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☛ **Group Leaders should be aware of the following points**

1. On the journey

On the journey to Dryhill pupils should be encouraged to look out for ways in which stone is being used in the environment. If this topic has not been part of the preparation for the visit, it should be covered in the follow-up.

2. Items to bring on the Visit

Appropriate clothing & footwear. Wellies are easy to clean. Enough copies of worksheets/notes etc:

Map and Site 1: pupil work sheet 1 – The Fenced Cliff.
Site 2: pupil worksheets 2-5 – A close look at Rag & Hassock.
Sites 2 & 3: pupil worksheet 6 – Field sketch of sloping rocks; Folded rocks at site 3.
Site 2: pupil worksheet 7 – Sloping Beds Summary, [**as an alternative to sheets 2-5**]

Plus: Notebook, sketchbook, camera, magnifiers, water dropper bottles, tape measure, compass and materials for any other fieldwork activities, including equipment for collecting small amounts of soil samples.
Teachers and adult helpers should each have a *plastic* dropper bottle with dilute acid for testing limestone. Domestic lime de-scaler may be used, and should be diluted to adequately react with limestone [try x 10 dilution] . Tissues should be kept handy.

3. On Arrival

The car park in the middle of the site is very small, and it is advisable for a coach to stop instead just inside the entrance to Dryhill, where there is room for it to turn round and park. The first locality can then be seen ahead, on the left.
There are currently no toilets on site, but check the garden centre next door. The toilets are near the entrance. They also have a range of rock types for sale as rockery stone. Some common types could be purchased beforehand. See "**Working with Rocks"**.
Remind the children of Health & Safety issues. Avoid dog poo on this public open-access site.

4. Using the pupil work sheets

The Earth Science teaching trail and pupil work sheets are very detailed, as there is a lot of information to be found in the rocks. In the notes for each locality there are teaching points related to key observations and interpretations on the formation of rocks, and soils, with additional reference to wildlife. The pupil activity sheets are linked to these observations/teaching points. **Teachers will need to decide which materials are appropriate for their pupils to use and adapt the sheets accordingly**.

There are plenty of opportunities to record information by taking photographs, sketching, mapping and note-taking to aid follow-up work. When soil samples are taken the location should be marked on the map. With younger or less-able children it may be useful if the adult helper acts as a "scribe", recording the agreed answers on a copy of the activity sheet. All should complete their own sheets as part of follow-up work, as an individual record of the work they did on the visit.

Key points to investigate

We are looking for three lines of evidence from these exposures of rock:
1 - to find out how the rocks were formed;
2 - to find out what happened to the rocks after they were formed;
3 - to find out what is happening to them today or in the recent past.

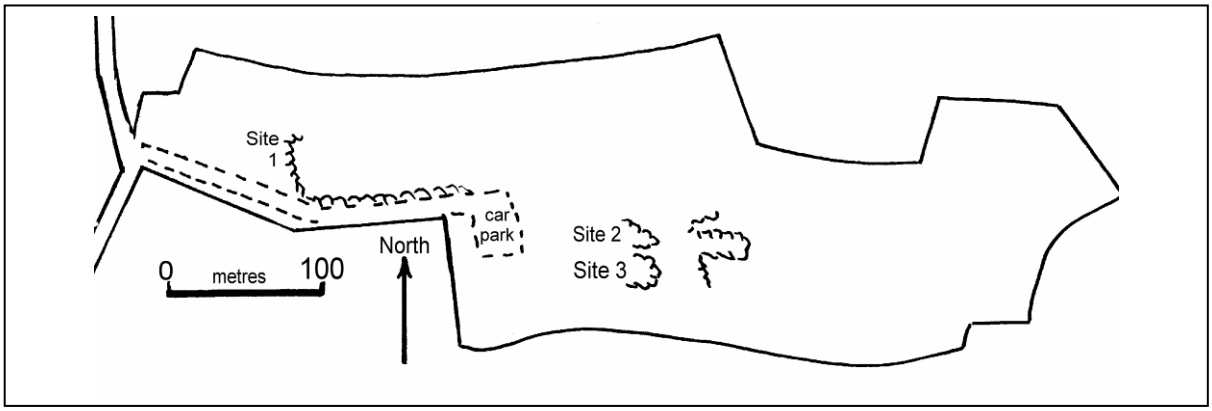

Figure1 Map of the Dryhill Sites

☛ Children should be able to use a compass and orientate their map at the first opportunity, likely beside the road just inside the entrance to the nature reserve. Bring the group to the fence at the north end of Site 1, the cliff of exposed rock, 100 metres east of the entrance. There is enough room for 30+ children to work and the scene can be set by making the following general observations, without the need to go beyond the fence. The reason for the fence is one of the teaching points.
Closer observations of the rocks and soil will be made later, at Site 2

Site 1. The Fenced Cliff

Figure 2 View of the Fenced Cliff

Observations/teaching points	Interpretation/comments
The rocks are layered in beds. The rocks appear to be made of sandy material.	The layering indicates that the original sediments were deposited in water and were made of sandy materials. Relate this to sedimentation experiment as part of your preparation – oldest on the bottom, youngest on the top. They are sedimentary rocks.
Some beds are harder than others, giving an irregular profile to the layering in the cliff.	The beds were made harder as a result of different type of sediment and material cementing the bits together. [Need a closer investigation – at a safer place]. The hard rocks are known as “rag”, separated by sandy rock called “hassock”.
The rocks are now 100 metres above sea level. Here the beds slope [dip] gently southwards [use a compass] and are broken by cracks called joints.	Long after they were laid down, [fossil shells in site 2 indicate that this was in the sea], the rocks were uplifted, tilted or folded and broken by great Earth movements over millions of years.
There is a thin soil on top, with trees growing there.	When rocks are weathered they break down to form soil. Samples taken at other localities can be investigated later.
At one time the ground was level with the soil at the top of the cliff face. Not any more!	No natural process, e.g. rivers, could have removed the rock and left a dry flat floor and near-vertical cliff face. This was once a quarry. We know from old photographs!

Between the base of the cliff face and the fence there is a slope which is made of broken rock debris, called scree.	Gravity is at work all the time. The broken rock material has fallen from the cliff face since quarrying ceased in 1960s. This will have been assisted by weathering processes, including freeze-thaw and plant roots. Relate this observation to **Working with Rocks** as part of your preparation.
The scree slope is being colonised by vegetation and soil is being formed.	Link to this observation to work on soils and plants.
The cliff and scree are fenced off for some reason.	The fence is here to keep people a safe distance from the danger of falling rocks and from climbing on the rock face.

NOTE: Site 1 is the northern part of a downfold [syncline], with most of the rest hidden by scree, soil and trees a few metres to the south.

TASK 1. Complete pupil worksheet 1. (See DRY8 Pupil worksheets)

☛Follow the fence south eastwards and join the road leading east towards the car park. On the left are exposures of the same rocks as those seen at site 1. Here the beds look as though they are horizontal, but they actually slope [dip] northwards into the rock face. The scree slope is steep and overgrown, making the face difficult to reach. Just look from the opposite side of the road, and keep an eye out for traffic.

The small holes
Notice the small holes in the rock face. Ask the children what they think they are. Some children may suggest that they are drill holes for blasting! As several beds are quite soft ["hassock"], they have been easily excavated by various creatures. Bees, wasps and small birds [e.g. sand martins] are possible candidates.

Pass the car park
Notice there are blocks of hard rock, known as "rag", around the edge of the car park. Here they are used to limit parking along the road and car park. A discussion on the use of rocks quarried from this site can be held later, after looking at them more closely at sites 2 and 3.

Head across the grass (slightly south of east) from the car park for about 80 metres towards the trees. (See **Figure 1**)
It might be useful to point out the wide variety of tree and other plant species, and the presence of the invasive Japanese knotweed. Evidence indicating the presence of moles and rabbits can also be seen, excavating samples of sandy soil, giving clues to the rock type present beneath.

Site 2 is on the left [north], with site 3 on the right [south], separated by a small ridge.
The activity sheets are based on Site 2, with an additional question based on a quick look at Site 3. As these are small quarries it is best to split a class of 30+ into two groups of 15+. An option would be to have wildlife-based activities available for use by the group not working at the rock exposures. However, if two teachers are available, it should be possible to use the Site 2 teaching materials for work at Site 3. The key difference between the sites is in the folded nature of the beds of rock: in site 2 they all slope [dip] to the north, while in site 3 they are clearly part of a downfold [syncline], with beds dipping both north and south, meeting in the middle! The group at site 2 will need to look at the fold in site 3, and the group at site 3 will need to look at site 2 to complete the sketch exercise. The south side of the face at site 3 has overhanging tree roots, best viewed at a distance! Before entering each quarry the children could be asked to predict what they might see, possibly even which direction the rocks might dip [slope].

Site 2. Sloping Beds.

☛ Here the beds dip [or slope] northwards and consist of two rock types: harder sandy limestone ["rag" or "Kentish ragstone] standing out from soft sandstone ["hassock"], less resistant to weathering and erosion.
[**In Site 3** the beds are folded to form a syncline (or downfold), with beds dipping both south and north meeting in the middle ! The anticline (or upfold) forms the bluff between the two quarries].
Folding in layers of rock can be demonstrated later, using strips of card and foam.

Tests on each rock type will need to be made, including using a water dropper for porosity and second dropper with dilute acid to check for lime content. A magnifier and 1mm graph paper can be used to help measure grain size.

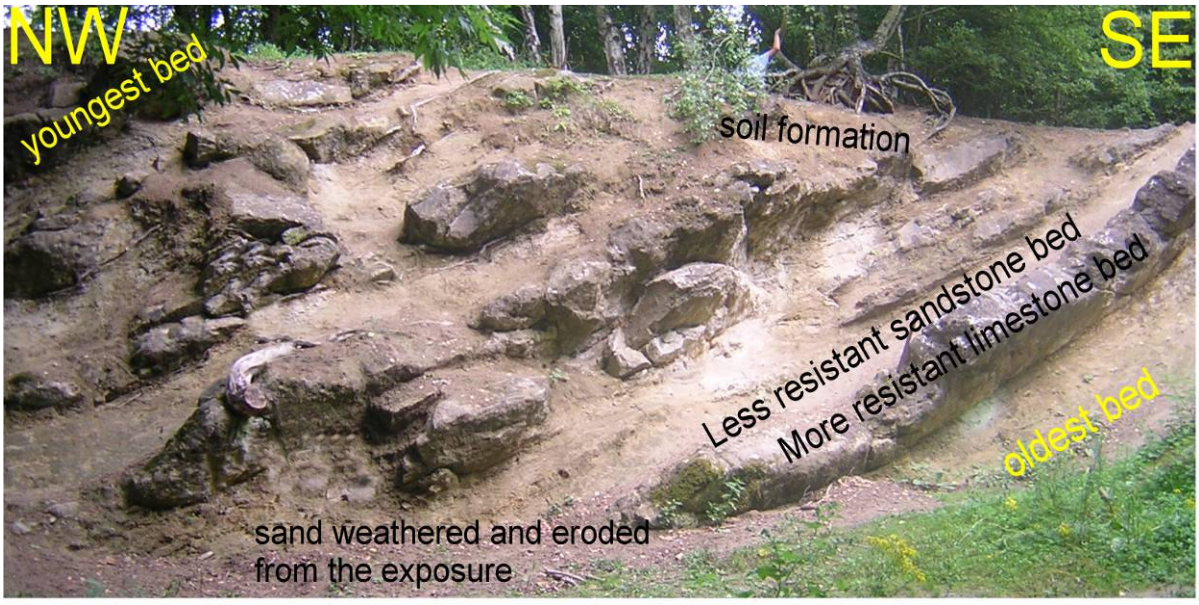

Figure 3 Site 2 - Sloping Beds

Observations/teaching points	Interpretation/comments
The rocks are layered in beds and made of sandy material.	The layering indicates that the sediments, made of sand and other bits, were deposited in water. Relate this to sedimentation experiment as part of your preparation – oldest on the bottom, youngest on the top. They are sedimentary rocks.
The harder rocks are made of a mixture of sand grains 1-2 mm and react with dilute acid as lime mud cements them together.	The sand grains are made of the mineral quartz. The lime mud is made of the mineral calcite. Such sandy limestones form in warm shallow seas.
The softer rocks are made partly of sand grains 1-2 mm in size. (Many also react with acid when they contain calcite: some do not! Clay mud just about sticks them together). These rocks often show very thin layers of bedding. They are easily eroded. [NOTE: a 1mm measuring grid is provided on worksheet 3 to help measure the grain size]	These are weak sandstones, which contain quartz and clay, sometimes with a little lime mud. In both rocks there is also the green mineral, glauconite, best seen in fresh samples. Today this only forms in warm shallow seas. As this mineral contains iron it weathers to brownish minerals. In 1815 William Smith gave the name "Greensand" to these rocks.
Fossil sea shells can be found in the rocks, including bivalves related to modern oysters.	This indicates that the rocks were formed in the sea. These particular fossils indicate a Lower Cretaceous age [115 Ma].
The rocks are now 100 metres above sea level. Here the beds dip northwards and the harder sandy limestones are broken by cracks, called joints.	Long after they were laid down in the sea, the rocks were uplifted, tilted or folded and broken by great Earth movements.
The ground surface at the top of the quarry shows that the rocks should have continued above, but have been worn away by weathering and erosion.	Weathering and erosion took place after the rocks were folded, long before they were quarried.
There is a thin sandy soil on top, rich in brown humus. Trees grow there, with roots pushing down into the joints and along the bedding layers of the underlying rock.	When rocks are weathered they break down to form soil. Plant acids and acid rain are involved in the weathering of limestones. The sand grains and clay particles are left behind to form soil. A soil sample could be collected from this locality for later investigation.
At one time the ground was level with the soil at the top of the cliff face.	This was once a quarry. The rocks have been dug out and carried away. We know from old photographs!
You would expect rocks in a quarry to be freshly broken. They were fresh in the 1960s, but things have happened over the last 40 years. Rainwater and gravity are involved in moving materials down the face. Children also slide down the slopes! Note the accumulation of scree material below the faces. These soon become colonised by moss, lichen, grasses etc. Note also evidence of moles and rabbits.	The rocks have been weathered by several processes: Chemically by acid rain and plant acids; Physically by freeze-thaw and plant roots. See "**Working with Rocks"** as part of preparation. Clear links with biology.
The rocks can be tested for porosity using water from a plastic dropper bottle. The sandy limestones are not usually porous, but the softer sands usually are.	Although the limestones are not porous they are permeable – water goes down the cracks! See Working with Rocks. The lack of surface water gives the area its name – Dryhill. It might be useful to locate a spring nearby and investigate local water supply as follow-up.

NOTE: We have already mentioned that the limestone [rag] was quarried for use as a building stone and as an aggregate for making roads. This can be investigated as part of follow-up.

TASK 2. Site 2 - Sloping Rocks
Pupil worksheets 2 to 6 can be completed here. (See DRY8 KS2 Pupil Worksheets)
(Worksheet 7 may be used as an alternative to worksheets 2 to 5.)

Site 3. Folded Beds.
This site may be used as an extension, or to manage large parties which need to be split into two smaller groups.

Figure 4 Site 3 - Folded beds

☛ Retrace the route back to the car park and coach.

Other activities on site
A range of other activities can be undertaken at Dryhill, especially those related to plants and animals. Kent C.C. and Kent Trust for Nature Conservation have produced an activity pack for primary schools based on Trosley Country Park. Most of the Trosley activity sheets could be used at Dryhill.

Garden Centre
The garden centre next door to the park entrance has toilets and a range of rockery stone from other parts of Britain! Worth having a look and investigate different rock types. See **Working with Rocks.**