Robinswood Hill

Teacher's Guide

The following information is designed to help you when accompanying pupils to this site. It is best used in conjunction with the Pupils' Worksheet and Teachers' Version of the Worksheet.

If you require a geologist to accompany you on part or all of your field trip, please contact Gloucestershire Geology Trust on 01452 864438 or info@glosgeotrust.org.uk.
[A charge may be made for this service, which will depend on the amount of time and preparation involved.]

Access and Safety

Parking is available at the Gloucestershire Wildlife Trust Conservation Centre, Reservoir Road, Gloucester. This trail is not suitable for wheelchair users or those who have difficulty walking due to steep paths and slippery surfaces.

As the geology trail featuures a quarry, it is advised that pupils and teachers wear hard hats to protect from falling debris. Sturdy footwear must also be worn as the route has steep, slippery when wet paths.

As the site is a SSSI, no hammering or damage to the quarry face can be undertaken.

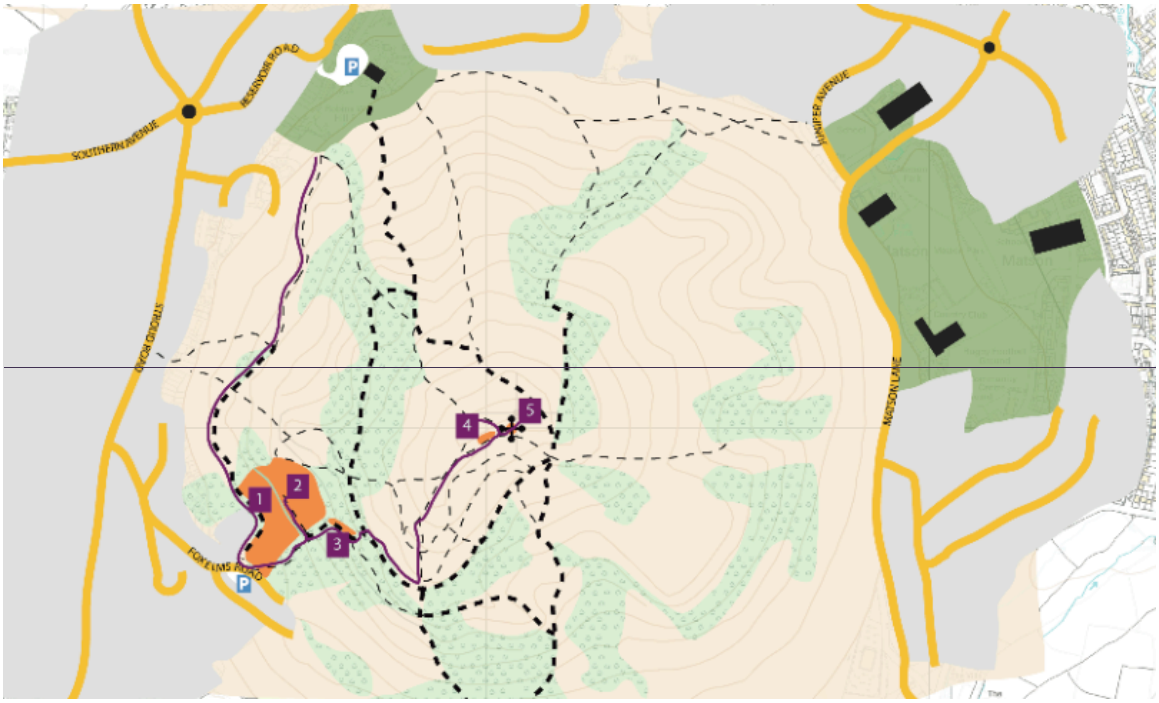
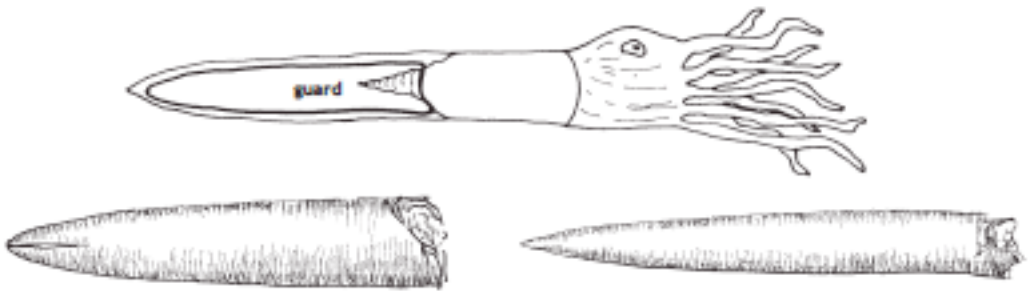


Figure 1 Geology Trail Route Map with site localities and trail shown with purple symbology

Site 1

The path to the quarry cuts through the **Dyrham Formation**, exposed (but overgrown) in a cutting just north of the main quarry. The clays here weather to a brown colour but are pale grey when fresh, the colour change being due to oxidation (rusting) of iron in the sediment. Some fossils, including bivalves, belemnites, starfish and crinoids, have been found in these rocks although they tend to be just casts or impressions, often stained with iron. Horizons of *siderite* nodules have been found towards the top of the cutting.



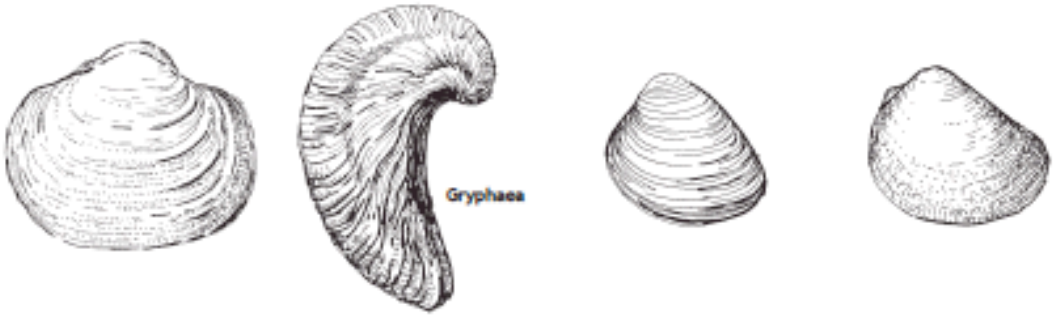
Belemnites

These are an extinct form of mollusc of which the internal shell is preserved as a cigar or dart shaped guard of calcite with a conical chambered hollow at one end. The bottom right image is a reconstruction - the guard is the only part of the animal we find as a fossil. The rest of the soft parts of the body rot away when the animal dies.

Types of fossil found in the Cotswold Escarpment

Crinoids

A crinoid is a fossil "sea-lily", an animal of the phylum Echinodermata (a group which also contains sea urchins today). Broken fragments of stems are most common as fossils.



Bivalves

Aquatic molluscs characterised by a calcareous shell composed of two valves of similar size and shape enclosing the animal within. Gryphaea is an exception to this, having one flat valve covering the entrance to a curved valve.

Brachiopods

Shelled marine animals with two shells of unequal size. They range throughout the geological timescale up to the present day and are abundant and varied as fossils.

Site 2.

This large quarry is a Site of Special Scientific Interest (SSSI) as it exposes the best inland section of Early Jurassic rocks in the country. This means that it is protected by law and hammering or digging in the quarry face is illegal. It is recommended that hard hats be worn here. Do not get too close to the quarry face as there is a danger from falling debris, or too close to the edges of the platforms on the upper levels as the ground may be unstable!

Mis-shapen brick from the redundant brickworks

It seems likely that this quarry was originally used to extract iron from the *ferruginous* bands. Most of the excavation of the site was however for the clayey-silt to supply the brickworks that once stood in the garden behind you. The strata exposed in this quarry belongs to the **Dyrham Formation** and consists of cycles of sedimentation that tend to coarsen upwards, leaving hard sandy beds at the tops of cycles. At the top of each cycle *clastic* sedimentation virtually ceased resulting in a population explosion among the fauna and the consequent formation of the limestone bands and relative abundance of fossils.

The **Dyrham Formation** consists of clayey-sandy silts, silty sands, thin pebble beds and limestones. In this strata are some thin bands of pebble conglomerates and limestones that are often shelly and form beds up to 50cm thick. In the wooded area to the right of the quarry are boulders of material left behind by clay working that have fallen from higher levels. These boulders contain many fossils that can be collected from the loose material which make it the best site on the trail for fossil collecting (see fossil boxes). At the top of the section is a hard band rich in belemnites and bivalves, best accessed from the platform above. The upper portion of this band is pebbly and weathered but is the same material as the lower portion, indicating this bed was exposed to weathering above sea level. The top part was

broken up before the sea advanced again burying and re-cementing it beneath later sediments.

Site 3.

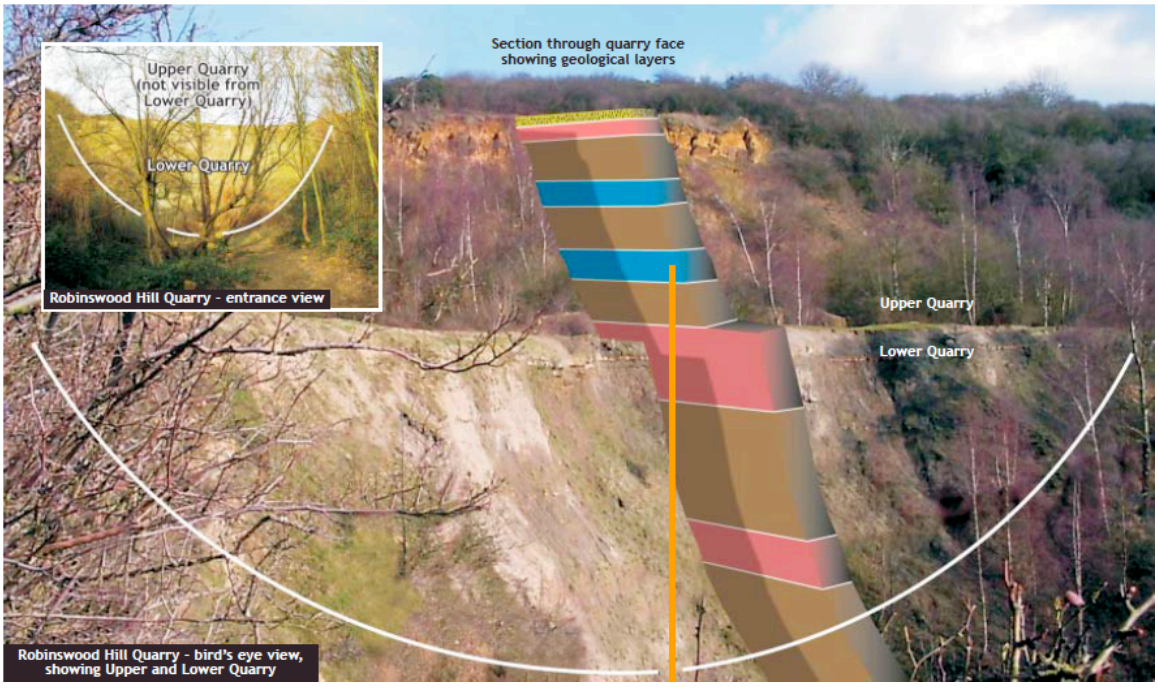
This section of the quarry is still a SSSI and exposes two ammonite zones of the **Dyrham Formation**. The platform at the top of this section can be seen to occur on other hills along the edge of the escarpment to the south-west and marks the top of the **Dyrham Formation.** This platform is formed by the harder rocks of the **Marlstone Rock Formation** and the sandstones underlying it (see sketch below). In this quarry only the bottom few centimetres of the Marlstone are preserved but the bed is somewhat thicker, the top of it being exposed at Site 4.


Dogger found at Quarry entrance

The sandstones at the top of the **Dyrham Formation** contain doggers, large nodules of sand cemented together by calcite. Above these is an iron oolite, the basal part of the **Marlstone Rock Formation.** It contains small brown spherical grains *(ferruginous ooids)* and numerous belemnite, bivalve and brachiopod fossils. The base of the sandy beds is one of the main horizons for the emergence of springs on Robinswood Hill, the sandy beds acting as an aquifer above the impermeable clays. Below the sandstone is an erosional surface where another pebble-conglomerate band can be seen. The rocks are stained red as a result of their iron content. The lower section consists of two cycles of soft grey shales and fine limestone bands overlying c.3m of darker coloured shales. Active *geomorphological* processes can be seen on the top platform where cracks are appearing behind blocks starting to fall away from the hill.

At this site it is worth looking at the view of the Cotswold escarpment and Severn Vale to the S (consisting of Jurassic age rocks), the Forest of Dean to the SW

(consisting of mainly Carboniferous age rocks), May Hill to the W (an inlier of Silurian age rocks) and the Malvern Hills to the NW (made up of Precambrian and Lower Palaeozoic rocks) (see sketch below). The landscapes as they appear now were formed during the Quaternary period. Around 430,000 years ago the Severn Vale would have been filled with glaciers and the outwash from meltwater would have flowed into a huge lake to the north of Gloucester.



Site 4.a

The lower cutting beside the path exposes the top of the **Marlstone Rock Formation.** The top surface of the Marlstone is uneven and weathered, representing a period of uplift or sea level fall resulting in the absence of a part of the sequence. Many *belemnites* can be found in the scree here. Clay belonging to the **Whitby Mudstone Formation (Upper Lias Clay)** is found above the weathered zone and is best seen in the higher cutting**.** The weathered zone at the top of the Marlstone marks an *unconformity* on which the clays of the **Whitby Mudstone Formation** rest.

Site 4.b

The rocks exposed at this site belong to the **Whitby Mudstone Formation** and

have been found to contain ammonite fossils, mainly in the basal part of the section. Near the base is a grey, silty mudstone containing *micritic* limestone nodules. The soft clays are particularly prone to landslipping, especially when wet. The uneven ground typical of landslips is a characteristic feature of the Cotswold Escarpment and its outliers.

Site 5.

This site is beside the narrow ridge that forms the hill's summit. This ridge was probably created by landslipping on either side of the ridge during the last glacial period. These mass movements may have disturbed the strata leading to the tilting of the beds. Exposed here is the contact between the Lias Group and the Inferior Oolite Group. The base of the section is made up of finely *laminated* soft sands of the **Bridport Sand Formation.** These are poorly cemented and contain iron-stained laminations and at the top of this bed is another erosion surface. The **Cephalopod Bed** here is quite thin and represented only by a concentration of belemnites in an iron-rich band at the top of the **Bridport Sand Formation.** The succeeding beds comprise iron-rich, rubbly, ooidal sandy limestones, characteristic of the **Leckhampton Member (Birdlip Limestone Formation).** This junction between the Lias and Oolite is marked by a significant change in *lithology* that represents entirely different environmental conditions, following a period of erosion.

Landslipping on the Cotswold Escarpment is extensive and tends to occur where clay forms a major part of the sequence. They are gravity driven movements of rock and soil that can transport massive amounts of material downslope. Many landslips occured when ice trapped within the rocks melted at the end of the ice age. Landslipping still occurs locally, especially when the clay becomes unstable after heavy rain. Landslipped ground is hummocky and uneven, becomes boggy when wet and often contains cracks when it dries out. Such slippages may leave steep crescent shaped depressions in the hillside where the material slipped from.

Zonal Ammonites

Ammonites are an extinct form of shellfish that underwent rapid evolutionary changes and allowed quite thin, successive time intervals (or zones) to be identified in the rock record from their fossilised remains. These intervals are known as 'biozones' as they are recognised by their biological (fossil) content and by studying these biozones geologists can accurately record and date sequences of rocks.


Pleuroceras spinatum


Amalthus margaritatus


Prodactylioceras davoei


Uptonia jamesoni


Tragophylloceras ibex