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INTRODUCTION

☛ Field groups will need measuring tapes, compasses, clinometers, hand lenses and grain size comparator cards, as well as clipboards, a short ruler and copies of the relevant field sheets for individual pupils. (See **DRY8 worksheets**).
Group Leaders will need, in addition, a plastic bottle of dilute HCl, a small plastic bottle of water, a flexible sheet of foam rubber, or similar material, to demonstrate the shape of folds.

☛ From the car park take the group across the grass towards Site 1, concealed in the trees to the right (a compass heading of 105 degrees North from the car park). (See **Figure 1**) Site 1 is on the left, and site 2 is on the right. Each can accommodate parties up to 15. Larger parties can be split between the two sites and alternate these exercises. In both sites the ground underfoot is uneven, and can be overgrown.

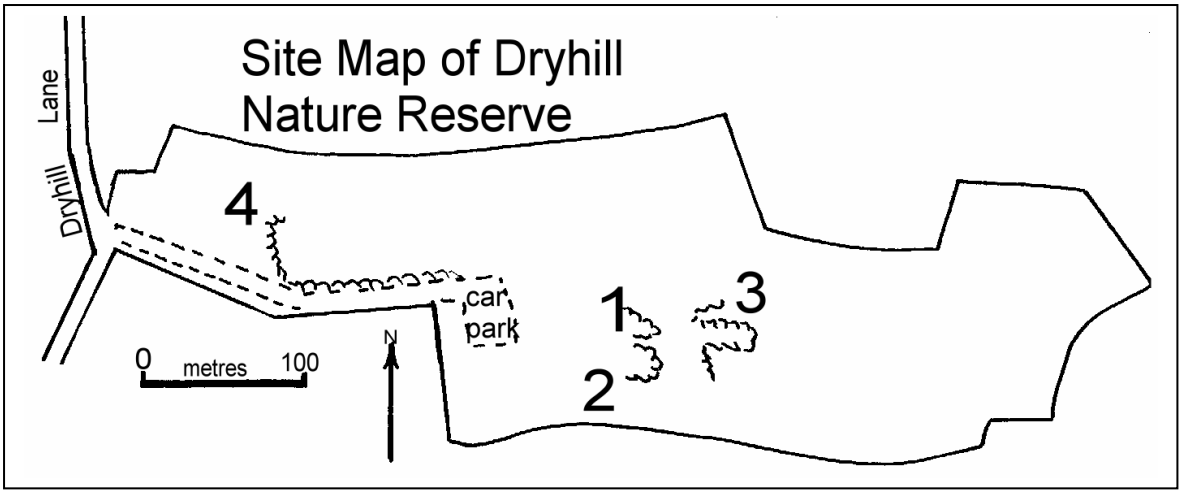

Figure 1 Site Map Of Dryhill Nature Reserve

Bring the group together and remind them they are here to collect, record and interpret evidence, and use the information to make predictions. The opening questions are to focus on the key objectives of the exercise:

1) To identify the rocks and describe the exposure.
2) To measure the thickness of part of the succession.
3) To describe the dips of the rocks and make predictions about their folded nature.
4) To measure the dips of the beds and plot them on the map.

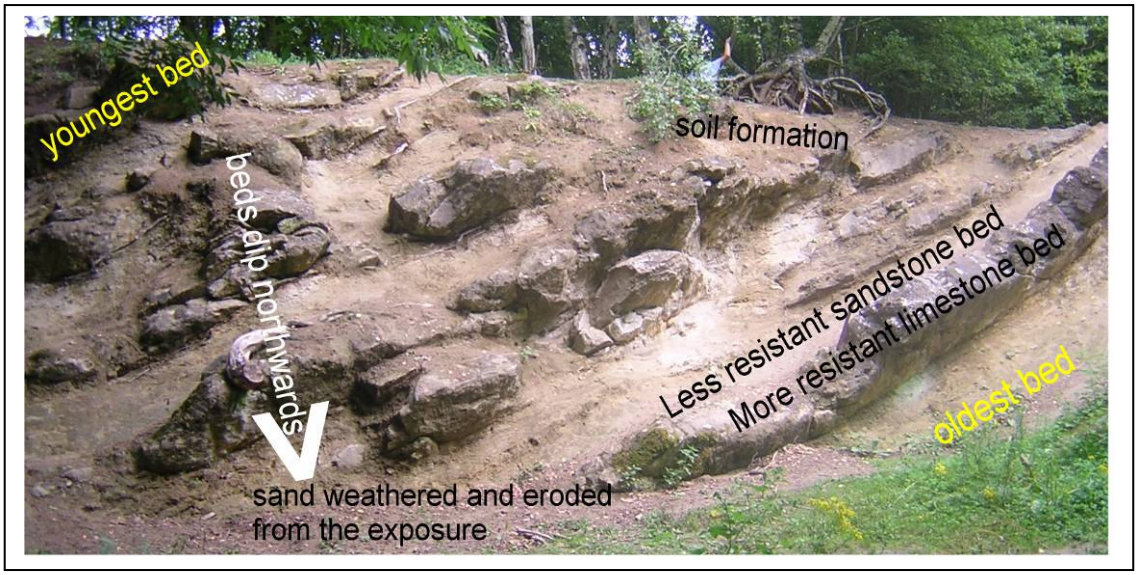

Figure 2 Dryhill, Site 1

Possible questions	Possible acceptable responses
What evidence can you see that suggest that these rocks have been weathered (i.e chemically or physically broken down)?	More resistant beds "stick out" whilst less resistant beds have been "worn away" into grooves. Lumps of rock at the base of the face have been weathered (Physical weathering produces "lumps") from it and fallen down (eroded). The roots of vegetation are growing into the rock. The soil at the foot and top of the exposure have been formed from the rock by weathering. (The soil is thin because the soil has only been forming since the end of quarrying in the 1960s).
Look at the exposure and suggest if it looks like a sedimentary or igneous outcrop.	Sedimentary, because: The rocks are in layers. There seem to be two different kinds of layers. There is also a lot of loose sand, suggesting grains are being weathered from a cementing material.
When you inspect these rocks more closely what kind of evidence would you look for to confirm they are sedimentary? [NOTE: The sandstones have calcite cement and they too react with HCl]	Any observation that confirms an origin at the earth's surface: e.g. fossils; grains cemented together (or being weathered apart); bedding planes, or cross bedding; porosity, (indicated by water drops soaking into the rock); presence of calcite indicated by effervescing in dilute HCl, confirming limestone (but not marble, in the presence of the other features).
If they are sedimentary rocks, then which is the oldest bed, and which is the youngest?	The oldest are always underneath, and the beds get progressively younger towards the top layer. Here the oldest is to the south (right) and youngest to the north (left). (Principle of Superposition).
If they are sedimentary rocks would they have been laid down at this angle?	No, they would have been laid down horizontally. (Principle of Original Horizontality)
The angle of these beds is evidence of the Earth forces that moved them from their original horizontal position. Can you measure (or estimate) the direction and angle of dip?	The beds are dipping almost northwards (in fact 014 degrees east of north). The precise amounts vary depending on exactly where the beds are measured. Here they are between 40 and 50 degrees from the horizontal.
From the preparatory work you did on folded rocks in which direction would you predict lies a syncline, and which way the anticline.	In simply folded rocks the dip is towards a syncline and way from the anticline. So the prediction is that the syncline is to the north, and the anticline is to the south (i.e at Site 2)

Remind pupils that they have made two predictions: that, if folded, the syncline is to the north (left) and the anticline is to the south (right).

The first worksheet asks them to focus on the first part of the exercise here at **Site 1,** investigating the rock type, and the sequence of layers. The pupils can easily be supervised as they complete it.

Field Exercises at Site 2

☛ As the group walks the short distance to the south, into the quarry at **Site 2,** remind them of their prediction, that the rocks should be folded into an anticline in this direction.

[If the group are completing Site 1 and 2 in reverse order, then the focus should be on the sketching and description of the rocks, as below, reverting to the prediction about "where the anticline should be" before they leave for **Site 1.**]

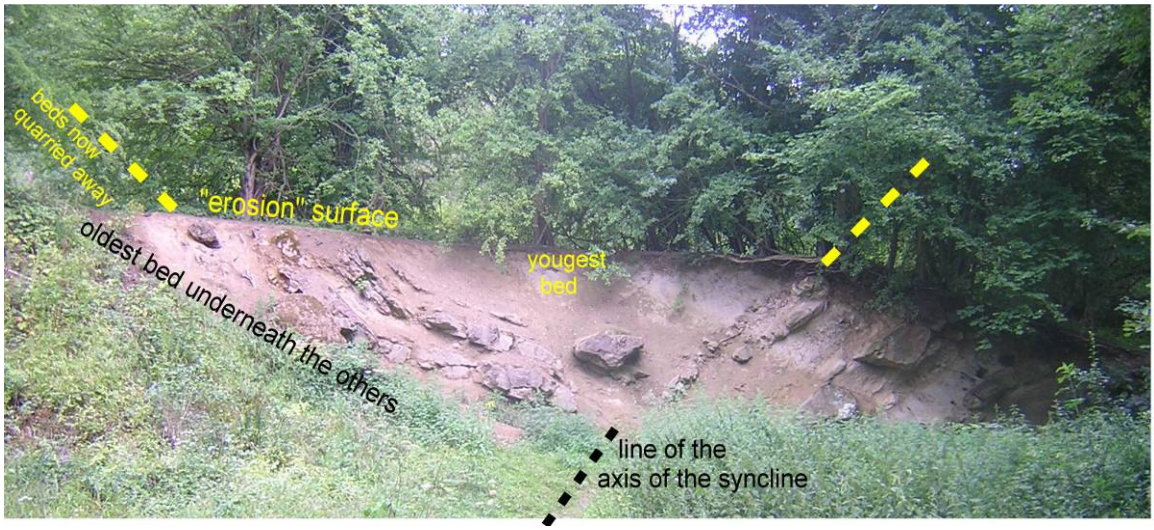

Figure 3 Site 2, Dryhill

Possible questions	Possible acceptable responses
Ask pupils to describe and name the fold they can see.	The beds are dipping towards the centre of the fold. It's a syncline.
Where is the anticline they predicted? [In the absence of a response, prompt the group to apply the rule about how the dips indicate where the anticline is.]	The anticline isn't missing, the group has just walked past it. The horizontal beds marking the axis are concealed beneath the vegetation by the footpath to the north (left), and may not be easily visible under summer growth.
In the syncline, which bed is the oldest one, and which is the youngest?	The youngest bed is on top (at the centre of the syncline) and the oldest bed is underneath, at the edges of the exposure
Did the folding happen before or after the beds of rock were formed?	The beds have been affected by the folding, and so must have been there first. (Principle of Cross-Cutting Relationships)
What kind of forces are believed to have been strong enough to do this to rocks?	Plate Tectonic forces. The folds in the Wealden area were caused at the same time as the Alpine folding by compressional forces from south to north, as a destructive plate margin across southern Europe and closed up the Tethys Ocean, forming the Alps. (See Fig 1 in document **DRY4 briefing**)
Use the sheet of foam rubber, or paper, to demonstrate simple folding if necessary, and ask what can be said about the pressures that moved these rocks from the horizontal?	The forces were compressional, (i.e. the rocks have been shortened) and came from north (left) and south (right). This means that the rocks have been shortened by compression in this direction.
Remind pupils that folds are three dimensional and ask them to stand somewhere on the quarry floor where they would expect the "bottom" of the fold to run below the soil. Draw their attention to the line of this fold already drawn on **Worksheet 1.**	Anywhere along a line running SW to NE through the face, in line with the axis of the fold. (See **Figure 3**). Then remind the group that the axis also runs in the opposite direction i.e. through the rock behind the face.
What is the evidence that this fold has been weathered and eroded?	The beds at the top of the face now end at a nearly flat "erosion" surface (which has in fact been quarried away) with a thin soil covering.

Pupils are then supervised as they complete worksheet 2.

Field Exercise at Site 3

☛ After completing the dip measuring exercises at **Sites 1 and 2**, and whilst still there, pupils are asked to draw in on their map where they predict the line of the anticline will run to the east. (The line of the syncline already drawn on the map is a rough guide). Then they are asked to go and look for it and see if they are right.

Positions d"", "e" and "f" on the map may be difficult to approach due to vegetation and slippery scree slopes of sand, but pupils can see the shape of the folds in the exposures from ground level. Notice that the beds in the long face at **Site 3** appear to be horizontal, but are in fact part of the fold. (See **Figure 5** in document **"DRY4 briefing")**

Field Exercise at Site 4

☛ Walk the group the 250 metres along the access road to the car park (beware of traffic!) to the west to reach the fenced exposure of outcrop 4. Do not draw special attention to the roadside exposures as the party passes.

Point out that scientific evidence is often fragmentary with pieces of the puzzle missing. This is especially so in Earth Science where much evidence is still buried, and much of the rest has been eroded away.

Here the group is set a challenge: working in small groups, to use their new skills of understanding folds and investigate if they think there is any evidence for a fold at site 4. If so, what kind of fold?

Point out they may not approach the faces, or cross fences. This is an exercise in observation and prediction.

Evidence is to be recorded on the worksheet and field sketch.

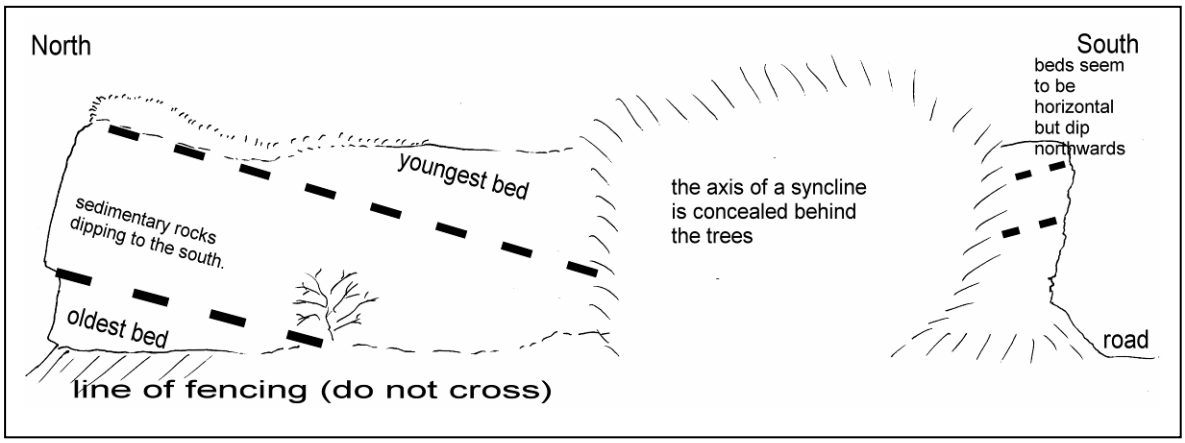

Figure 4 Sketch of The Fold at Site 4