

GEOLOGY AND GEOMORPHOLOGY OF HONG KONG

**STUDENT
HANDBOOK**



Geology and Geomorphology of Hong Kong

Field Trip Handbook

Field Site: High Island Reservoir East Dam, Sai Kung East Country Park

Duration: 100 minutes

Related Curriculum: F.1-F.3 Geography

- Core Module: Living with Natural Hazards - Are we better equipped than the others?

Learning Objectives:

Knowledge:

1. Identify the landform features around East Dam
2. Distinguish different types of rocks and its formation
3. Identify geological landform features and its formation processes
4. Understand the relationship between plate movement and natural hazards

Skills:

1. Apply geographical inquiry method during the field trip
2. Use magnifying glasses and binoculars to study natural landscape and landform features

Attitude:

1. Appreciate the beauty of nature in country parks and special areas
2. Be more aware of the unique and spectacular natural resources in country parks and special areas and recognise the need of conservation
3. Recognise the need for sustainable management of our physical environment



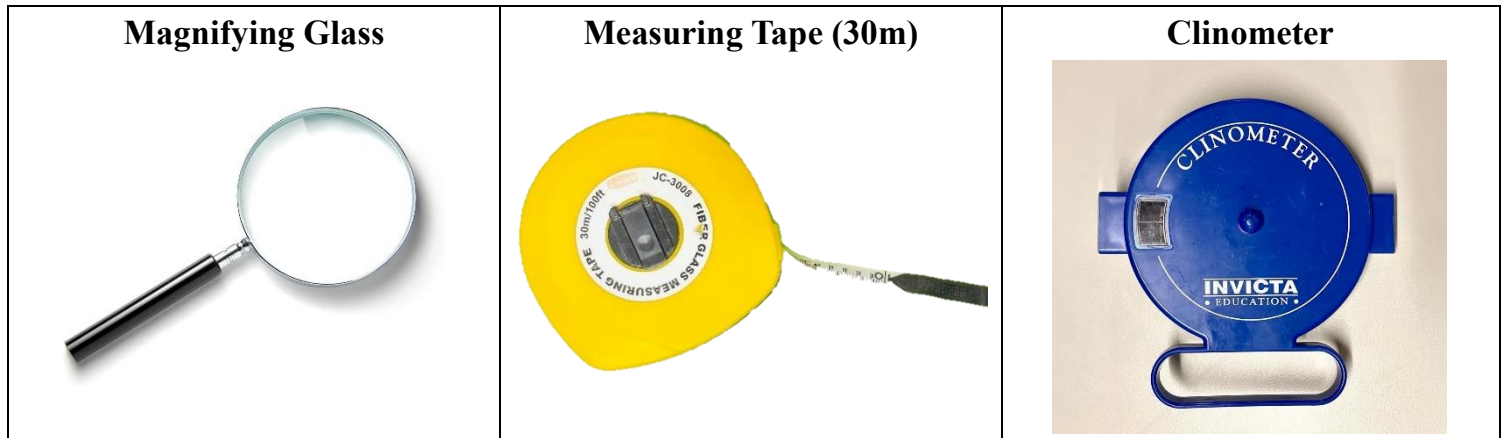
Safety Code and Code of Conduct

- A. Bring enough drinking water and outdoor equipment, including organic mosquito repellent and rain gear.
- B. Do not leave the group without the permission of teacher/ instructor.
- C. Do not take away anything from nature. The fallen part of the plant can only be picked up for observation and should be put back in its original place.
- D. Do not eat or pick any branches, leaves, flowers or fruits of the plants.
- E. Do not litter or pollute the natural environment.
- F. Care for the environment and take your litter home.
- G. Seek teacher/instructor's help if needed.

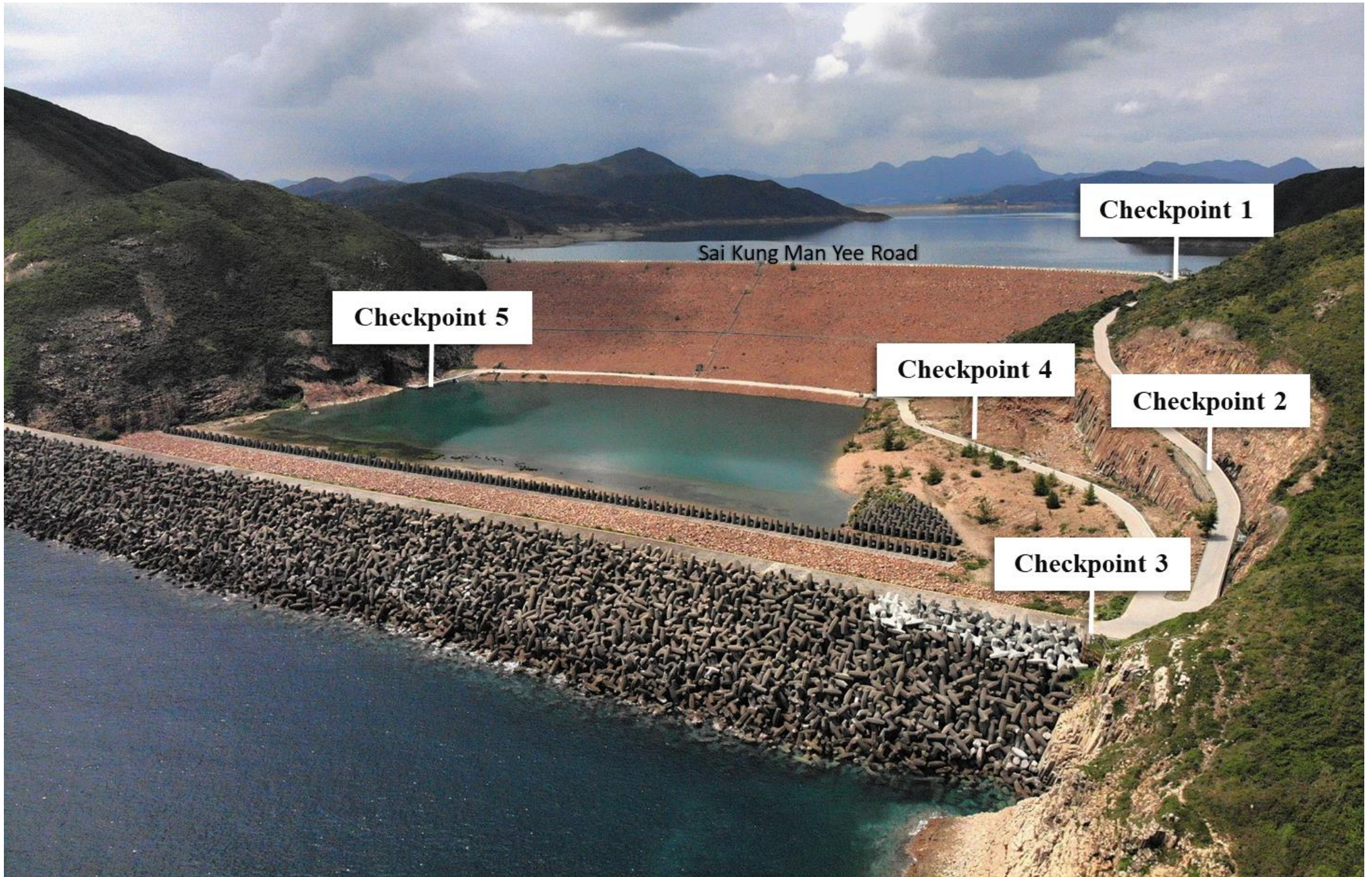
Equipment Checklist

Item	Quantity (per group)	✓
Field Trip Handbook	1-2	
Pen/Pencil	2-3	
Clipboard	1-2	
Magnifying Glass (for observing rock types at checkpoint 1)	1	
Measuring Tape (30m)	1	
Clinometer	1	
Binocular (Optional)	1	
Camera/Phone with camera functions	1	
Pairs of gloves (if needed)	1	

Photo of Equipment



Map of Field Site





Treasure Hunt

Equipment Checklist	
Items	Quantity (per group)
Pen/Pencil	2-3
Clipboard	2
Magnifying glasses	1
Clinometer	1
Measuring tape (30m)	1
Binocular (Optional)	1

Time needed: 100 minutes

Venue: East Dam, Checkpoints 1-5

Group work: Divide into groups of 4/5 to complete the following tasks



Treasure Hunt:

The purpose of this activity is to enable students to develop a general insight into the natural hazards that occurred at East Dam about 140 million years ago, and to explore the spectacular geomorphic features of Sai Kung today. In total, there are 5 checkpoints with different tasks and topics. You are going to go through each checkpoint identified in the “Map of Field Site” and answer the following questions by reading the interpretation panels along the road to all checkpoints or scanning the QR codes below. Most answers can be found in the Hong Kong UNESCO Global Geopark pamphlet and webpage.

For short questions, please provide short, simple and concise answers, while for multiple-choice questions, please circle **ONE** correct answer in each question.



[QR code 1] Pamphlet

**Appreciating the High Island
Hexagonal Rock Columns**



[QR code 2] Webpage

**High Island Reservoir East
Dam > Geology**

Task 1: Rock Types and Geomorphological History of Sai Kung

In order to acquire a basic understanding of the common rock types found in East Dam and the geomorphological history of Sai Kung, please have a look at the interpretation panels around **Checkpoint 1** or scan the QR codes, and answer the following questions.




1. How many region(s) do Hong Kong UNESCO Global Geopark contain? List the region(s) and point out the one where East Dam is located at.

2. Can you name two places where hexagonal volcanic rock columns are also found, except East Dam?

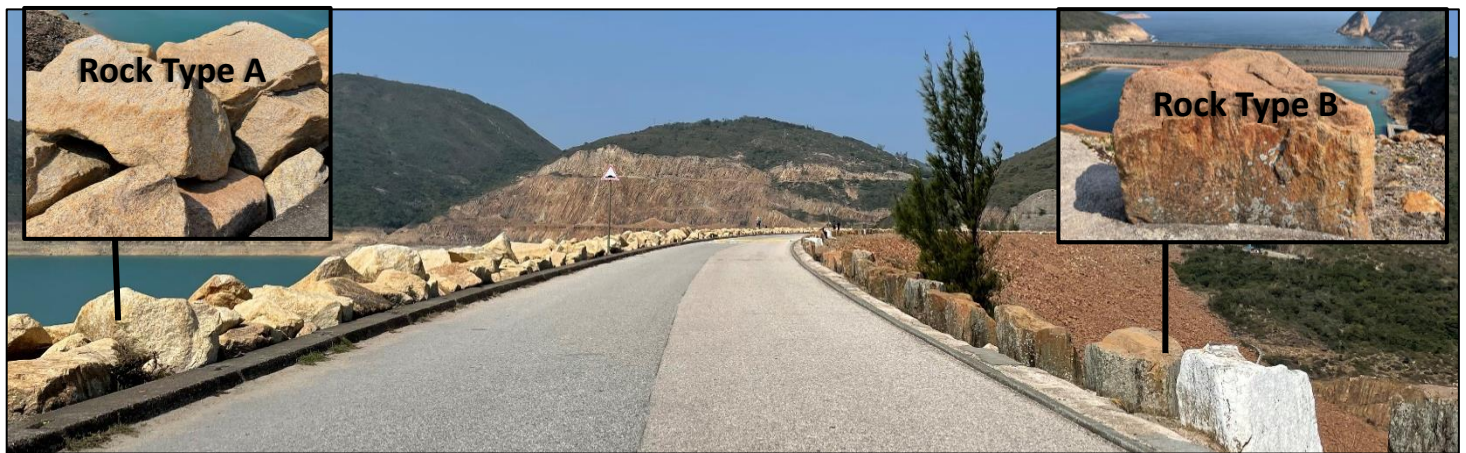
3. What was the correct period of the volcanic activity forming the land in High Island in Sai Kung.

A	Jurassic period
B	Cambrian period
C	Permian period
D	Cretaceous period

4. Two types of igneous rocks (A & B) are found at Checkpoint 1, on the two sides of the road. Take a look at the rock types on-site with reference to the features description provided below, and name the correct rock types.

 Use Magnifier to observe the rocks

* Be aware of traffic on the road.



Features of Tuff (extrusive rock):

- Formed by explosive volcanic eruption, rock, ash, magma and other materials are released from the volcano, and this ejecta travels through the air and falls back to Earth in the area surrounding the volcano. This ejecta is then compacted and cemented into a rock at the surface, i.e. tuff.
- Contains smaller grains, including quartz, and feldspar. The tuff is consolidated quickly when the ejecta come into contact with air. The crystals remained small in size.
- Usually pink or grey in colour.
- The volume of ash (tuff) found at the site indicated the eruption was explosive, similar to the eruptions observed along convergent plate boundaries nowadays.

Features of Granite (intrusive rock):

- Formed by the slow crystallisation of magma below the Earth's surface.
- Contains larger grains (highly visible with the unaided eye), including quartz, feldspar and mica.
- Usually light-coloured.

Answers:



- Extrusive Rock
- Intrusive Rock

Rock Type A:



- Extrusive Rock
- Intrusive Rock

Rock Type B:

Task 2: Hexagonal Rock Columns

At Checkpoint 2, please have a look at the hexagonal rock columns and interpretation panels along the road or scan the QR codes, and answer the following questions.



5. How did the volcanic activity happen and result in the formation of hexagonal rock columns? Please put the following episode in the correct order. (Order 1-4, 1 is the earliest episode, while 4 is the last one)

<p>The top of the volcano lost support and collapsed, a huge oval-shaped basin measuring 18 km in length emerged, now known as the High Island Caldera.</p>
<p>The volcanic activity occurred in relation to a large volcano at High Island in Sai Kung. Volcanic eruptions occurred along the convergent plate boundary, and a large amount of lava and ash were released from the volcano.</p>
<p>The magma chamber below was emptied.</p>
<p>Eventually, the hot volcanic materials cooled down and contracted inside the caldera, consolidating into the hexagonal rock columns.</p>

6. What are the differences between the hexagonal rock columns found at East Dam and the one shown in Figure 1? Try to spot the differences in features and cite some interpretations from geologists to explain the differences. (*Advance level)

Figure 1. Daepo Jusangjeolli Cliff at Jeju Island, South Korea



The cliff is composed of dark basalt hexagonal rock columns. It was formed when the lava from Hallasan Mountain erupted into the sea of Jungmun.

Locations	Differences	Colour of rocks	Types of rocks	Explanation
		✓ the correct answer		
East Dam, Hong Kong		<input type="checkbox"/> Light <input type="checkbox"/> Dark		
Jeju Island, South Korea		<input type="checkbox"/> Light <input type="checkbox"/> Dark		

7. Which option is NOT the correct description of hexagonal rock columns at East Dam?

A	The average diameter of a column is 1.2m.
B	It is composed of low silica content.
C	The rock is acidic.
D	The rock is light-coloured.

8. What is the largest average diameter recorded for the hexagonal rock columns in Hong Kong?

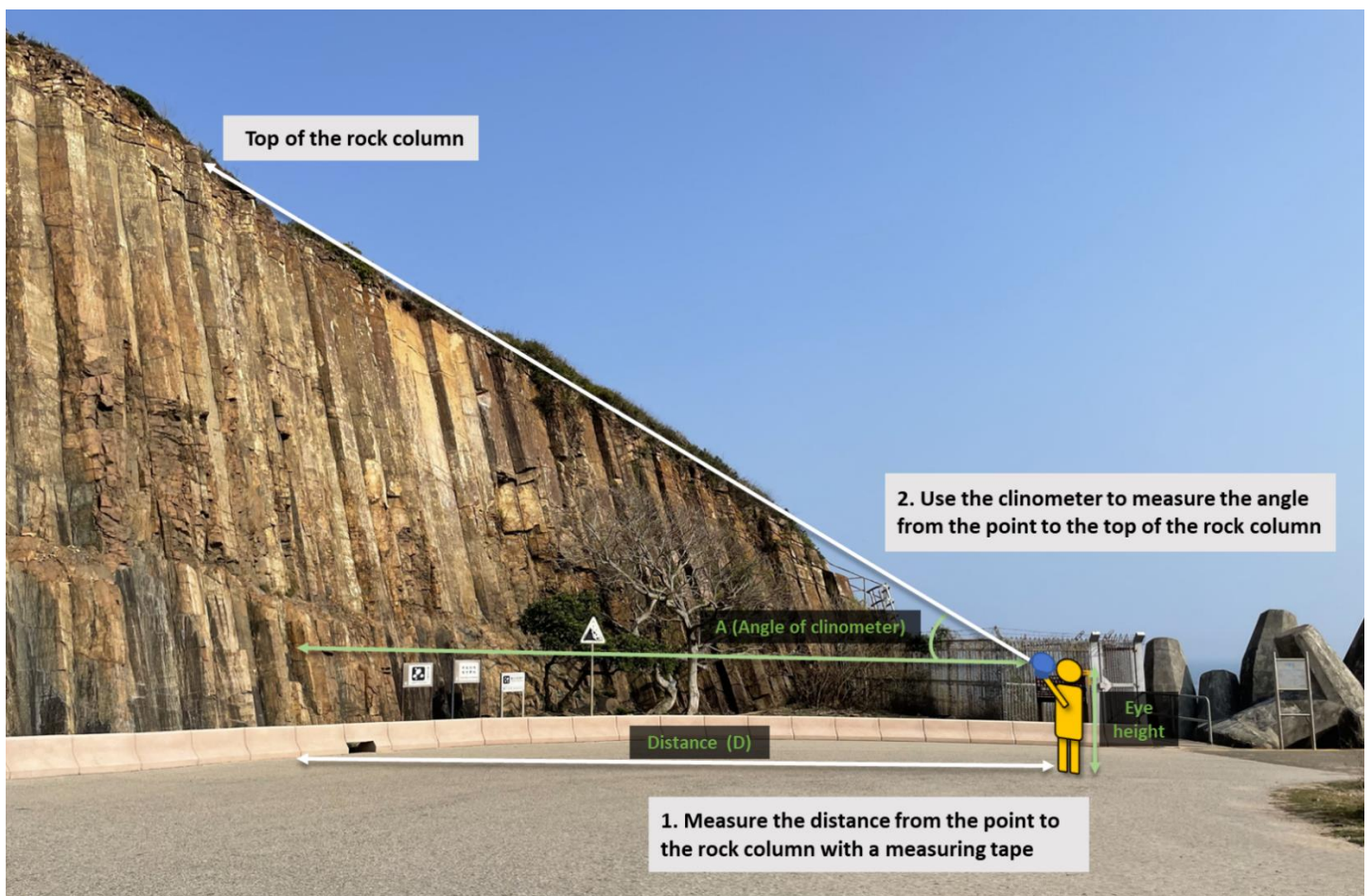
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Task 2: Hexagonal Rock Columns: Measuring the outcrop height of hexagonal rock column

- Go to Checkpoint 3. Target one specific hexagonal rock column.
- Choose a point where you can see the top of the rock column. The distance between the point and the rock column should be at least or about the outcrop height of the rock column above the land surface.
- Measure the distance from the point to the rock column with a measuring tape.
- Use the clinometer to measure the angle from the point to the top of the rock column.
 - Look through the clinometer with one eye and at the top of the rock column with another eye. Line up the crosshair of the clinometer with the rock top.
- Read the degree scale on the clinometer.
- Calculate the outcrop height of the rock column using the equation:

Outcrop height of rock column(h) = $\tan A \times$ distance to rock column (D) + eye height (above the ground)

** Eye height above the ground is usually 1.3m*

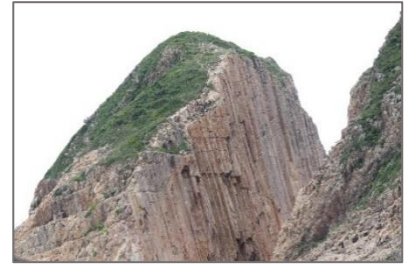


9. How tall are the hexagonal rock columns above the ground?

It is approximately _____ m tall.

Task 3: Formation of Coastal Landform

At Checkpoint 3, please look at the coastal landform on the opposite shore, describe its features and guess the correct coastal landform for it.



10. Name the coastal landform.

11. Guess the correct order of landform formation, and match the correct descriptions with the correct diagrams.

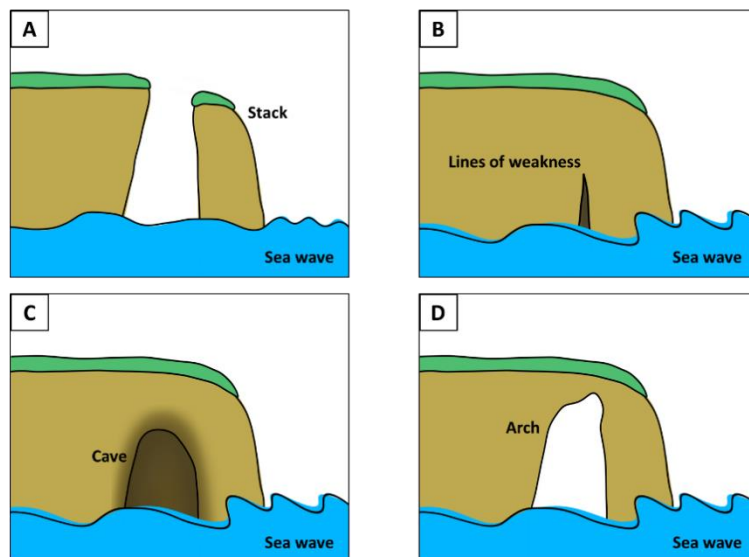


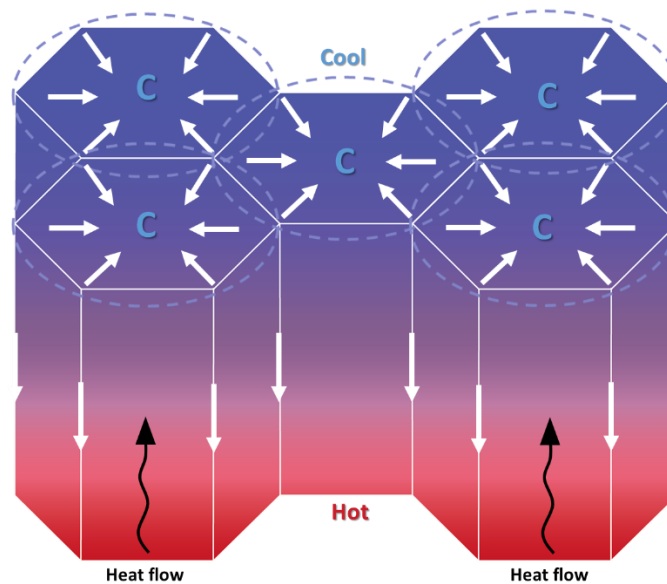
Diagram	Sequence of formation	Descriptions on formation
A		• The cave continues to be eroded and expanded until it cuts through a headland to form a sea arch.
B		• Lines of weakness are expanded by sea waves into a sea cave.
C		• There is a joint at base of the cliff at headland. Lines of weakness formed.
D		• A sea stack is formed when the arch continues to be eroded until its roof collapses into the sea.

Task 4: Formation of Hexagonal Rock Columns & Iconic Landmark of East Dam (*Advance level)

At Checkpoint 4, a wall of hexagonal rock columns is also found here. However, can you notice any differences between the one you see at Checkpoint 2 and the one here? Spot the differences and read the interpretation panels scan the QR codes to figure out the formation. Try to do a field sketch with your groupmates.



Figure 2. Formation of Hexagonal Rock Columns



12. Why are the rock columns hexagonal in shape? Please put the following episode in the correct order. (Order 1-4, 1 is the earliest episode, while 4 is the last one)

	Every contraction circle is surrounded by adjacent six circles. In the central area of neighbouring contraction circles, materials contract in opposite directions and create cracks, thus forming a network of hexagonal fissures.
	As volcanic substances cool down, the hexagonal fissure network sinks continuously until it is segregated into hexagonal rock columns.
	After volcanic eruption, the volcanic materials deposited in the caldera cooled down and compacted slowly when they came into contact with air on the surface.
	When they decreased in bulk, they moved towards centre points to maintain stability, forming uniformed contraction circles.

13. Identify the iconic landmark you see at Checkpoint 4.

_____ -shaped rock columns	A _____ is found in between the rock columns
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14. Field Sketch: Field sketch the formation of the deformed hexagonal rock columns and the dark dyke
Remember to provide appropriate annotations to explain the formation and the features.



Tips for Field Sketching

Purpose of field sketching:

- To record information and observations for the study sites during field study.
- To identify and highlight the key geographical features of the study sites.
- To explain the key geographical features of the study sites.
- One of the methods to present qualitative data.

Important steps to note while conducting field sketching:

- Before sketching, observe the sites and identify the main geographical landforms which you want to sketch.
- Identify and decide the foreground and background of the scene you want to sketch.
- Start to sketch the main geographical features with a pencil, e.g. hills, rivers, etc.
- Then add in other features, e.g. roads, trees, etc.
- If appropriate, you could add more details to record the scene.
- Label the main geological features in the sketch.
- Annotate the sketch by adding the formations or explanations of the geological features identified and labelled.
- Finally, name the sketch with an appropriate heading.

Task 5: Formation of Coastal Landform

At Checkpoint 5, a coastal landform is found here. Observe its features, name the landform and learn more information with the interpretation panels or scan the QR codes.



15. With reference to the information provided in Q11 (Task 3), can you name the coastal landform shown at Checkpoint 5?

16. Describe the differences in the features between the coastal landform at Checkpoint 3 and the one found here. Do you think there are risks for visitors who walk near the sea cave?

Extra information about Checkpoint 5:



In the past, the sea cave could only be seen from a distance. In 2016, a 50 metres wooden bridge was built by the AFCD, allowing visitors to take a closer look at the landform.

During the wooden bridge construction, the AFCD committed to protecting the natural environment and ecology, drilling and piling were avoided during construction to prevent damage to the surrounding geology or ecology.

Extending Question:

Do you think it is a good measure to construct a bridge inside the Geopark?

**Post-trip Activity:
Hong Kong UNESCO Global Park**

Discussion:

In groups, discuss the current management of Hong Kong Geopark with reference to what you saw during the field trip or information searched online. You are encouraged to provide evidence (photos taken during the field trip/ Google Earth search) to support your arguments.

- 1. What are the risks of natural hazards found in the Geopark? How are these risks related to the geological characteristics of the place?**

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- 2. What can the government and visitors do to minimize the risks?**

Government:	Visitors:

- 3. Is Hong Kong Geopark well-managed? Please share your thoughts.**

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