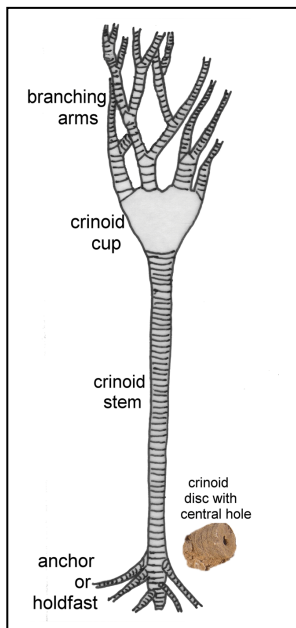


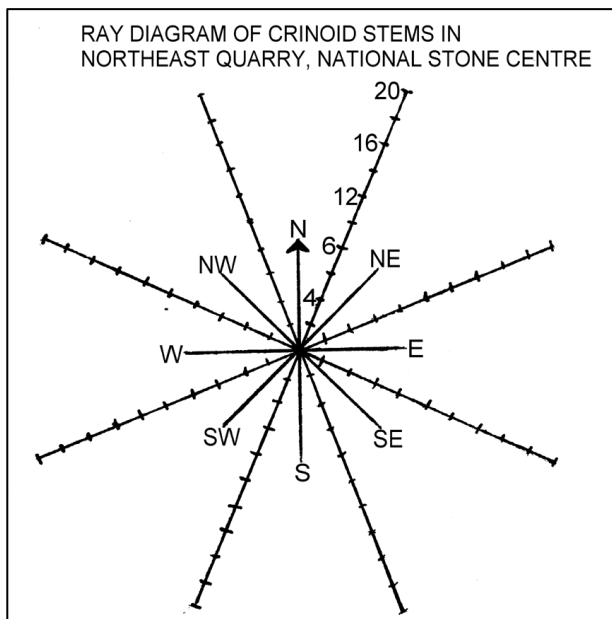
PUPIL PREPARATION WORK.



The rocks at the site you will be visiting contain evidence from a time 340 million years ago. It is called the Carboniferous Period. In the rocks there are fossils called crinoids. They look like plants, but are in fact animals which have a skeleton made up of many discs of calcite with holes, rather like polo mints. They lived in a sea that is no longer there. After death these calcite skeletons were broken up by wave action into pieces, usually pieces of stem. They are now lying in the rocks where they were deposited by the waves and currents. The orientation, or heading as measured by a compass, of these stems might be useful evidence to tell us something about the wave directions in these Carboniferous seas. Below is the data as measured from the site you will be visiting.

Plot this data on the radial graph below (its like a bar graph, except it radiates from the centre of a compass rose). Since the crinoid's two ends point in two opposite directions, the data repeats itself. If the Excel "Radar Chart" option is available it may be used as an optional method of plotting the graph.

Direction	N to NE	NE to E	E to SE	SE to S	S to SW	SW to W	W to NW	NW to N
Number of stems (Frequency)	19	11	7	6	19	11	7	6



1. What conclusions about wave directions can you draw from your graph?

2. What other data might help you be more certain of your conclusions?

3. Design an experiment you could do in a laboratory to model show how short lengths of "crinoids" align themselves in shallow water waves. How will you model the waves?

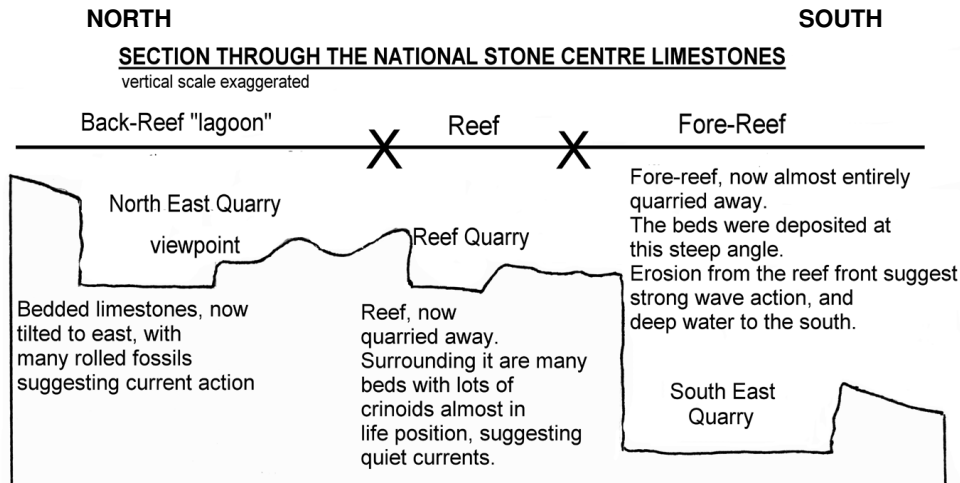
What will you use as "crinoids"?
 What will you observe or measure?
 Are the "crinoids" parallel, or across the wave direction?.

FOLLOW-UP WORK. Interpreting the Evidence from the Limestones.

1. CONDITIONS OF DEPOSITION:

Use the section below to help you label and summarise your evidence from the National Stone Centre. Then, using all of the evidence from your visit, describe the conditions at the time these Carboniferous beds of limestone were deposited. You should refer to:

- 1) Named fossils, where they lived and what happened to them after they died.
- 2) The probable temperature, depth and clarity of the sea water
- 3) "Reefs", fore-reefs and back-reef "lagoons" and how they can be told apart.
- 4) Wave directions and strengths (strong or weak, as far as you can)
- 5) How the reef animals might have died.



	North East Quarry	Reef Quarry	South East Quarry
Bedding & dip amount & direction			
Fossils (In Life position? Y/N)			
Probable water depth (shallow / deep)			
Probable wave strength & direction			
Fore-reef / Reef / or Back-reef?			

2. SEQUENCE OF EVENTS

Place the lettered statements (A to G) below about the sequence of events at The National Stone Centre in a time sequence. Place the letter for the oldest event at number 1, building up to the youngest event at number 7 at the top.

Next to each statement write your reason for placing the statement at this point in the time sequence. Your explanations should be based on the

Earth Science principles you used on the visit, where appropriate.

- A. Quarrying of limestone
- B. Restoration of the site followed by protection as an SSSI
- C. Warm clear shallow sea with reefs, crinoids, brachiopods and corals
- D. Burial of the animals and decay of the soft parts (muscles and connective tissue)
- E. Cementation of the sediment into limestone rock
- F. Uplift of the limestone and tilting by tectonic forces
- G. Weathering and soil formation

TIME SEQUENCE OF EVENTS AT THE NATIONAL STONE CENTRE

Youngest event	Reason for placing it here in the sequence
7	
6	
5	
4	
3	
2	
1	
Oldest event	