A-level Worksheet Answers

Three Cliffs Bay Geotrail Answers

To use this worksheet you will need access to Google MyMaps

Click here to go to the Three Cliffs Bay Geotrail

Introduction

This geotrail was inspired by the Scratching the Surface geology and landscape walks series by Dr Geraint Owen. It covers a broad range of geological concepts including sedimentary rocks, fossils, mountain building, folding and faults. This walk also begins to introduce geological mapping skills.

How to use this worksheet

The location of each stop is indicated on Google MyMaps. Each stop has an explanation with accompanying photographs showing key features of the site. This worksheet provides activities that can be done at each of the stops.

Stop 1: Conglomerate and slickensides

Activity

Bedding

Try to identify the layering (bedding) in the conglomerate by studying the structure of the full outcrop. You might also find bands of different size pebbles within the larger beds.

Conglomerate outcrop at stop 1 showing thick (up to 1m) bedding at an angle of around 45 degrees

Limestone outcrop at stop 3 showing thin (less than 20cm) bedding at an angle of around 90 degrees

Q1. How many different types of pebbles can you find (look for different colours)? Which type is the most common and what is it?

There is one main type of pebble, it is glassy and varies in colour from white to pale pink. This common pebble is quartz. Other pebbles can be found but are much rarer, there are some lithics, which are other pieces of rock that have been incorporated into the conglomerate.

Field Notes and Sketches

Q2. Describe the conglomerate.

Use the following prompts to help:

- What colour is the rock?
- What size are the clasts? Give a range.
- How rounded are the clasts? This is not how circular they are but how smooth the edges are. Use one of the following terms to describe their roundness:
  Well rounded, Rounded, Sub-rounded, Sub-angular, Angular, Very Angular
- What type of clasts are there? What is the most common?
- What is surrounding the clasts? Is it a mineral (known as cement) or finer sediment (known as matrix)?

The rock is mostly white with some slightly pinker bits. The majority of clasts are between 0.5-3cm. The clasts are mainly rounded to sub-rounded and over 95% of the clasts are quartz.
The clasts are surrounded by a white mineral very similar to the clasts themselves; this is a quartz cement.

Conglomerate

slickensides

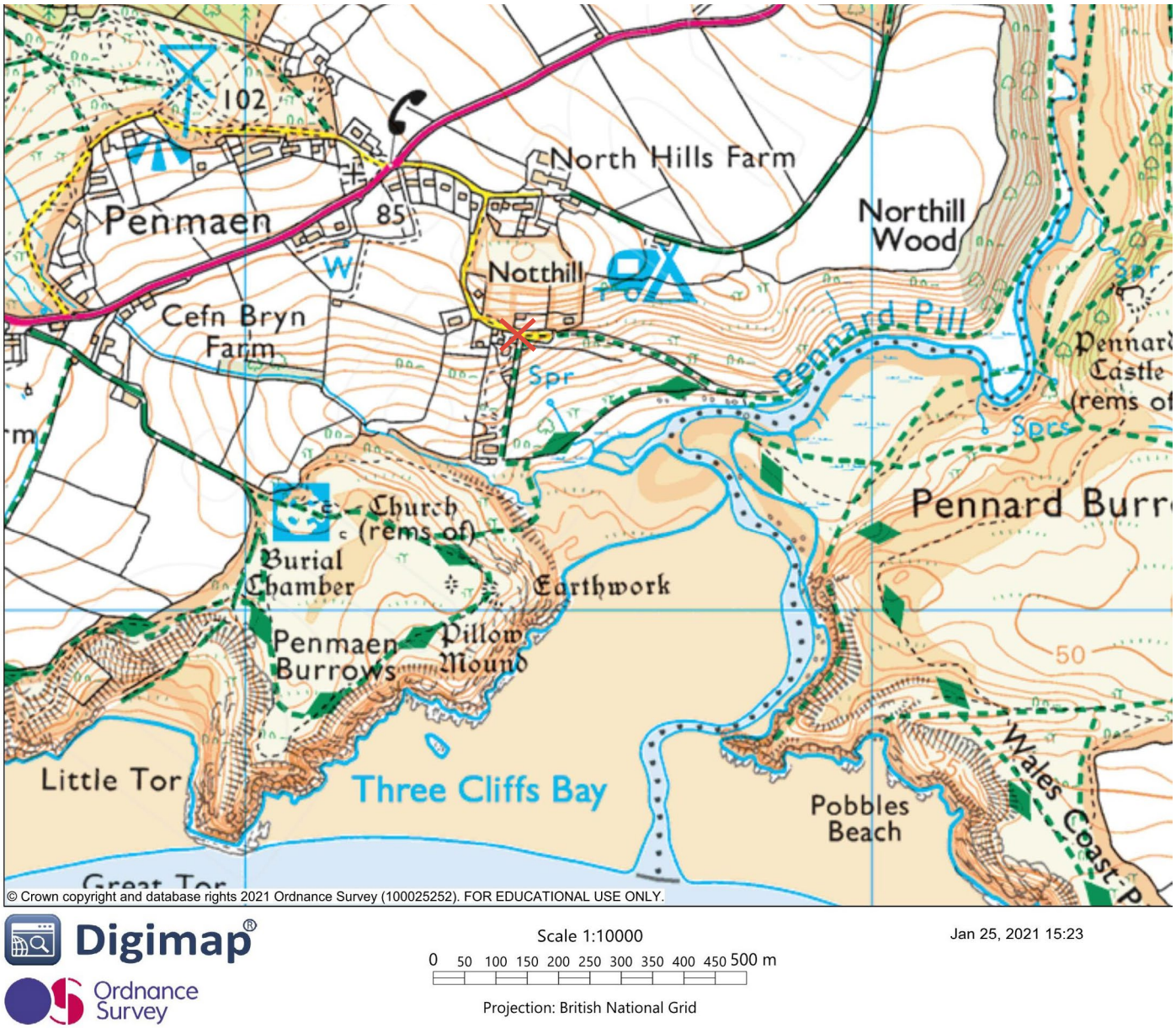
Activity

Slickensides

Run your fingers along the slickensides, which direction does it feel smoothest?
This is the direction the rocks were moving against each other.

Stop 2: Overlooking the bay

Q1. As a geologist it is important that you can always find your exact location on a map. This is so when you find a new rock type or contact between different types of rock you can mark the information on a map. This is how geological maps are made. Use the OS map below to locate yourself on the map.



OS map of Three Cliffs Bay downloaded from Digimap

Stop 3: Limestone and fossils

Identify the fossils using the identification sheet

Q1. How many different types of fossils can you find?
Draw the different species of fossil in the space below
and identify them using the photos provided on the identification page.

Remember the fossils are 3D and could be cut in any direction, meaning one species of fossil could create many different shapes on a 2D rock surface.

Remember to add a scale and label your sketch

Activity

Storm beds

Identify as many storm (fossil) beds as you can. How far apart are they? This tells you how regular the storms were.

Storm bed in the laminated limestone at stop 3

Field Notes and Sketches

Stop 4: Folds and faults

Activity

Mountain building

From which directions would pressure have been applied to create the fold here? Hint: try pushing two sides of a piece of paper to see how it folds, your hands are applying a compressional force as would have happened during the mountain building event that formed this fold.

Fold at stop 4

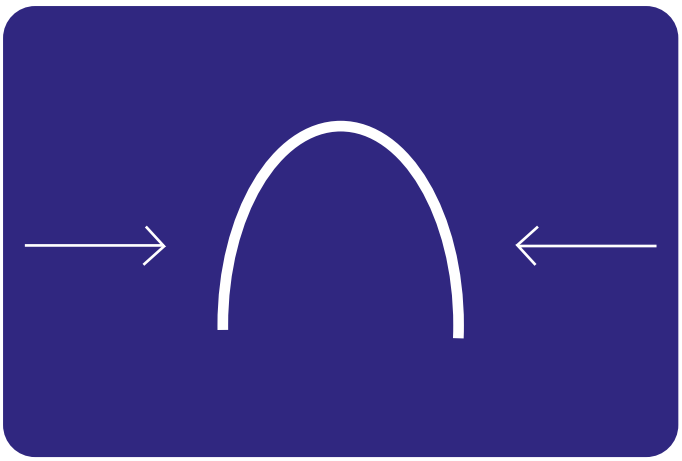


Diagram showing compressional stress needed to create a fold

Field Notes and Sketches

Stop 5: Caswell Bay Mudstone

Q1. Locate yourself on the map below. From your current location draw a straight line on the map in a NW-SE direction as far as the stream in the middle of the bay. This line represents the strike of the Caswell Bay Mudstone. Now look across the bay in the direction of strike, where would you expect the Caswell Bay Mudstone to be found?

OS map of Three Cliffs Bay downloaded from Digimap

Use a pencil; you may need to rub parts of your line out at the next stop

Stop 6: Fault in the bay

Answer the following questions using the map from stop 5:

Q1. The strike of the Caswell Bay Mudstone here is very similar to that found at stop 5. Draw a line at this location towards the centre of the bay in the correct orientation to represent the strike of the Caswell Bay Mudstone on this side of the bay. Notice your two lines don't join. This is because the rocks have been displaced by the fault through the centre of the bay.

Q2. Draw the fault on the map. This will be a straight line through the centre of the bay. Think carefully about the most likely orientation of the fault. Add arrows either side of the line to indicate the direction of movement along the fault.

Q3. You can now extend the lines which represent the strike of the Caswell Bay Mudstone as far as the fault line. They do not cross the fault because the fault cuts through the rocks (This is where you may need to rub out some of the line you drew earlier).

Aerial view of Three Cliffs Bay

Stop 7: Glacial deposits

Q1. Describe the glacial head using the same check list as used to describe the conglomerate at stop 1.

The rock is made up of grey clasts surrounded by a finer orange/brown matrix. The clasts range in size from 1cm-50cm, with an average of around 10cm. The clasts are very angular. Over 95% of the clasts are carboniferous limestone although there are a few white/yellowish clasts of calcite. The clasts are surrounded by an orange/brown sandy matrix. This rock would be described as a breccia.

Glacial head

Q2. Look at the dip of the bedding in the periglacial head, notice it is not horizontal. However, the deposit has not been deformed. How could this sediment have been deposited with bedding at an angle? Hint: The shape of the landscape during the deposition of this unit would have been similar to what it looks like today.

The sediment was deposited on a slope. When angular material like this moves down slope, it has very high internal fiction meaning it will often stop moving before the sediment reaches horizontal.

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Find the worksheet at www.s4science.co.uk/geotrails/geologytrails/threecliffsbay

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