HOMEWORK EXERCISE 1.

This is a description of what happens when the salts in real seawater are concentrated by evaporation. Read the description and then write out the list of the minerals in the order you would expect them to be deposited. Do this with the first one at the bottom of the list. (That's where we find the oldest layers of rock. The youngest are on top)

1) **Calcite** (calcium carbonate) is precipitated first;
2) **Dolomite** (Calcium and magnesium carbonate) is next;
3) **Gypsum** ($CaSo_4.2H_2O$) or **anhydrite**($CaSo_4$) depending on temperature;
4) after the original water had been reduced to about 10% of the original volume, **Halite** (NaCl) is precipitated;
5) last of all, when the water has been reduced to the equivalent of 1.5% of the original volume the rare potassium chlorides, like **Sylvite** (KCl), and potassium and magnesium sulphates, like **Polyhalite**, would be formed.

Over geological time, such intense evaporation of seawater has been extremely rare.

Your list shows the order we would expect if the salinity of the seawater was continuously **increasing.** If at any time the salinity began to **decrease**, then the order of the layers will be expected to reverse.

List of minerals, oldest at the bottom.
(Youngest layer)

5

4

3

2

1

(Oldest layer)

The rocks deposited in Yorkshire about 255 million years ago formed in a sea known as the Zechstein Sea. These rocks seem to have been formed by evaporation of seawater, leaving behind some very valuable minerals, found today deep underground. Figure 1 below is a section through the rocks as if you could see them in a column. Study the section and then answer the questions.

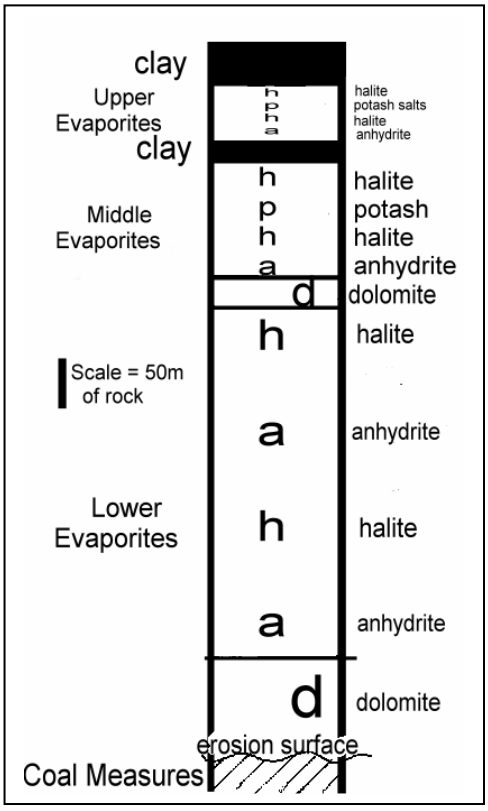

Figure 1 Geological Column

QUESTIONS:

1) Approximately what percentage of the thickness of these rocks (above the erosion surface) is made up of evaporites?
_____%

2) Shade in the parts of the column that might have been formed when the seawater was getting **more saline**. Leave blank the other parts, deposited when the seawater was getting **less saline**.

3) Can you explain why these evaporites were not re-dissolved when the sea flooded back into the area after these beds were deposited?

HOMEWORK EXERCISE 2.

Figure 2 shows the present coast of Yorkshire and the western coast of the Zechstein Sea as it was 225 million years ago. Also marked are the western edges of the areas where thick halite (NaCl) and potash (KCl) deposits are found today buried underground by younger rocks. Study the map and answer the questions below.

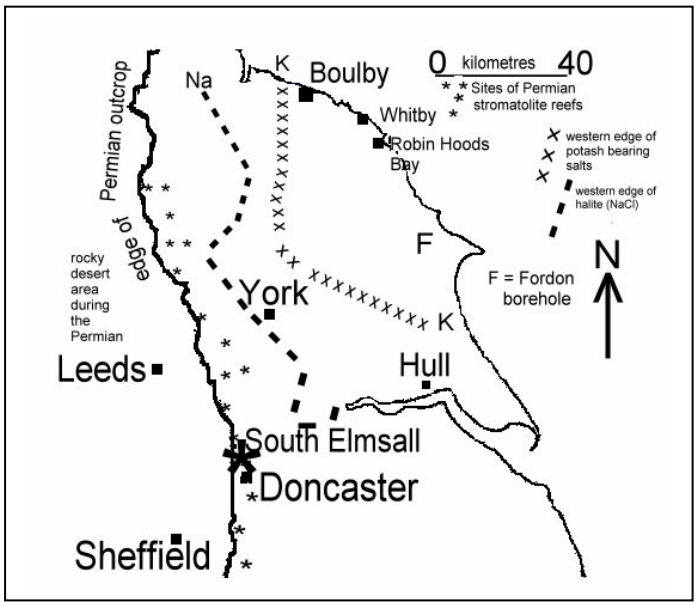

Figure 2 Map of the Zechstein Deposits in Yorkshire

1) In which direction was the centre of the Zechstein Sea in relation to Whitby?

2) Why were no evaporite salts deposited to the west of Sheffield and Leeds?

3) In which parts of the ancient Zechstein Sea did the stromatolite reefs survive?

4) Would the seawater have been deep or shallow when the potash salts were deposited? Explain your answer.

5) Why do you think very few fossils are found in evaporite rocks?

FOLLOW UP WORK

From your work at South Elmsall Quarry place the list of events below into a time sequence in the table, oldest at the bottom and building up to the youngest at the top.

Use the letter to indicate the event in the left hand column. Put the first (oldest) even next to number 1, and the last (youngest) next to number 8.

Your explanations should be based on the Earth Science principles of **Superposition** (younger beds lie on top of older beds) and **Cross Cutting Relationships** (features which cut across other features are younger) where appropriate.

A conservation of the site as an SSSI
B infilling of the quarry
C faulting uplift and tilting to the east by plate tectonic forces
D weathering and erosion revealing the dolomitic limestone at the surface
E quarrying of the rock for refractory furnace linings
F growth of bryozoan and stromatolite reefs in the shallow water
G deposition in a shallow tropical sea of dolomitic limestone in beds
H burial due to evaporite rocks being deposited on top

YOUNGEST EVENT AT THE TOP	WHICH EARTH SCIENCE PRINCIPLE DID YOU USE TO WORK OUT WHERE THIS STATEMENT GOES IN THE SEQUENCE?
8	
7	
6	
5	
4	
3	
2	
1	
OLDEST EVENT AT THE BOTTOM	