

Sham Chung Field Study on River

Concept recap

channel characteristics, fluvial processes

Enquiry question

Describe and explain a phenomenon:	How does the size and shape of bed load vary from upstream to downstream?
Hypothesis testing:	Size of bed load decrease downstream./ Roundness of bed load increase downstream.

----- PLANNING & PREPARATION -----

What data to collect

Primary data	Size and roundness of bed load
Secondary data	Distance of field sites from river mouth

When to collect data

Fieldwork date	
Fieldwork time	
Present weather conditions	
Precipitation three days before the fieldwork	

Is today suitable for a river fieldwork?	 Things to consider: weather conditions/ some phenomena occur only under specific time
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Where to collect data

Sham Chung River (refer to the *Map: Fieldwork sites for river and woodland studies*)

Is it an appropriate location for a river fieldwork?	 Things to consider: safety/ accessibility/ appropriate scale/ match with fieldwork topic
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How to collect data

- Work in groups of 3 to 4 students.
- Each group records bed load data of their assigned site (Site A, B, C or D), then collaborates with the other groups to finish *Data record sheet 1*.
- Each group should collect data with appropriate methods and tools.

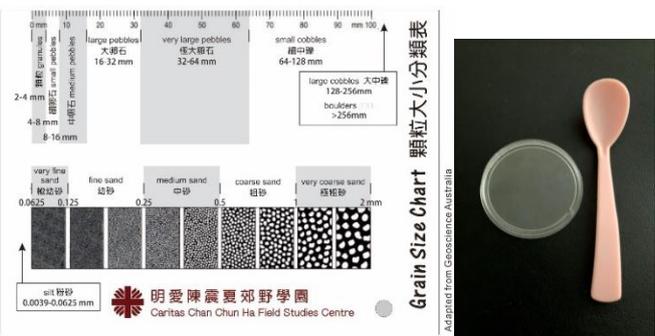
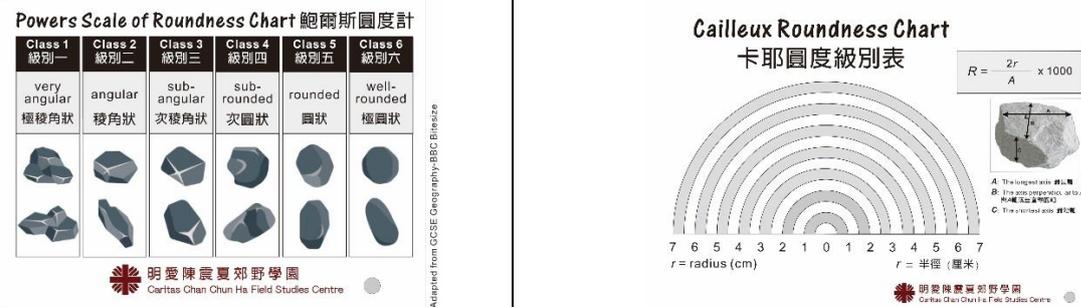
Select appropriate data collection methods and tools provided, and complete the table below.

Research items	Data collection methods	Equipment/ tools (Can select more than one)
Size of bed load	Measurement	Meter ruler, vernier calliper, grain size chart
Roundness of bed load	Method 1) Observation	Powers Scale of Roundness Chart
	Method 2) Measurement	Cailleux Roundness Chart
Distance of field site from river mouth	Measure on map (secondary data)	

Data collection methods

A) Observation	B) Measurement	C) Counting
D) Scoring	E) Interview	F) Questionnaire

Photos of equipment/ tools

 <p>Vernier calliper</p>	 <p>*Grain size chart (with spatula and transparent dish)</p>
 <p>Meter ruler</p>	 <p>*Powers Scale of Roundness Chart</p> <p>*Cailleux Roundness Chart</p>

*Obtain from the attachment on the last page. Please print in the original size.

----- **DATA COLLECTION** -----

Sampling

There are three methods for selecting bed load samples.

<p>Method 1) Systematic sampling</p>	<p>At the field site, use a measuring tape to set a transect across the channel. Select six bed load with equal intervals.</p>	
<p>Method 2) Stratified sampling</p>	<p>Divide the cross section of the channel into three sections. Select two bed load in each section. Suitable for field sites with a wide channel.</p>	
<p>Method 3) Purposive sampling</p>	<p>Observe bed load in the field site, choose the six most representative bed load. Suitable for field sites where a large number of boulders are exposed above water level.</p>	



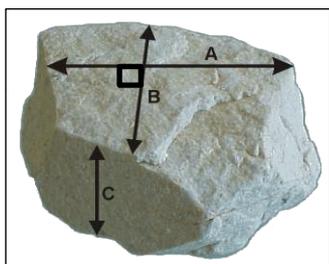
Things to consider:

The more bed load measured the more reliable your results will be.

Bed load size (by measurement)

Equipment/tools	meter ruler, vernier calliper, grain size chart (with spatula and transparent dish)
Procedure	<ol style="list-style-type: none"> 1. Select bed load samples with appropriate sampling method. 2. Look at the biggest face of the bed load. Take the middle axis (B)* of the bed load as the diameter (Figure 1). 3. Measure the diameter of each sample by using a meter ruler or a vernier calliper (Figure 3 and 4). Record the data. 4. Bed load with diameter less than 2 to 3mm have to be determined by grain size chart (Figure 5) or sieving. 5. Calculate the average diameter of bed load. 6. Determine the size class of bed load (Figure 2).

↓ Figure 1 *The three dimensions of a particle*



A = The longest axis
 B = The middle axis (the longest axis perpendicular to A-axis)
 C = The shortest axis

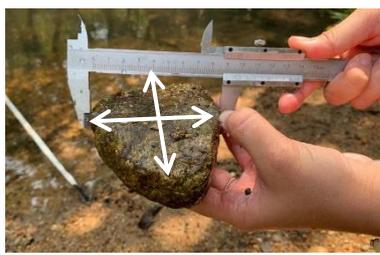
↓ Figure 2 *Classification of particles (For detailed classification, please refer to the attached grain size chart)*

Size class	Boulder	Cobble	Pebble	Granule	Sand	Silt and clay
Diameter (mm)	>256	>64-256	>4-64	>2-4	>0.06-2	≤0.06

↓ Figure 3 *Measure bed load size by meter ruler*



↓ Figure 4 *Measure bed load size by vernier calliper*



↓ Figure 5 *Determine particles size by grain size chart*



Bed load roundness

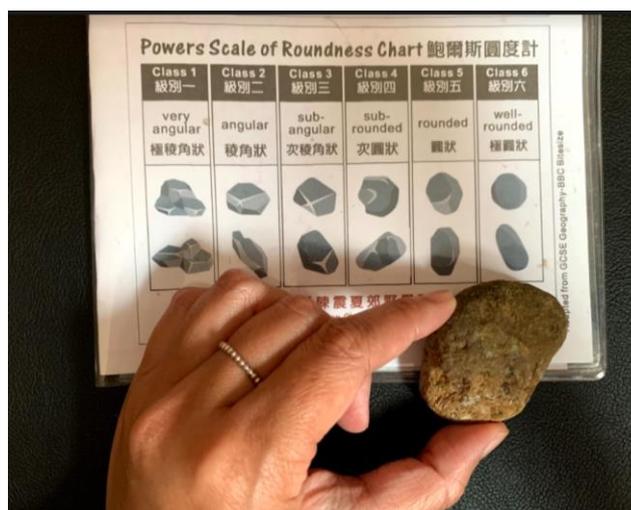
There are two field survey methods for determining bed load shape.

Method 1) Powers Scale of Roundness	Categorise roundness class by visual comparison
Method 2) Cailleux Roundness Index	Work out roundness value by a formular

Method 1) Powers Scale of Roundness (by observation)

Equipment/tools	Powers Scale of Roundness Chart (Powers visual chart)
Procedure	<ol style="list-style-type: none"> 1. Select bed load samples with appropriate sampling method. 2. Take one bed load from your sample. 3. Compare the shape of the bed load sample with Powers Scale of Roundness Chart (Figure 6). 4. Determine the roundness class and record the data. 5. Repeat the above procedure for each bed load in your sample and calculate the average roundness class.

↓ Figure 6 Determine the roundness class by Powers Scale of Roundness Chart



Method 2) Cailleux Roundness Index (by measurement)

Equipment/tools	meter ruler, vernier calliper, Cailleux Roundness Chart
Procedure	<ol style="list-style-type: none"> 1. Select bed load samples with appropriate sampling method. 2. Take one bed load from your sample. 3. Measure and record the length of the longest axis (<i>A</i>) (Figure 1). 4. Hold the flattest plane of the bed load, lay the sharpest corner on a chart of concentric semicircles to assess the radius of this corner (<i>r</i>) (Figure 7) and record the data. 5. Calculate the Cailleux roundness index (<i>R</i>) using the following equation: <div style="text-align: center; margin: 10px 0;"> $R = \frac{2r}{A} \times 1000$ </div> <p>Values of <i>R</i> will lie between 0 and 1000, with 1000 representing a perfectly circular bed load.</p> 6. Repeat for each bed load in your sample and calculate the average <i>R</i> value.

↓ Figure 7 Assess the radius of the sharpest corner by Cailleux Roundness Chart



Data Record Sheet 1: Bed load size and roundness

Field site	
Distance from river mouth	
River bed material	<input type="checkbox"/> Rocky <input type="checkbox"/> Sandy <input type="checkbox"/> Muddy
Fluvial landform features	
Human alteration on river channel	

	Size	Roundness <i>(choose either method)</i>			
Sample number	Diameter (mm) [B-axis]	<input type="checkbox"/> Powers Scale of Roundness (class)	<input type="checkbox"/> Cailleux Roundness index (value)		
			The longest axis (cm) [A-axis]	<i>r</i> (cm)	<i>R</i>
1					
2					
3					
4					
5					
6					
Average: _____mm		Average: Class _____		Average: _____	
Size class: <input type="checkbox"/> Boulder <input type="checkbox"/> Cobble <input type="checkbox"/> Pebble <input type="checkbox"/> Granule <input type="checkbox"/> Sand		Roundness description: <input type="checkbox"/> Very angular <input type="checkbox"/> Angular <input type="checkbox"/> Sub-angular <input type="checkbox"/> Sub-rounded <input type="checkbox"/> Rounded <input type="checkbox"/> Well rounded			

----- **DATA PROCESSING & PRESENTATION** -----

1. Calculate the average diameter of bed load, the average roundness class of Powers Scale and the average value of Cailleux of Roundness Index in *Data Record Sheet 1*.
2. Collaborate with the other groups to complete the *Data summary of Sham Chung River bed load characteristics*.
3. Use appropriate graphs to present the following data:
 - a) The changes of bed load size and roundness from upstream to downstream
 - b) The relationships between the size of bed load and distance from river mouth
4. Draw a long profile of Sham Chung River (P to Q) by using the *Map: Fieldwork sites for river and woodland studies*.

Data summary of Sham Chung River bed load characteristics

	Site A	Site B	Site C	Site D
Distance from river mouth (m)				
River bed materials				
Size				
Diameter (mm)				
Size class				
Roundness				
Roundness class of Powers Scale				
Roundness description				
Value of Cailleux Roundness Index				

----- **INTERPRETATION & CONCLUSION** -----

1. How does the size and shape of bed load vary from upstream to downstream?/ Is the hypothesis valid?
Explain with the graphs you have drawn.
2. Refer to field evidence, explain the reasons for the characteristics of bed load in Sham Chung River.

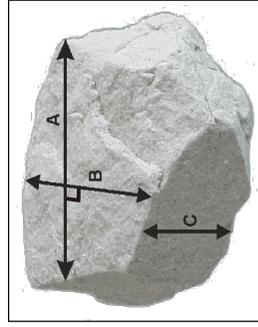
----- **EVALUATION** -----

1. Are field sites A to D well chosen for the enquiry question? Suggest modification to improve the field study data reliability accordingly.
2. Which sampling method is used to select bed load in your field site? Account for the merits and demerits of the method.
3. Which tool is used to collect bed load size data in your field site, meter ruler, vernier calliper or grain size chart? Account for the merits and demerits of the tools.
4. Compare the merits and demerits of using Power Scale of Roundness and Cailleux Roundness Index to determine the roundness of bed load.
5. Is the data collected sufficient to explain the changes in the size and shape of bed load? Suggest other data that can be collected.

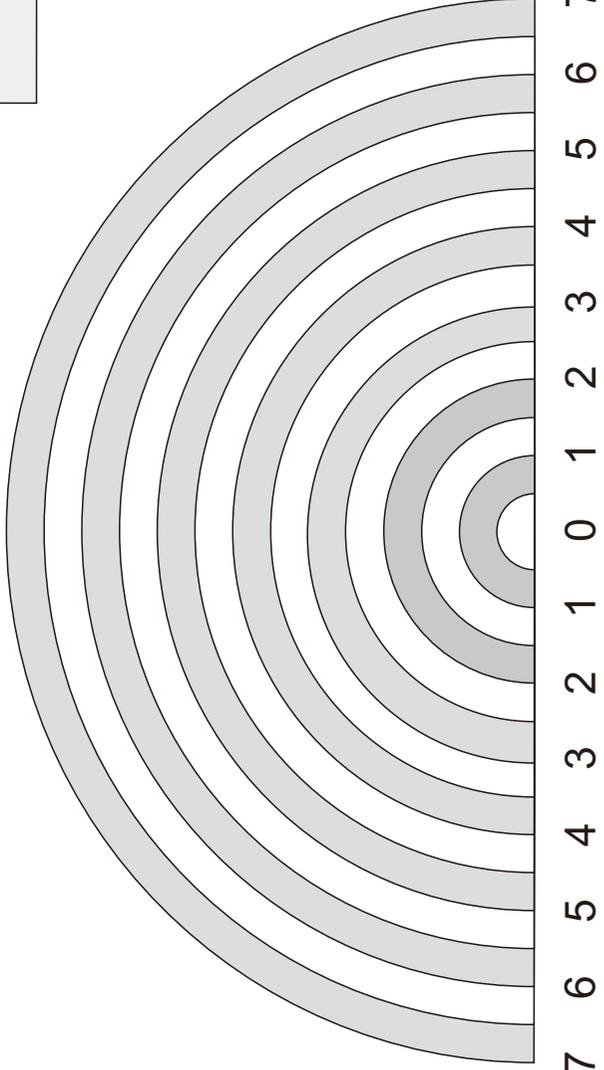
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Cailleux Roundness Chart 卡耶圓度級別表

$$R = \frac{2r}{A} \times 1000$$



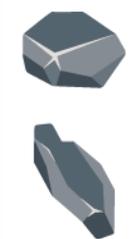
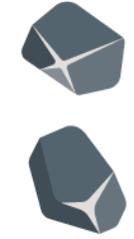
- A:** The longest axis 最長軸
- B:** The middle axis (the longest axis perpendicular to A-axis) 中軸 (垂直於A軸的最長軸)
- C:** The shortest axis 最短軸

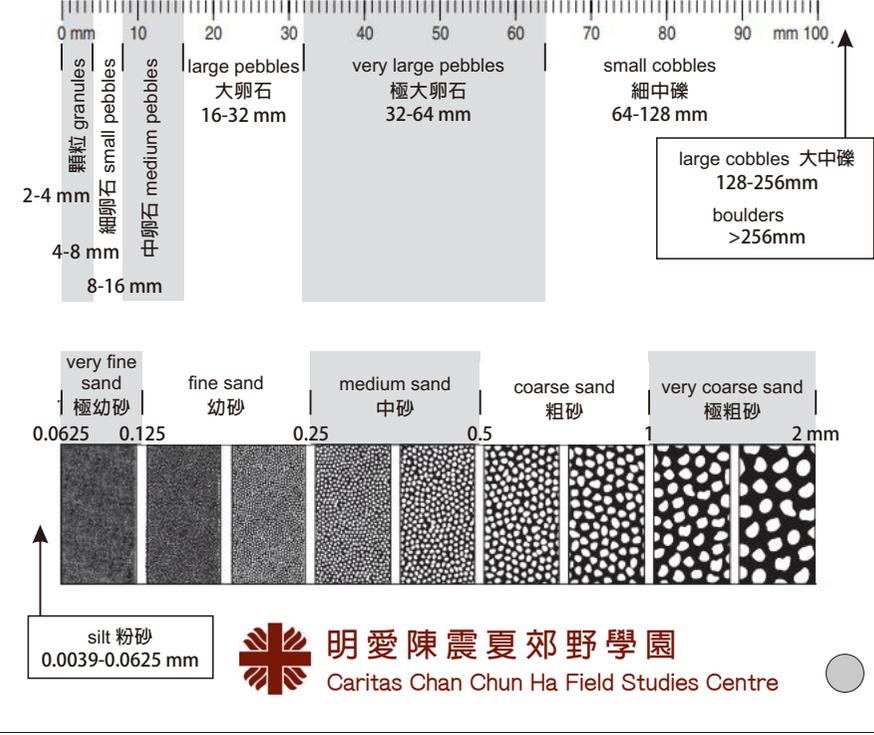


7 6 5 4 3 2 1 0 1 2 3 4 5 6 7
 r = radius (cm)
 r = 半徑 (厘米)

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Powers Scale of Roundness Chart 鮑爾斯圓度計

Class 1 級別一	Class 2 級別二	Class 3 級別三	Class 4 級別四	Class 5 級別五	Class 6 級別六
very angular 極棱角狀	angular 棱角狀	sub-angular 次棱角狀	sub-rounded 次圓狀	rounded 圓狀	well-rounded 極圓狀
					



Grain Size Chart 顆粒大小分類表