

NATIONAL STONE CENTRE: KS4 EXERCISES AT THE FIRST TWO LOCATIONS (1)

Introduction

Small Groups of pupils will need: a) a clipboard with relevant worksheets and maps;

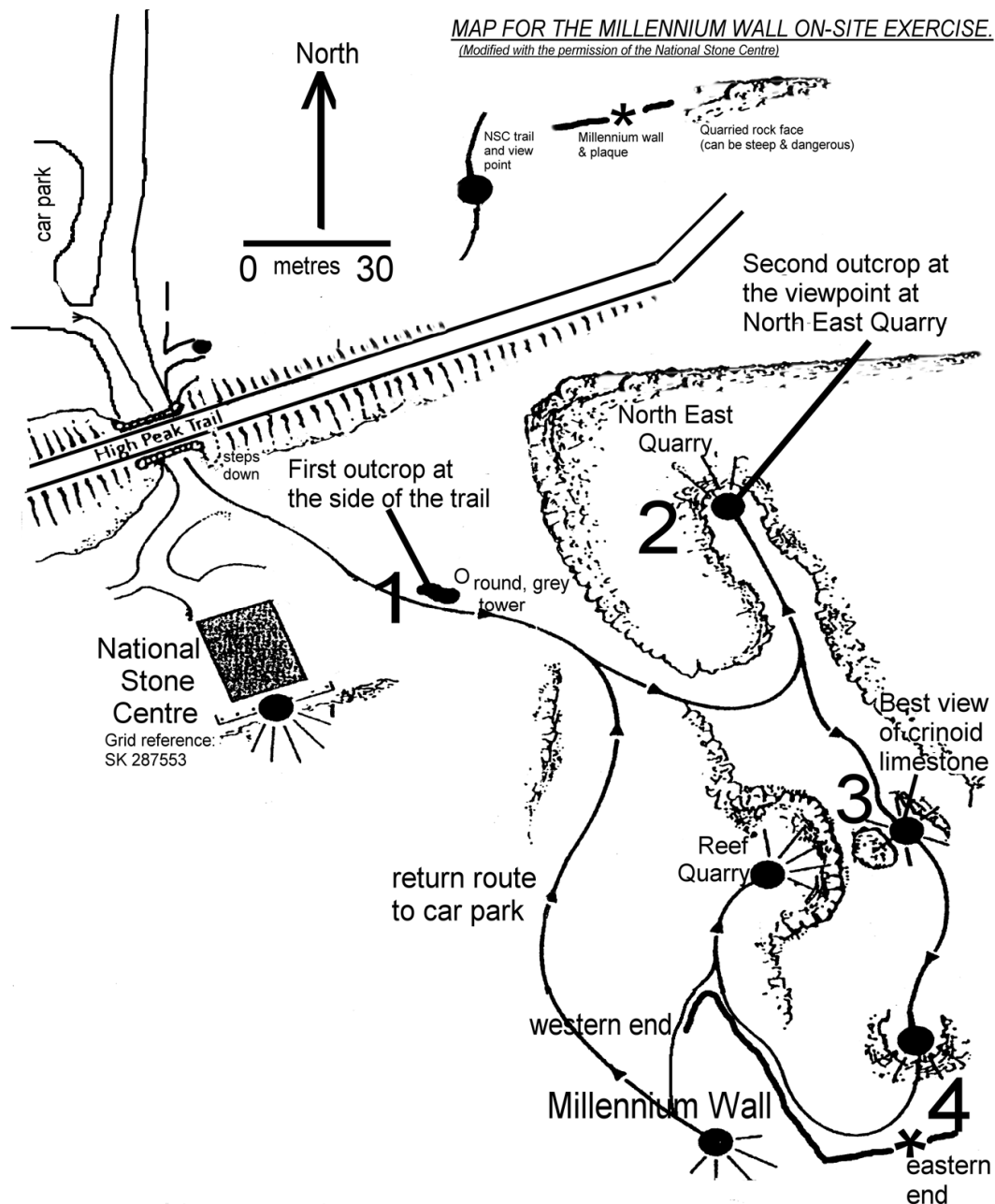
b) a measuring tape, compass & clinometer

Group leaders should have a plastic bottle of dilute HCl

Go through the simplified section of a reef with the pupils. Explain that they are looking for evidence that similar conditions might have existed here 340 million years ago.

The first and second exposures allow an investigation of the rocks formed in the back-reef area, and the processes that have affected the rocks since their deposition (cementation, uplift, weathering, erosion and quarrying). The third exposure is of the reef itself, and the final viewpoint shows the fore-reef deposits. See **Figure 1**.

Figure 1. Map of the National Stone Centre Outcrops



NATIONAL STONE CENTRE: KS4 EXERCISES AT THE FIRST TWO LOCATIONS (2)

1. Conducting The Fieldwork At The First Exposure. (About 30 minutes)

Bring the group to the first outcrop that is below the round pointed tower, and just east of the Stone Centre. (See Figure 1). Remind pupils of the idealised model of a reef they are investigating and ask them to inspect the exposure.

There should be no hammering or collecting from this protected site



“What observations can you make about the rock at this exposure?”

[It is layered, contains fossils: (brachiopod) shellfish, a coral, and crinoids (See Figures 1 & 2. below for assistance); it fizzes with dilute HCl]



More information on the fossils can be found in **NSC8 Info fossils**

“What kind of rock is this. Is it igneous sedimentary or metamorphic?”

[It is a sedimentary limestone, (of Carboniferous age, dated by the fossils it contains). It also fizzes in dilute HCl]

“What do the fossils contained in the rock tell us about its origin?”

[The shellfish (brachiopods) corals, and crinoids, are shallow marine organisms. The rock was formed in a shallow sea]

“How did these once-living animals become part of a rock?”

[Died, washed around by currents leaving coral & crinoids lying on their side, until buried. All soft parts decay away leaving only the calcite skeleton]

“How can we explain why this rock is no longer beneath sea level?”

[There must have been uplift and tilting of the crust. This rock is currently about 200m above sea level.]

NATIONAL STONE CENTRE: KS4 EXERCISES AT THE FIRST TWO LOCATIONS (3)

“Measure the dip of the bedding and mark it on your map”	[Around 10-15 degrees to the North East. See Figure 1.]
“How might this distort the evidence we are using to interpret this reef?”	[The evidence is no longer in the original horizontal. It has been tilted by earth movements]
“Which of the 3 parts of our “reef” might this outcrop represent?”	[Not the reef itself because the fossils are lying on their side (moved by currents) and there is bedding present; not the fore-reef because the deposit is not steeply dipping. So it is back-reef, but tilted 15 degrees to the NE by earth movements since deposition.]

2. Conducting The Fieldwork At North East Quarry. (About 20 minutes)

👤 Walk up to the viewpoint **at North East Quarry** (see map) to view these limestone rocks. Remind pupils that the site is the one they plotted the crinoid orientation data for their preparation. Questions here might focus on observing evidence for the cycle of deposition, uplift, weathering and erosion. It is advised that you **do not** cross the fence and approach the quarry face.

“These rocks are all limestones. Which is the oldest bed in this quarry?”	[The lowest layer visible. The other beds are progressively younger to the top. Here, the quarry floor is the top of the oldest rock layer, and is the sea floor surface from which the crinoid measurements used in the preparation work, were taken.]
“These layers of rocks were all deposited horizontally, under the effect of gravity in a shallow sea. What has happened to them since?”	[Uplift to about 200m above sea level, and slight tilting to the east.]
“Which way would you walk to move onto younger rocks?”	[Uphill, as older beds of rock are deposited first, with younger rocks on top. (The exception to this principle is in areas where the beds are inverted)]
“In which of the 3 parts of the reef do you think these beds were deposited?”	[Not the reef because the fossils are lying on their side and there is bedding; not the fore-reef because the deposit is not steeply dipping. So it is back-reef, but tilted 10 - 15 degrees to the NE by earth movements since deposition.]
“Can you remember from your crinoid ray diagram preparation work which direction you think the waves were coming from in the Carboniferous seas?”	[Either from SE or NW. Main wave train, and deeper water probably from the right and behind (SE)]