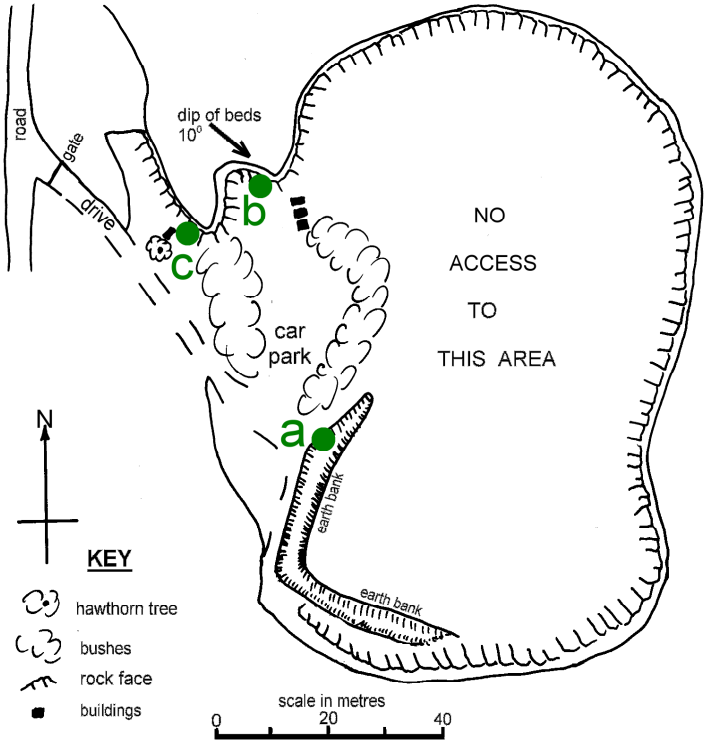
PUPIL WORKSHEET 1 Pupil Name.....

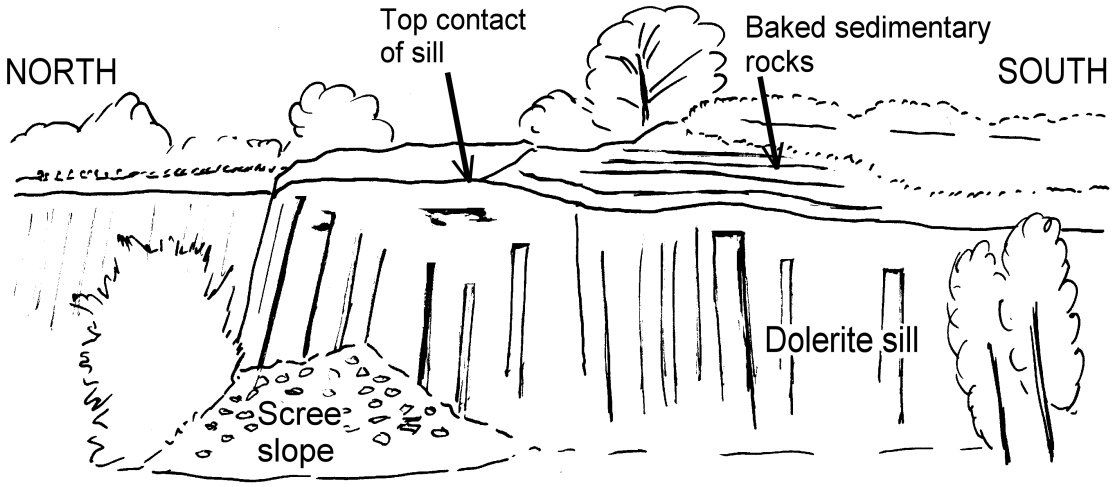
Site 1 Snableazes Quarry.



1) Mark on your position as site "**a**" on the map to the left.

2) As you come to sites **"b" and "c",** mark those on the map as well.

Site 1a: Snableazes Quarry, East Face.



3. Draw in the **bedding** and **joints** on the sketch above.

4. Mark and label the following features on the sketch of the quarry above:

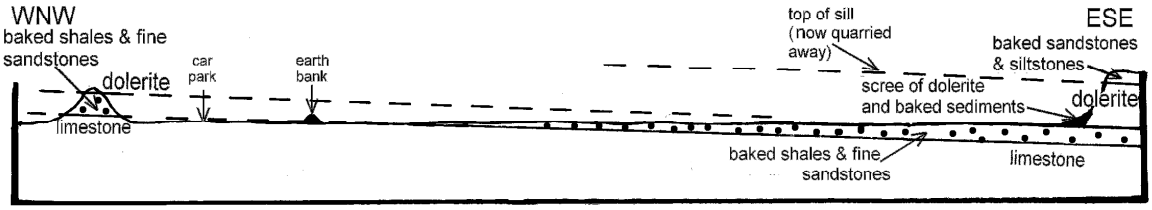
a) North & South;
b) Dolerite sill;
c) Top contact of sill;
d) Baked sedimentary rocks;
e) Scree slope.

PUPIL WORKSHEET 2 Pupil Name.....

Snableazes Quarry In Section.

1. At Site 1b measure the dip of the beds.
The dip of the limestone is _10° to 15°_____ towards __130° North__.

2. Use the sketch section below to help you investigate the rocks at sites **(t)** to **(z)** as you move through the quarry. On the sketch section below draw in where you think the top of the sill might have been before it was quarried away.



Location	Description of rock	Type of Rock (I, M or S).
t	**Vertically jointed dolerite about 15 to 20 metres thick**	**Igneous**
u	**Angular lumps of rock weathered from rock face to form a scree**	**Sedimentary**
v & w	**Bedded grey limestone.**	**Sedimentary**
x & y	**Baked shales and siltstones.**	**Sedimentary rocks now metamorphosed.**
z	**About 1m of vertically jointed dolerite sill**	**Igneous**

3. The quarry was used by tarmac for road-stone till 1987. Which of the rocks in this quarry would have been useful as road-stone and why?

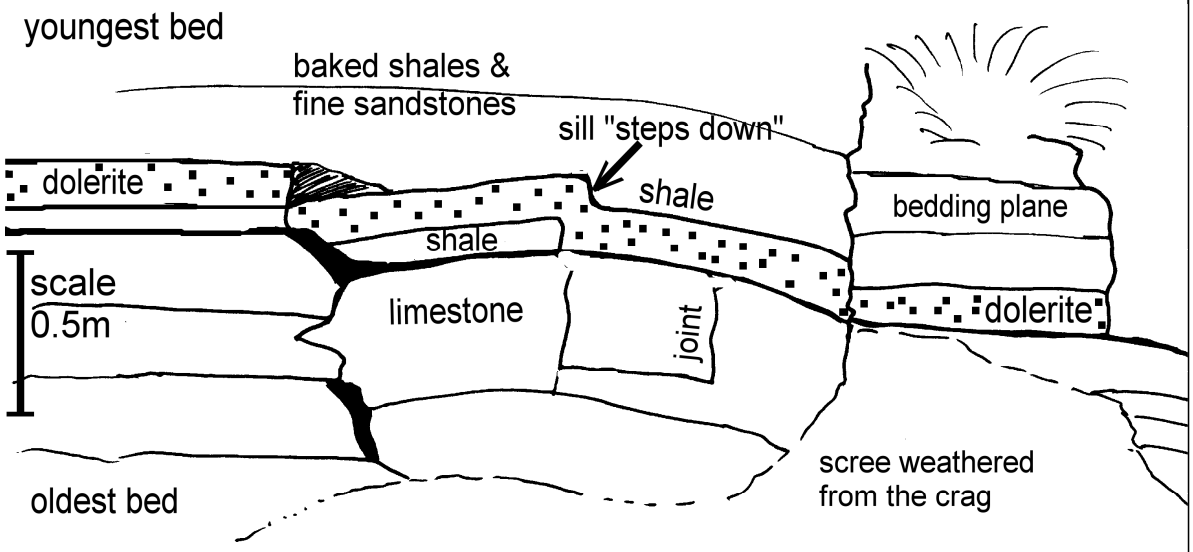
The dolerite, as it is physically and chemically more resistant than the other rocks because it is made up of resistant interlocking crystals and has low porosity, and therefore lower surface area for chemical weathering.

4. What geological reason might have caused quarrying to stop at this site?

The dip of the rocks causes the useless overburden to thicken to the east, making moving it more expensive – and quarrying less economic.

PUPIL WORKSHEET 3 Pupil Name.....

Site 1c: Snableazes Quarry, West Crag.



1. The top of the limestone and part of the sill have been drawn on the sketch. Draw in the dolerite from left to right of the exposure and label where it "steps down". Mark on the height of the scale bar on the left.

2. On the field sketch of the crag above draw and label the following features:

a. limestone; **b. baked shales and fine sandstones;**
c. a joint plane; **d. one or more bedding planes;**
e. oldest bed; **f. youngest bed;**
g. scree slope; **h. dolerite sill.**

3. What feature of the small sill is evidence that it must have been a liquid when it was formed?

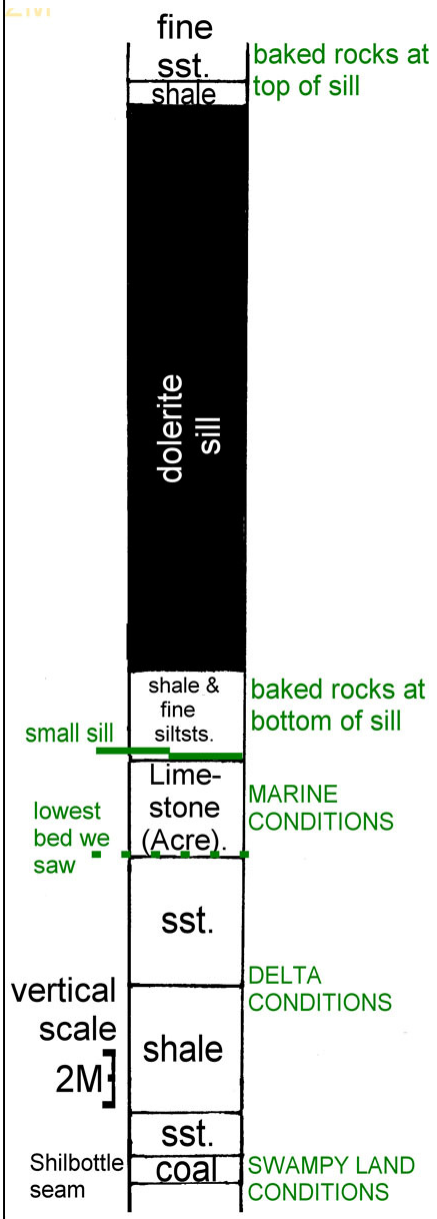
___ The sill "steps up / down" across a bedding plane in the shale. Since it can't be both older and younger than the shale it must have been intruded later and cut across the shale bed. _____

4. Number the following statements in the order in which they happened. Number the oldest event as 1 and youngest as 5.).

2 deposition of shales & fine sandstones in delta conditions
3 uplift weathering and erosion
1 deposition of limestone in marine conditions
4 intrusion of dolerite sill, baking the rocks top and bottom
5 quarrying for roadstone

PUPIL WORKSHEET 4 Pupil Name.....

Site 1: The Rock Succession At Snableazes Quarry.



The column to the left shows the rocks in the area with the oldest at the bottom (think of it as a sketch of a borehole down through the rocks).

2. Shade in the thickness of the column which is the large sill you have seen, and then label it.

3. Label the **baked rocks at the top of the sill.**

4. Label the **baked rocks at the base of the sill**.

5. Draw a horizontal line across the column to mark the **lowest** (oldest) **bed you have seen** in the quarry.

6. Mark on and label the **small sill** you have just seen.

7. Why can't you see the Shilbottle coal seam?

_____**it is underground**_____

8. Use the scale to estimate how far from the coal seam you are standing.

_____**about 10m above the seam**_____

The changing rock types tell us that the environment of deposition was changing from swampy land area, to delta to marine deposits.

9. Write 3 labels on the lower part of the column **below the sill** to mark where rocks show:

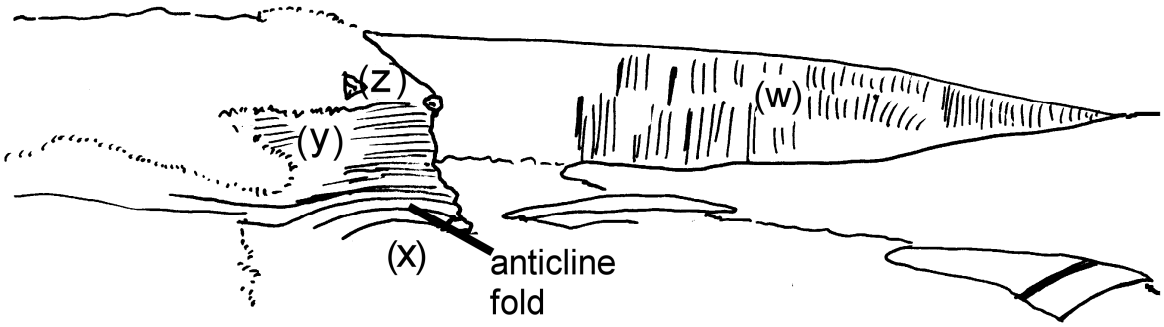
marine conditions;
delta conditions; and
swampy land conditions.

1. What must have happened to sea level during this time of deposition?

_____Sea level must have risen (change from land to sea)_____

PUPIL WORKSHEET 5 Pupil Name.....

Site 2a: View of Cullernose Point.

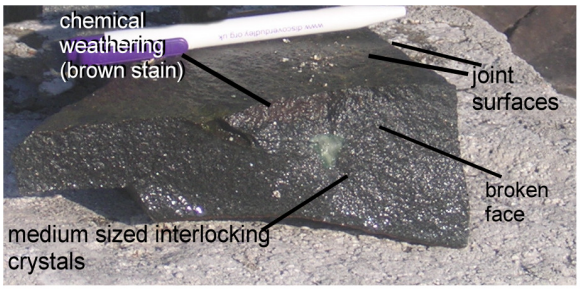


Complete the sketch by drawing in the eastern skyline and water line.	
Sketch in the joints in the igneous rock around point (w) on the sketch. Is this likely to be a dyke or a sill?	**It is a sill, as the joints are vertical and the cooling surfaces would near horizontal and roughly parallel to the bedding planes.**
Describe the material on the beach near point (x) and explain how it got there.	**Large boulders eroded from the cliff and well rounded by wave action.**
Draw in the bedding planes around point **(y)**. What kind of folds are these?	**Anticlinal (upfolds).**
What kind of stresses caused these folds?	**Compression from an east – west direction**
What do we call this kind of deformation ?	**Plastic deformation**
Describe the sediment around point **(z)** which covers the area inland. Is it older or younger than the rocks below? How do you know?	**Un-sorted deposit of clay and large boulders** **It is younger** **Principle of Superposition.**
How do you think this un-sorted and much younger deposit, was formed?	**Unsorted surface deposits of clay and boulders are likely to be glacial deposits from around 12,000 years ago, as the ice sheets melted.**

PUPIL WORKSHEET 6 Pupil Name.....

Site 2b: Cullernose Point. Dolerite & Columnar Joints.

Sketch the features of a broken piec of dolerite. Label the following: **medium grained crystals, black colour, interlocking texture, joint faces.**



Cullernose Point: vesicles.
Vesicles are small holes in the sill which can be filled with minerals. Find and sketch one.

Sketch of vesicles.

Explain how the vesicle was formed?

Gas bubbles which formed while the magma was liquid become "frozen" when it solidifies.

Regular cooling of a magma can produce evenly spaced and hexagonal. Investigate if this has happened at Cullernose Point or not.

Choose the top of a column and leave a pen on it to mark it. This is column "A".
Sketch column "A" and the columns next to it in the box to the right.

Count the number of edges for each column, and measure the distance from the **centre** of column "A" to the **centre** of each of the surrounding ones. Record your measurements in the table.
Summarise your results in the following sentence.

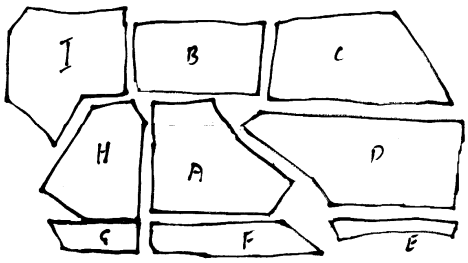
Most of the columns are **rectangular** in

shape. The closest spacing is **_72__**cm

and the largest spacing is **___120____** cm.

I think the cooling of this magma was **irregular** (circle your answer).

Sketch of joint blocks (EXAMPLE)



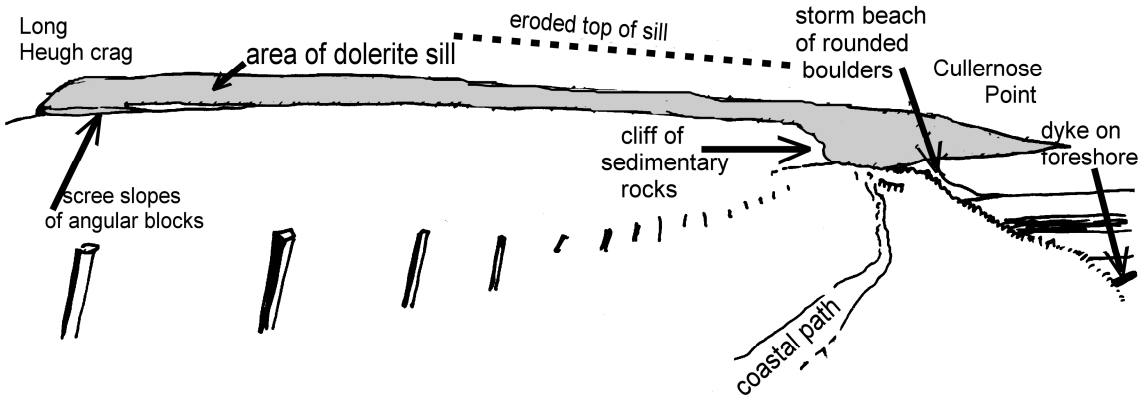
Block	Number of edges	Cm from centre of "A"
A	**5**	**-**
B	**4**	**80**
C	**4**	**94**
D	**4**	**80**
E	**4**	**113**
F	**5**	**80**
G	**4**	**86**
H	**6**	**72**
I	**7**	**120**

These figures are examples only

PUPIL WORKSHEET 7 Pupil Name.....

Site 2c: View Of Long Heugh Crag.

On the way back to the road, stop at **site 2c** and look back at the skyline to the north.



1. Complete the skyline and waterline of the sketch at the eastern end.

2. Draw in a dotted line above the skyline to indicate the eroded top of the sill, and label it.

3. Label the following features:

a) Cullernose Point;
b) sedimentary rocks;
c) dyke on foreshore (if visible above waves)
d) sill with vertical jointing;
e) rounded boulders on storm beach;
f) cliff of sedimentary rocks;
g) Long Heugh Crag;
h) screes of angular boulders;

4. Shade in the area of the sketch underlain by the sill and label it "dolerite sill".

5. Number these events in the order they occurred here, **numbering the oldest as 1.**

1. Deposition of sedimentary rocks

6. Deposition of boulders on the beach;

4. Glacial erosion and deposition;

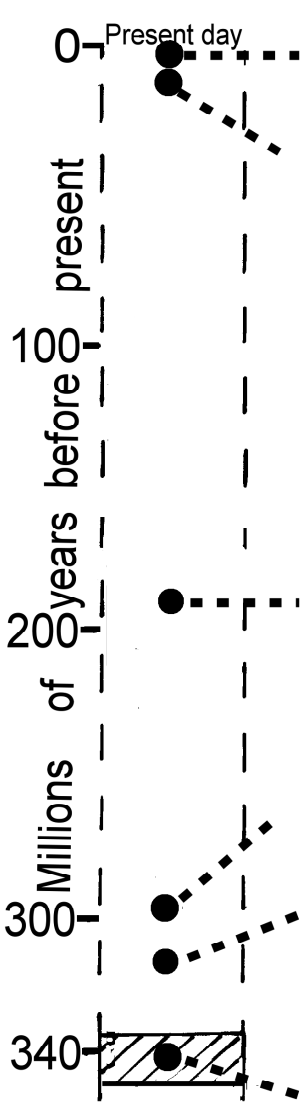
2. Intrusion of dolerite sill;

3. Uplift by Plate Tectonic forces;

5. Present day weathering & erosion

PUPIL WORKSHEET 8 Pupil Name.....

Summary Of Events.



C. Deposition of beach sands and boulders.

D. End of glaciation and beginning of weathering and marine erosion continuing to present day.

F. 340 million years of erosion leaving no rock evidence behind

B. Period of dolerite dyke and sill intrusion.

A. Period of faulting

E. Deposition of delta deposits with plant growth and burrowing animals

Write each of the following statements (or its letter) in the correct box on the geological event column above.

A. Period of faulting
B. Period of dolerite dyke and sill intrusion
C. Deposition of beach sands and boulders.
D. End of glaciation and beginning of weathering and marine erosion continuing to present day.
E. Deposition of delta deposits with plant growth and burrowing marine animals.
F. 340 million years of erosion leaving no rock evidence behind.

PUPIL WORKSHEET 9 Pupil Name.....

SUMMARISING THE ROCK CYCLES:
PUPIL HOMEWORKSHEET: The Two Rock Cycles at **Snableazes / Cullernose.**

FIRST CYCLE: deposition. What can you say about the deposition of the sedimentary beds in the quarry? HINTS: fossils, limestone, shales, oldest / youngest etc.

The oldest bed seen in the quarry is a limestone, about 3m thick. We did (did not) see fossils in it.

The younger sedimentary rock was a 6 metre thickness of shales and fine sandstones.

FIRST CYCLE: uplift and tilting. What can you say about the changes to the beds cause by plate tectonics? HINTS: tilting, intrusions, metamorphism etc.

The beds have been tilted about 10 degrees to the SE (130° north).

They have been intruded by a sill of magma (dolerite) which is about 15 to 20 metres thick. The sill was intruded in at least two layers, with the lower one stepping across a bedding plane proving that it was an intrusion coming after the sedimentary rocks, not a lava flow.

The heat from the sill has baked the muds and fine sandstones into a metamorphic rock. In places the limestone has been baked to a re-crystallised marble by the heat.

SECOND CYCLE: weathering and erosion. What evidence of **present day** weathering and erosion have you seen on the foreshore at Cullernose Point?

We saw the cliffs where the joints of the rock allow the rainwater to chemically weather the iron in it to brown. There was also vegetation (and bird guano!) attacking the rocks. On the beach were large black boulders eroded from the cliff by the waves and rounded off.

SECOND CYCLE: sediment transport. In what ways have you seen sediments being transported on the foreshore?

Wave action (rounding the boulders and depositing them on the storm beach).

SECOND CYCLE: deposition. What kinds of **modern deposits** have you seen and what rock types might they form in future? HINT: Don't forget plant and animal evidence – and which parts might survive as fossils.

Large rounded black boulders and sand. When these are cemented together they will form sedimentary rocks. They may contain fossil shells if they are not destroyed by the waves and boulders.