>
<p>A6</p>		<p>Type of water : Drip water</p> <p>The drip water originates from scallop ceiling.</p>

a)



b)

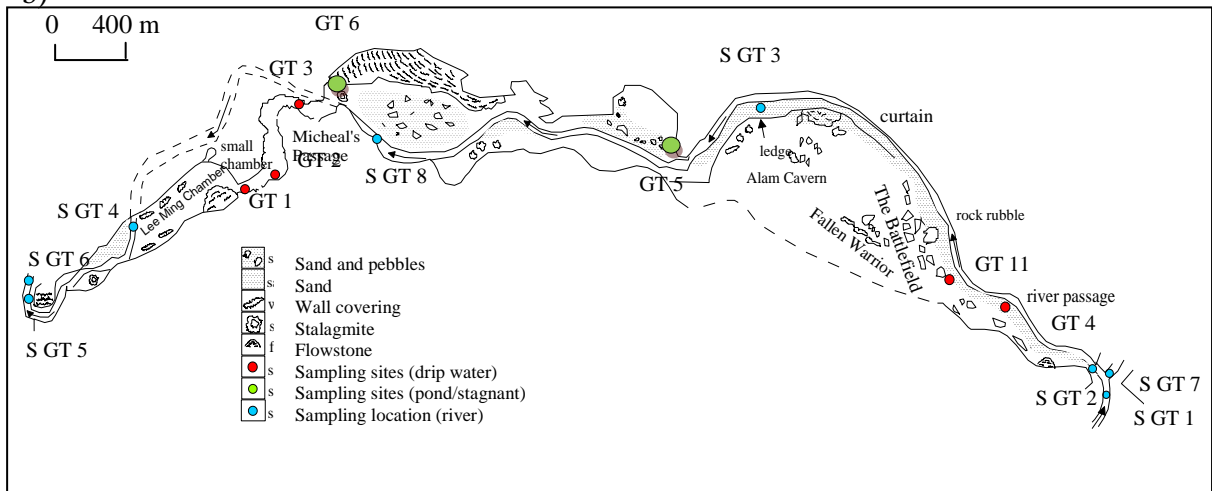


Figure 2.3 a): Location of Gunung Tempurung (Muhammad, 2003)

b): Map of Gua Tempurung and sampling sites (Muhammad, 2003)




Gunung Tempurung along cave passages which is a tributary from granitic hill in Main Range. Monthly samplings include a various types of karst water such as drip water, pond, spring and river. Detail descriptions of drip site are given in Table 2.2a and 2.2b.

3.3 Gunung Senyum, Pahang

Gunung Senyum characterizes by massive and thick limestone (Zakaria et al., 2006). Petrography study determines that Gunung Senyum host rock consists of dolomatic limestone, high dolomatic limestone, and calcitic limestone (Zakaria, 1993). This limestone hill comprises of 118 caves, but only 18 caves have been explored and 12 caves are tourism attraction Zakaria et al., (2006). Gua Angin, Gua Terang Bulan, Gua Taman Satu and Gua Taman Dua are connected to each other (Figure 2.4).

Gua Angin characterizes by a huge entrance chamber and decorated by magnificent stalactites and stalagmites. The piles of blocks can be seen at the side of the wall entrance (Figure 2.4). This chamber linked to the Gua Taman Satu. Only few drip water samples managed to be collected at Gua Angin. The water samples originate from trickles water down wall, showerhead drip waters, baldachino canopy. Detail descriptions of sampling site are given in Table 2.3.

Table 2.2a: Description of sampling sites in Gua Tempurung.

Sample ID	Description	
GT3	<p>*no photo available Type of water : Drip water The drip waters originate from draperies and form flowstones.</p>	
GT4		<p>Type of water : Drip water</p> <p>The drip waters emanates from stalactite. Drips onto small stalagmite.</p>
GT5		<p>Type of water: Spring</p> <p>Water emanates from spring. The spring only occurs coincidentally with high rainfall excess. The spring is flooded along Wind Tunnel area.</p>
GT6		<p>Type of water: Pond</p> <p>The water samples collected from small pond.</p>

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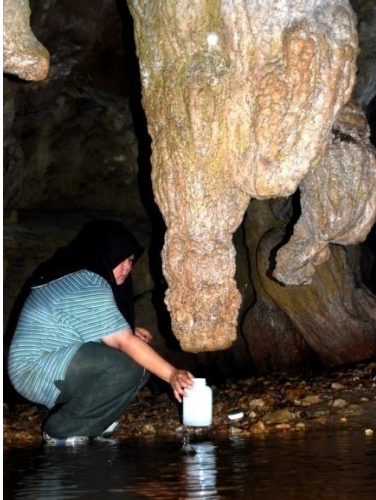






<p>GT11</p>		<p>Type of water: Drip water</p> <p>Drip waters emanates from big stalactites.</p>
<p>GT1</p>	<p>*no photo available Type of water : Drip water Drip water originates from stalactite and form a huge stalagmite. The drip is relatively slow.</p>	
<p>GT2</p>	<p>*no photo available Type of water : Drip water Drip water emanates slow dripping stalactite.</p>	
<p>GT21</p>	<p>*no photo available Type of water : Drip water The drip dripping as a showerhead stalactite. Only occurred during heavy rain in November and Mac during sampling period.</p>	

Table 2.2b: Description of sampling sites in Sungai Tempurung

Sample ID	Description	
SGT1	*no photo available	Spring located at the eastern side of Gunung Tempurung tributary with Sungai Tempurung.
SGT2		The upstream is located at the eastern side of Gunung Tempurung.
SGT7		Sampling site is located at the east entrance of Gua Tempurung.
SGT3		Sampling site is situated in the Alam Cavern.
SGT8	*no photo available	Sampling site is located at the Gergasi Chamber

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<p>SGT4</p>		<p>Sampling site is situated at Lee Ming Chamber. This chamber is floored with white to grey marble.</p>
<p>SGT5</p>		<p>Sampling site is located at the west entrance of Gua Tempurung. Only small gravels are observed</p>
<p>SGT6</p>		<p>Sampling site is situated at 20m away from west entrance. The white pure marble is observed along the river.</p>
<p style="text-align: center;"> SGT2 SGT7 SGT3 SGT8 SGT4 SGT5 SGT6 Upstream Downstream </p>		

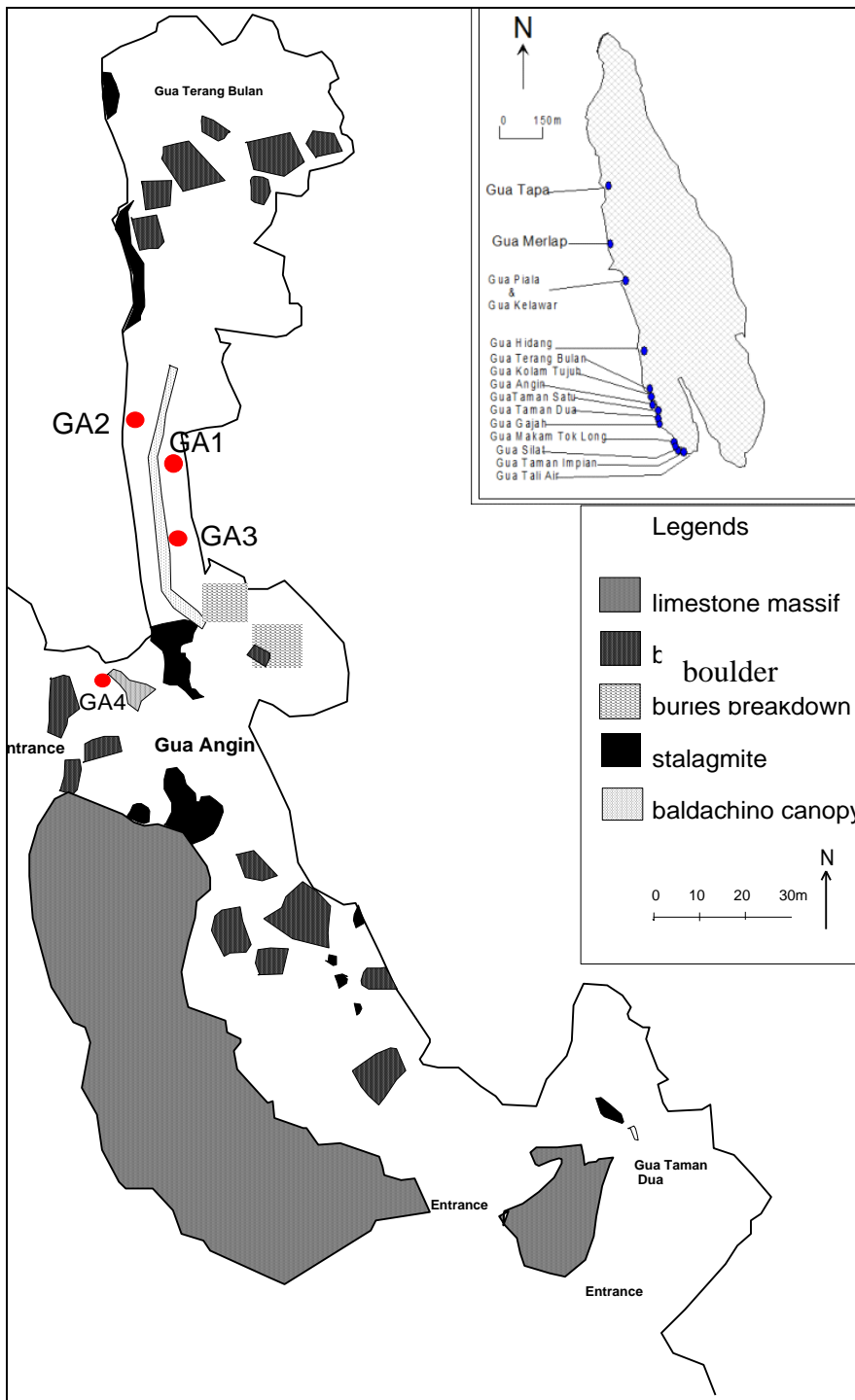
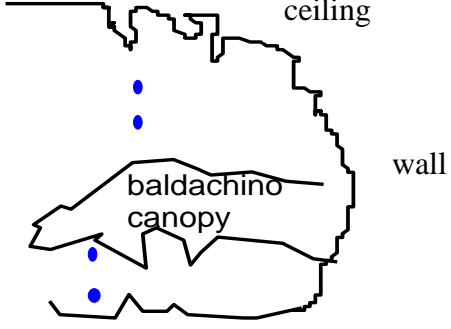


Figure 2.4: Map of Gua Angin and sampling sites (after Zakaria et al., 2006)

Table 2.3: Description of sampling sites in Gua Angin

Sample ID	Description
GA1	<p>*no photo available Type of water : Drip water Karst waters emanate from water trickles down wall.</p>
GA2	<p>*no photo available Type of water : Drip water The drips originate from draperies and developed showerhead drip waters.</p>
GA3	<p>*no photo available Type of water : Drip water The drips originate from stalactite and not developed a stalagmite.</p>
GA4	
	<p>Type of water : Drip water The drip waters emanates from baldachino canopy (Ford & William, 1989)</p>

2.4 Gunung Jebak Puyuh, Pahang

Gunung Jebak Puyuh is located approximately 10 km distance from Gunung Senyum and comprises a lot of caves system (refer Figure 1.1). The host rock is a massive limestone and consists of a light to dark grey limestones (Wong, 2004). Seven main caves have been explored for tourism and education trip such as Gua Terowong, Gua Rangkak, Gua Mayat, Gua Haluan Kapal, Gua Candi, Gua Straw and Gua Kerang.

Gua Straw is located in the middle of Gua Candi and Gua Kerang (Figure 2.5). The small cave system is extensively covered by a soda straw stalactite and wide range of stalagmites. Gua Straw is characterizes by wet atmosphere and shows broadly continual speleothem development. However, most of the soda straw discharge is extremely slow. Only two sampling sites are suitable for the study which are emanates from 'candlestick' stalactite and draperies. Detail descriptions of each drip site are given in Table 2.4.

2.5 Kaki Bukit, Perlis

Kaki Bukit, Perlis situated along the Banjaran Nakawan and underlined by Setul Formation. Gua Kelam is a tourism attraction sites in Kaki Bukit. Gua Kelam I is consists of small passages of 370m in length meanwhile Gua Kelam II is one of the longest cave in the region stretching up to 3.65 km. Previous literatures explained that Gua Kelam II is a tin ore mine and Gua Kelam I serves as the main route for mining activities (Figure 2.6).

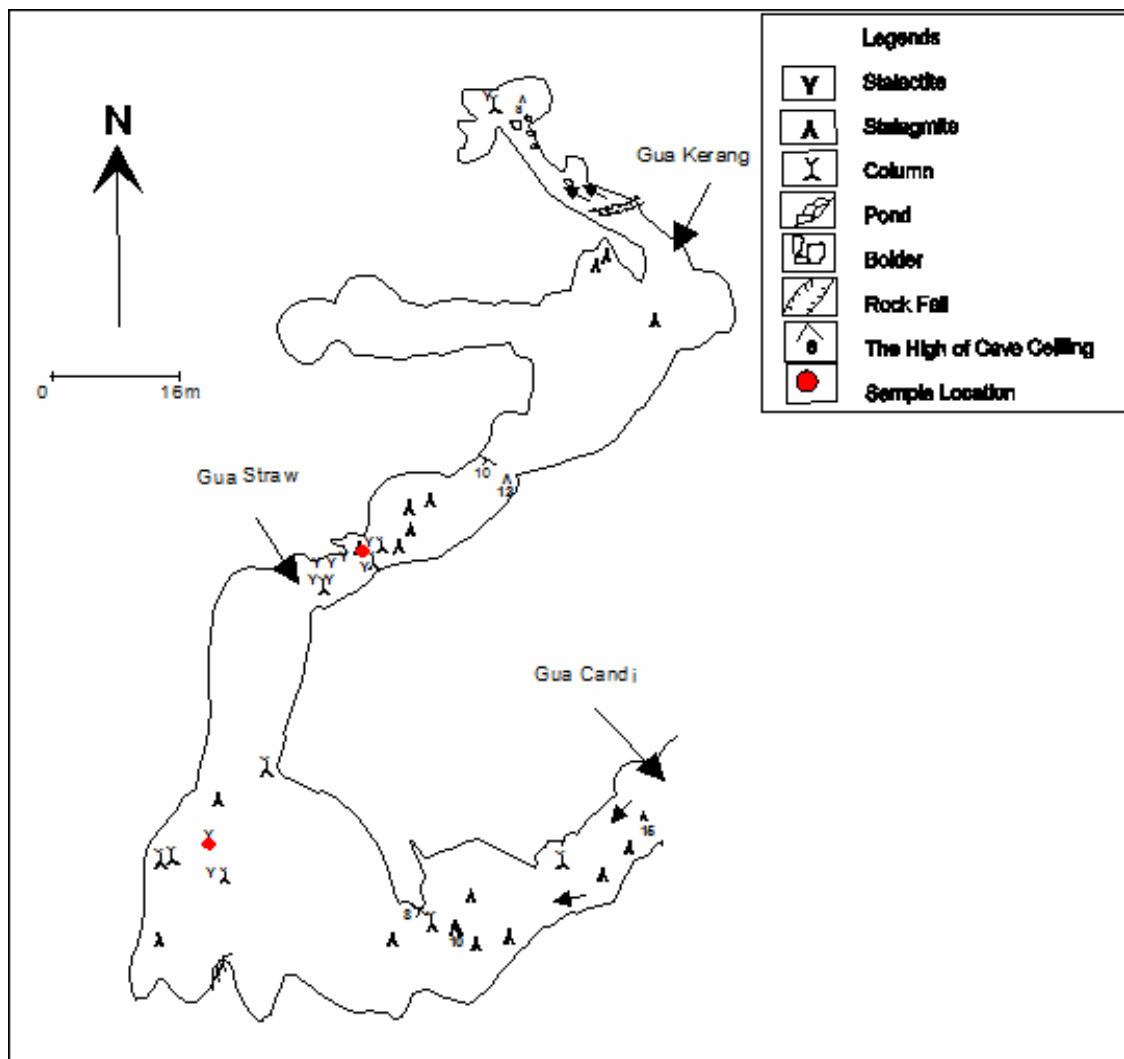
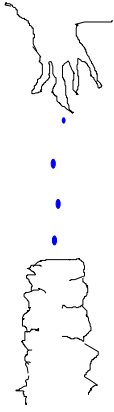


Figure 2.5 : Map of Gua Straw and sampling sites (modified from Wong, 2004)

Table 2.4: Description of sampling sites in Gua Straw.

Sample ID	Physical description	
GSTRW1		<p>Type of water : Drip water</p> <p>Drip emanates from 'candlestick' stalactite and dripped onto large stalagmite.</p>
GSTRW2	<p>*no photo available</p>	<p>Type of water : Drip water</p> <p>The drip waters emanates from draperies and form small rimstone-like.</p>

a)



b)

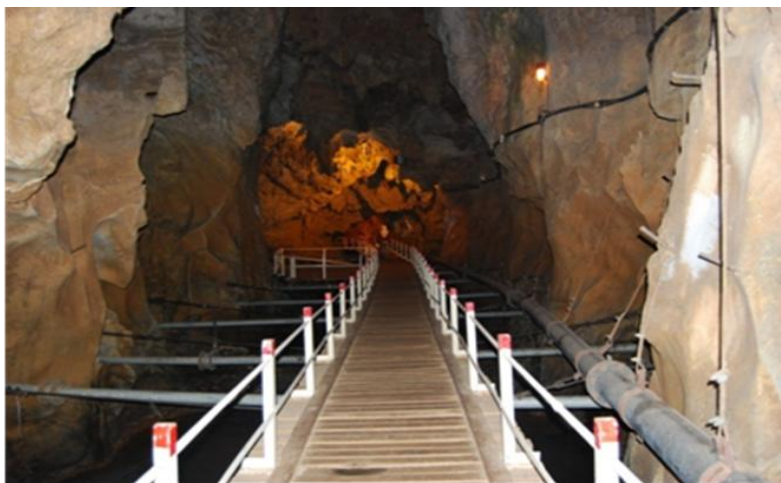




Figure 2.6: The characteristics of Gua Kelam

Generally, Gua Kelam I is an active cave. The cave is covered by a huge flowstone situated at the centre of the cave and small stalactites. The drip water collected from a small sodastick stalactite and fractures. Description of each drip sites is given in Table 2.5.

2.6 Bukit Baling, Kedah

Bukit Baling illustrates the fringing stalactites at the mouth of the caves. Gua Berlian is located at the foot hill of Bukit Baling. Based on the observation some part of the cave has been blasted for calcite crystal exploration (Figure 2.7). Only a small part of the cave illustrate evaporate conditions and form a soda straw and calcite crystal. The drip water emanates from alluvium cave ceiling, soda straw and water trickles down wall. A description of each drip sites is given in Table 2.6.

Table 2.5: Description of sampling sites in Gua Kelam.

Sample ID	Physical description	
KE 1		<p>Type of water : Drip water</p> <p>Drip emanates from small soda-stick stalactites.</p>
KE 2		<p>Type of water : Drip water</p> <p>The drip originates from fracture openings.</p>

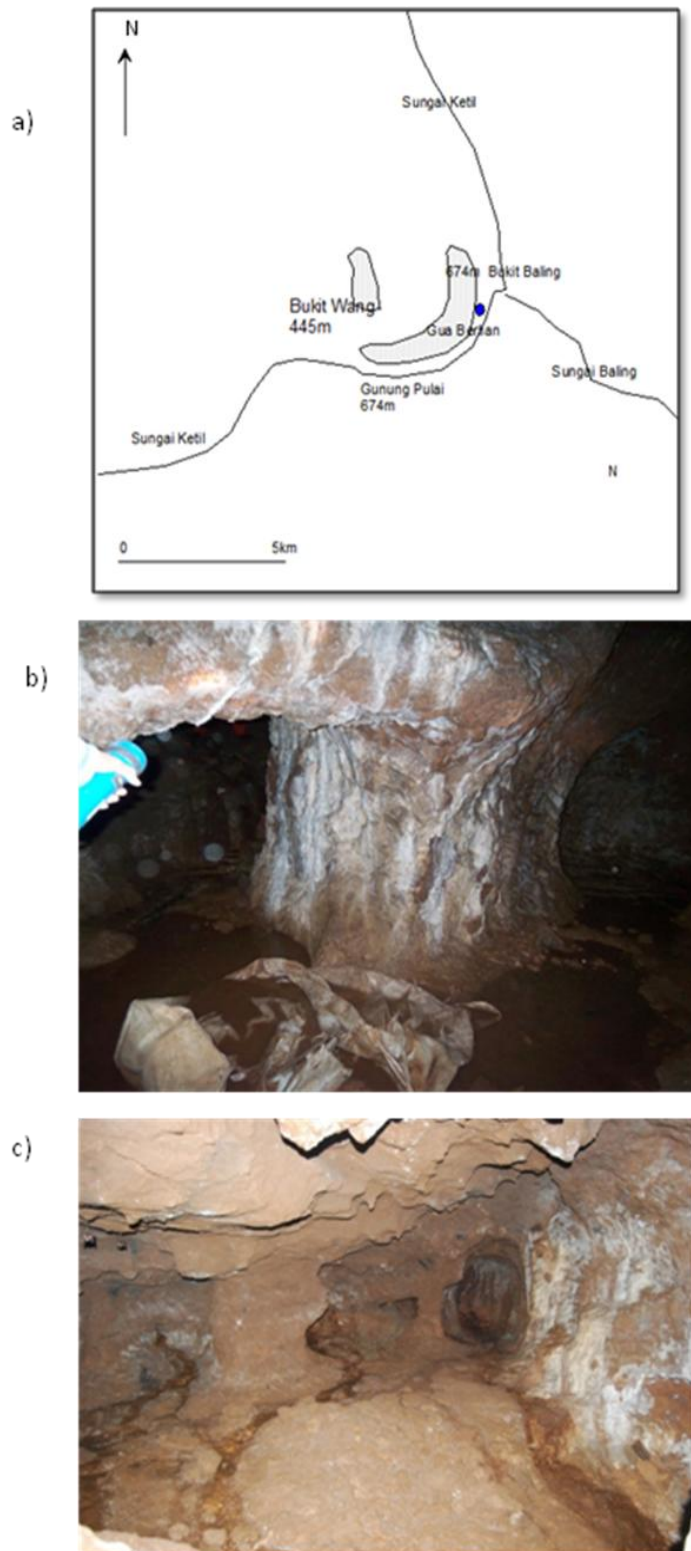


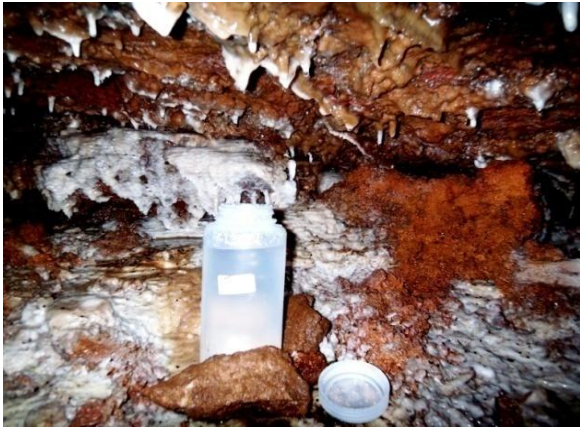


Figure 2.7: Location map of Gua Berlian (modified from, Yong, 1989)
 b) and c) the characteristics of Gua Berlian

Table 2.6: Description of drip sites in Gua Berlian.

Sample ID	Description	
BE 1		<p>Type of water : Drip water</p> <p>The drip waters emanates from alluvium cave ceiling.</p>
BE 2		<p>Type of water : Drip water</p> <p>The drip waters emanates from alluvium cave ceiling.</p>
BE 3		<p>Type of water : Drip water</p> <p>The drips on tip of approximately 1.5 cm long soda straw stalactite composed of white calcite. Dripped onto crystal surface.</p>
BE 4	<p>*no photo available</p> <p>Type of water : Drip water</p> <p>Drip waters originate from stalactite located at the outside of the cave.</p>	