# A GEOLOGICAL GUIDE TO HAM HILL COUNTRY PARK

Hugh Prudden

## Introduction

Ham Hill ranks as one of the best inland geological localities in Somerset. It is a country park some 6 miles west of Yeovil with open access and is well-maintained by South Somerset District Council which has published a booklet on the geology. There is a pub, toilets, parking and a study centre. It is very popular with the public and visited by geological groups. There is a wide range of geological interests. Please refer to the booklet *Ham Hill: the rocks and quarries,* and the extensive bibliography below for further information.

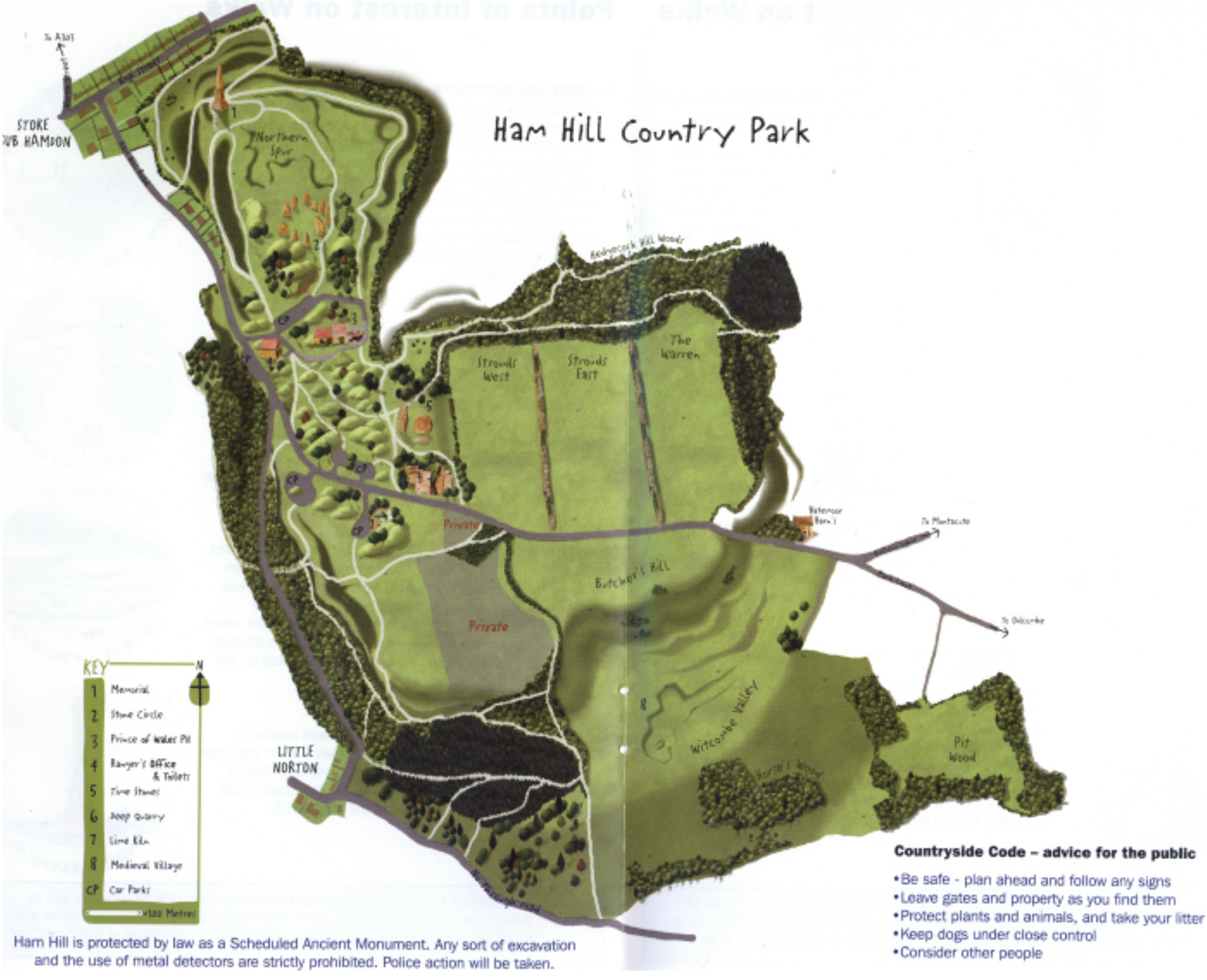



**Figure 1** Ham Hill Country Park (from *The Ham Hill Herald*)

Ham Hill offers the following features of interest:
-Structure of Ham Hill
-Sediments and sedimentary structures

-Strike-slip features
-Gulls
-Flowstone coatings
-Fossils and stratigraphy
-Landforms
-Palaeogeography
-Tectonic history and relationship to the basement
-An SSSI within working quarry at southern end of the Hill
-Use as a fine building stone since Roman times and over a wide area
-Bibliography

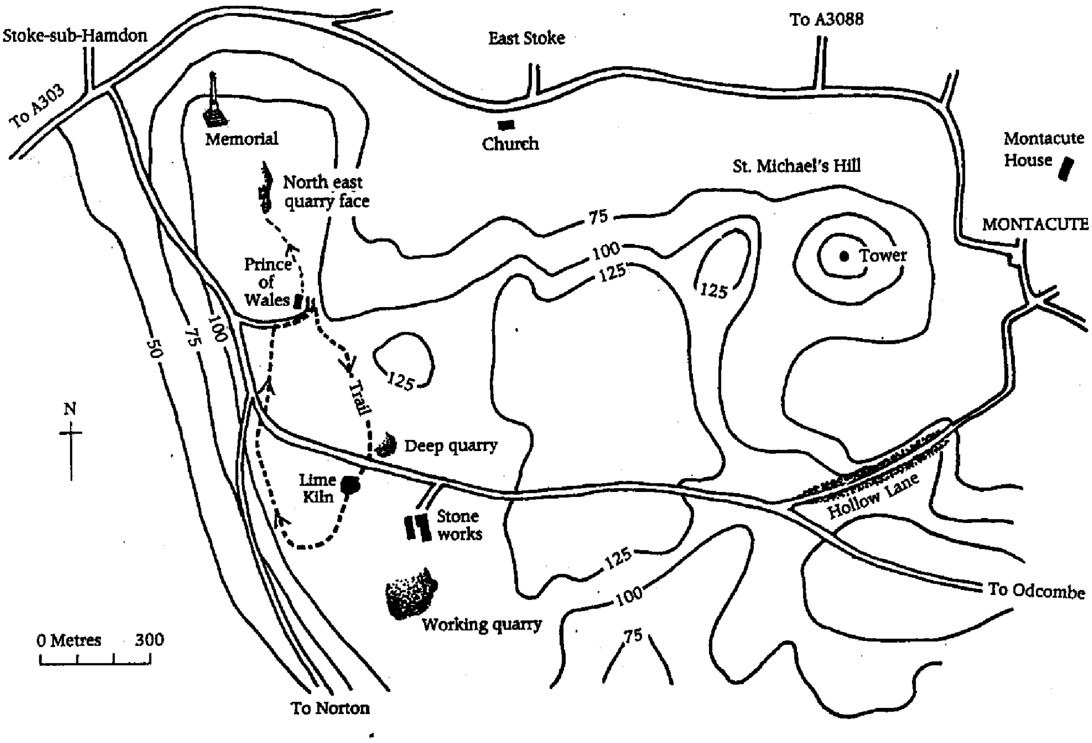



**Figure 2** Ham Hill features and access roads.

A tour of the **Regionally Important Geological Sites (RIGS)** is recommended. A visit to the north end of the hill **(RIGS A and D)** is suggested for those with only half a day. The Limekiln Trail to the south (**RIGS B and C)** can be followed if there is time for further exploration. Both start from the Prince of Wales. There are toilets at the Ranger's Office and a number of car parks.

The geological structure of Ham Hill is shown below (Prudden, 1995). The Ham Hill Stone forms a capping and is underlain by Yeovil Sands (now Bridport Sands).

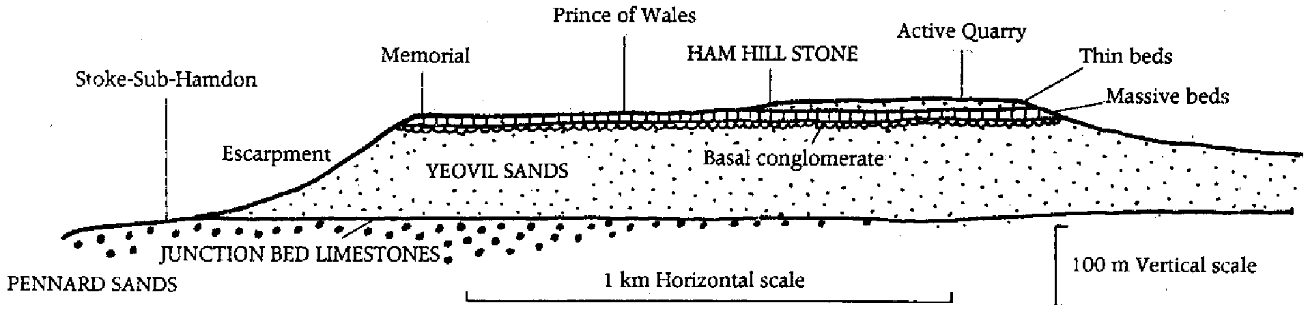



**Figure 3** The structure of Ham Hill.

# THE NORTH END OF HAM HILL

*Take the path immediately north of the pub for some 300 m*

## RIGS Site A North east quarry face (ST 4784 1715)

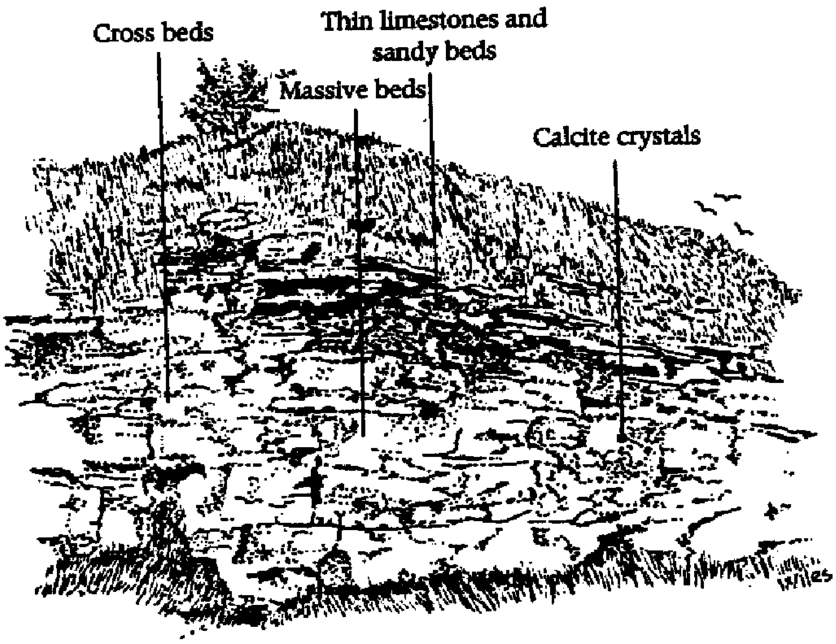


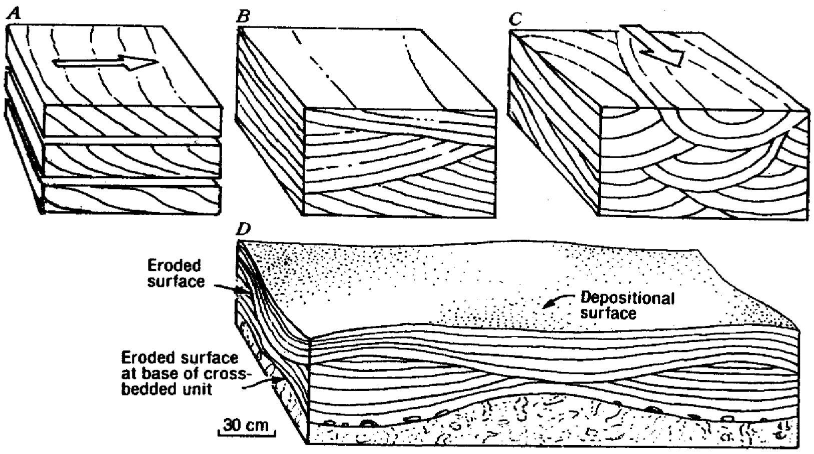

**Figure 4** Details of the northeast quarry face (Prudden, 1995).

Use Figure 4 to locate features of interest. The Somerset Geology Group was involved in discussions regarding the importance of preserving this face when there was a threat that it might be quarried away. It contains many important features, is not weathered, stands in a popular part of the Country Park and is easily accessed. The quarry face in Figure xx shows the following features:

**1. Massive beds** in the lower part of the face. Use a hand lens to examine the Ham Hill Stone (Hamstone). It is a shelly, sandy, partly ferruginous, (bioclastic) limestone composed of small shell fragments cemented with calcium carbonate. Thin to medium thickness, **evenly**

**bedded** shelly limestones and sandy beds are seen above the massive beds which suggest a more spasmodic supply of sediment. Tilestones were once worked in these thinner beds.

2. Unlike the Blue Lias at Somerton few of the beds can be followed for more than a few metres. Note the slope of the **cross-beds** as in A Figure 5) in the quarry face on the north-facing face indicating movement of shelly debris from the SW to NE.




. Cross-bedding, with arrows indicating current direction where appropriate. *A.* Three tabular sets with *(from top)* angular, parabolic, and sinusoidal cross-lamination. *B.* Wedge sets indicating variable current direction. *C.* Trough sets or festoon cross-bedding. *D.* Hummocky cross-bedding, thought to be formed by storm waves on the lower shoreface (Hunter and Clifton, 1982).

**Figure 5** **B**edding structures. (Robert Carter *Geology in the field.* Wiley)

3. Erosional **scours** and channelling shown by undulating bed contacts indicating partial removal of previously deposited sediments (**trough cross-bedding** as in C in Figure 5). What do these features suggest about the water depth and current velocity?

4. Sub-parallel vertical faces in the massive beds show **calcite crystals**. The rock face is smoothed (**slickensides**) and it is possible to pick out mainly horizontal striations. These indicate dextral (to the right) displacement which has opened-up the rock by brittle fracture. The faces with calcite crystals are the remaining faces of *en échelon* tension gashes (Figure 6).

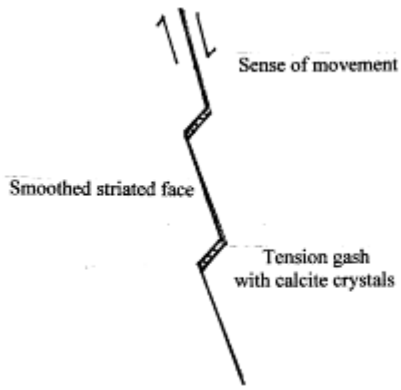



**Figure 6** Plan of tension gashes.

5. The northern end of the quarry face (ST 4777 1716) shows a set of N-S, steeply-inclined **fractures (joints)** in a zone 4 m wide in line with the strike-slip structures mentioned above. These N-S fractures occur extensively in Somerset.

Strike-slip movement indicate that the rocks at Ham Hill have suffered wrenching as a result of N-S compression (Tertiary Period), probably as a result of the reactivation of deep-seated strike-slip faults in the basement rocks. There are also less frequent indications of sinistral movement trending NE-SW. In the area around Ham Hill, of twenty nine faces with horizontal or near horizontal slickenside striations, twelve are dextral and trend approximately NNW-SSE, whilst eight are sinistral and trend NE-SW. These conjugate fractures can be traced in a zone of disturbance trending NNW-SSE toward the southern end of Ham Hill.

An examination of clean-cut Ham Hill Stone, to be seen in the work's yard or in smooth ashlar stonework, often reveals near-vertical zigzag lines that look like stylolites; they tend to be perpendicular to the bedding and are iron-stained. However, close examination of the fractures shows the presence of small calcite crystals indicating slight lateral displacement; these are additional evidence for compressional tectonics. These fractures are a source of weaknesses causing the stone to split and result in wastage for the quarry operator when processing the stone.

**Figure 7** Pseudo-stylolites. Probably the result of small lateral displacements.

It is important to set these features in their regional context. Figure 8 shows three important strike-slip faults in Somerset. Similar NNW trending faults are found throughout the South West of England and to the east in Dorset and Hampshire (Melville, 1982, Prudden, 2005).

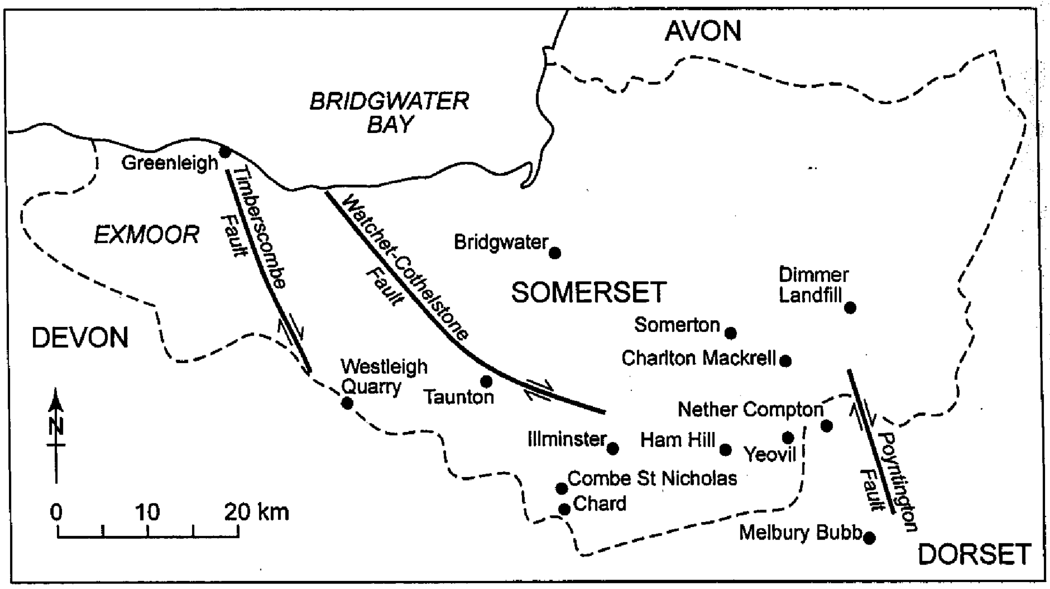



**Figure 8** Major strike slip faults in Somerset (Prudden, 2005).

6. A number of sub-vertical openings ranging from a few centimetres to over 60 centimetres wide are part of a network of **gulls** of varying widths and directions indicating that parts of the Hill had subsided and spread at some time in the past, possibly during the transition from arctic-like permafrost to a more temperate climate at a time of excessive melting, increased ground water and slope instability. Brunsden (1996) explained similar subsidence in the Isle of Portland to the possible extrusion of weak mudrocks from the lower slopes of Portland.

7. **Flowstone** has covered some of the crystal-covered faces on the right hand side of the quarry face where water charged with calcium carbonate in solution has dripped down, evaporated and consequently precipitated calcium carbonate.

8. A **Basal Conglomerate** (Figure 9) is well-displayed on the undersides of several of the nearby vertical monoliths erected to celebrate the Millennium. The conglomerate shows rounded sandstone pebbles and cobbles which indicate a period of erosion on the sea floor. Look for borings, serpulid encrustations, belemnite guards, ammonites, bivalves and crinoidal debris. The richness of fossil remains is in marked contrast to the rather barren Yeovil Sands below and the Ham Hill Stone which followed. Should we refer to the remains as a 'death' or 'life' assemblage? The borings and encrustations indicate exposure on the sea floor. The conglomerate marks an interval between the deposition of the sands and shelly debris (Figure 3). Similar pebble beds have been observed in the Pennard Sands (now Dyrham Formation) near Sparkford, Somerset, and in Gloucestershire. Slight intermittent tectonic uplifts may have resulted in shallower seas with wave agitation and even undercut cliffs providing the source of the pebbles.

**Figure 9** Basal Conglomerate showing bored sandstone pebbles in sandy shelly matrix; car key for scale.

## Site D The Pinnacle and nearby face (ST4780 1711)

This remnant of brecciated Hamstone shows a **gull** with, possibly, quarry waste infill. A narrow channel cut in the Ham Hill Stone demonstrates how the workmen chipped at the rock when quarrying.

Recent quarrying operations have revealed an old quarry face 50 m SW of the Pinnacle (ST 4765 1703). Massive beds of Ham Hill Stone are separated by a 3 m-wide zone riven with **N-S fractures**. A rock face 100m to the north shows smoothed, grooved slickensides trending 330˚ similar to the features mentioned at Site A. These features are similar to those seen previously at Site A. The beds on the west side of the Hill dip at 14˚ to the west. It is uncertain as to whether this dip is due to tectonic processes or superficial cambering.

**Figure 10** There is a zone of N-S fractures just to the left of the cap. Massive beds of Ham Hill Stone without fractures lie to the left and right; note the axe marks. There are gulls parallel to the fractures.

## Viewpoint at the Monument

*Take the path past the Pinnacle to the Monument*

This has to be one of the best viewpoints in Somerset. The Lower Lias clay vale is in the foreground with the Blue Lias limestone ridge beyond. Note the Bridport Sands-Inferior Oolite escarpment, in the northeast, which bends round to a N-S trend. The Mendip plateau is in the far distance. To the west one can see the Brendon Hills and Quantocks on a clear day. The Blackdown Hills lie to the southwest. Palaeozoic, Mesozoic and even Tertiary (on the Blackdown Hills) emphasise the richness of Somerset geology.

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# THE SOUTH END OF HAM HILL

*From the south side of the pub follow footpath signs for Leland/Monarch's Trails leading South. Pass the notice 'Warning steep quarry faces' and a barred gate; turn left where there is a post with an arrow and limekiln sign. A second notice warns against climbing steep slopes*

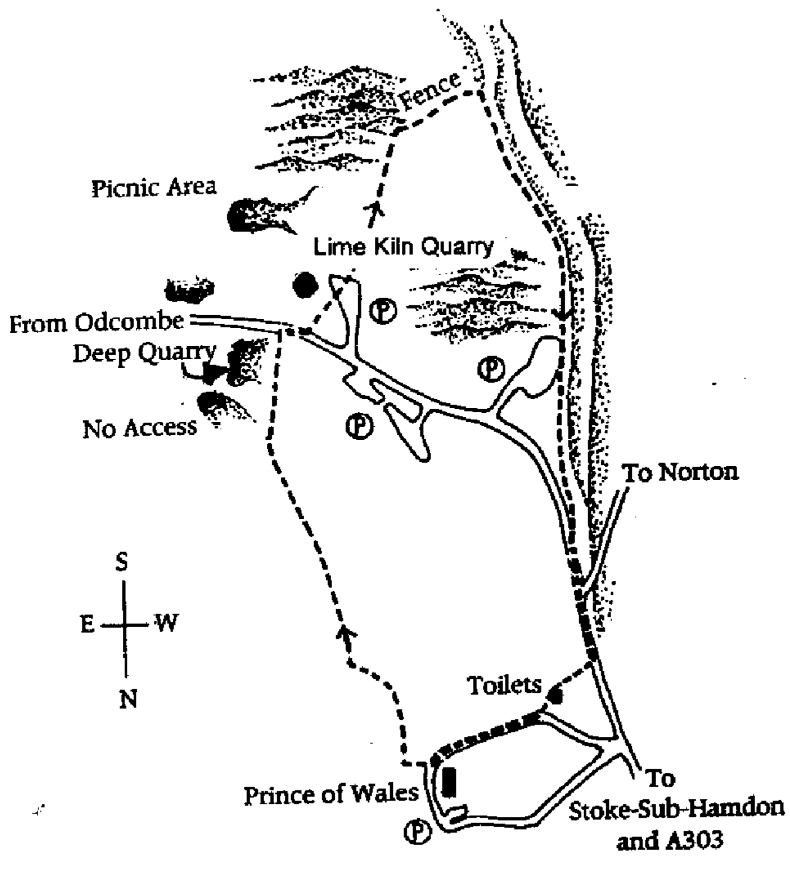


**Figure 11** The Limekiln Trail (Prudden, 1995).

## Site B The Limekiln Trail deep quarry (ST 4814 1650)

Figure 11 has south at the top of the map. The deep quarry shows the most impressive face especially when lit by the afternoon sun. Please remember the warning notices. The rock faces (Figure 12) are in excellent condition. Note the three-dimensional exposures of the trough cross-bedding. There appears to be a much thicker development of Ham Hill Stone than at the northern end of the Hill.

Two wide and several smaller gulls side-step downwards. The face on the right was worked back to a gull; the remaining faces show a heroic wall with tool marks where rock has been extracted.

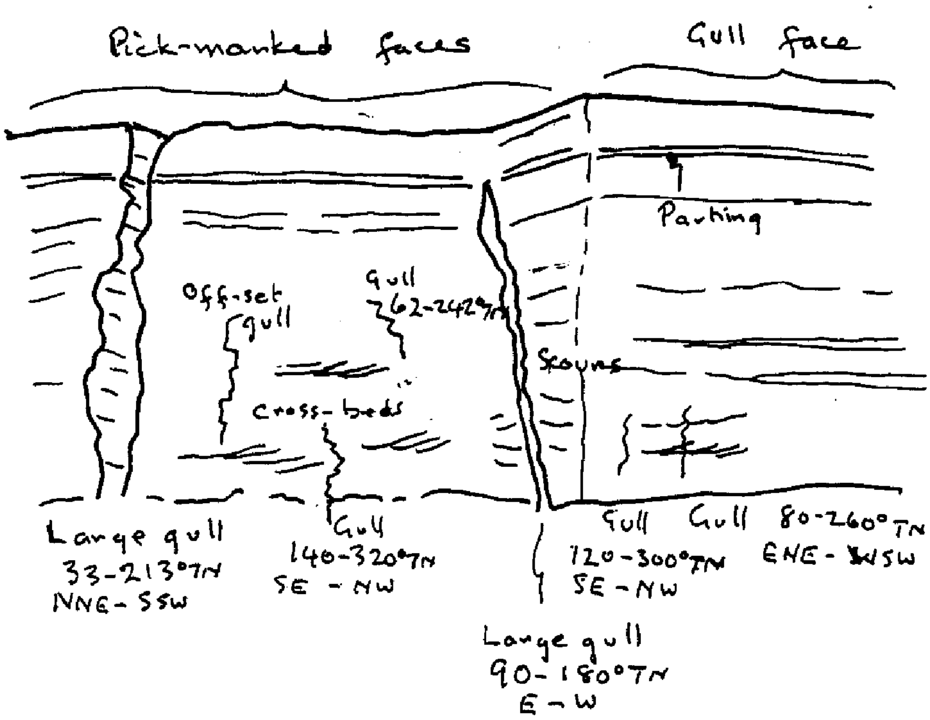


**Figure 12** Detail in the deep quarry,

The Ham Hill Stone produces a warm, golden building stone full of character and has been quarried since the time of the Romans. It is readily carved and sawn and has been extensively used for walls and buildings.

*Return to the track, turn left and continue across the road to the limekiln face.*

## Site C The limekiln face (ST 4808 1640)

With the help of Figure 13 note the smoothed faces with horizontal striations similar to rock surfaces worn down by a passing glacier but obviously not by a glacier in this case. There is a conjugate set of striated surfaces: N-S dextral movement (to the right) and NE-SW sinistral movement (to the left). There is an area of brecciated rock to the left. Some beds dip at 15° to ENE. Beds can be seen dipping at 45° to ENE in the shrubby area 20m to the north of the limekiln. Clearly there is a N-S line of disturbance similar to that at the northern end of the

Hill and this site appears to be a continuation of it. Or there may be a set of *en échelon* faults on the Hill. There are a number of gulls.

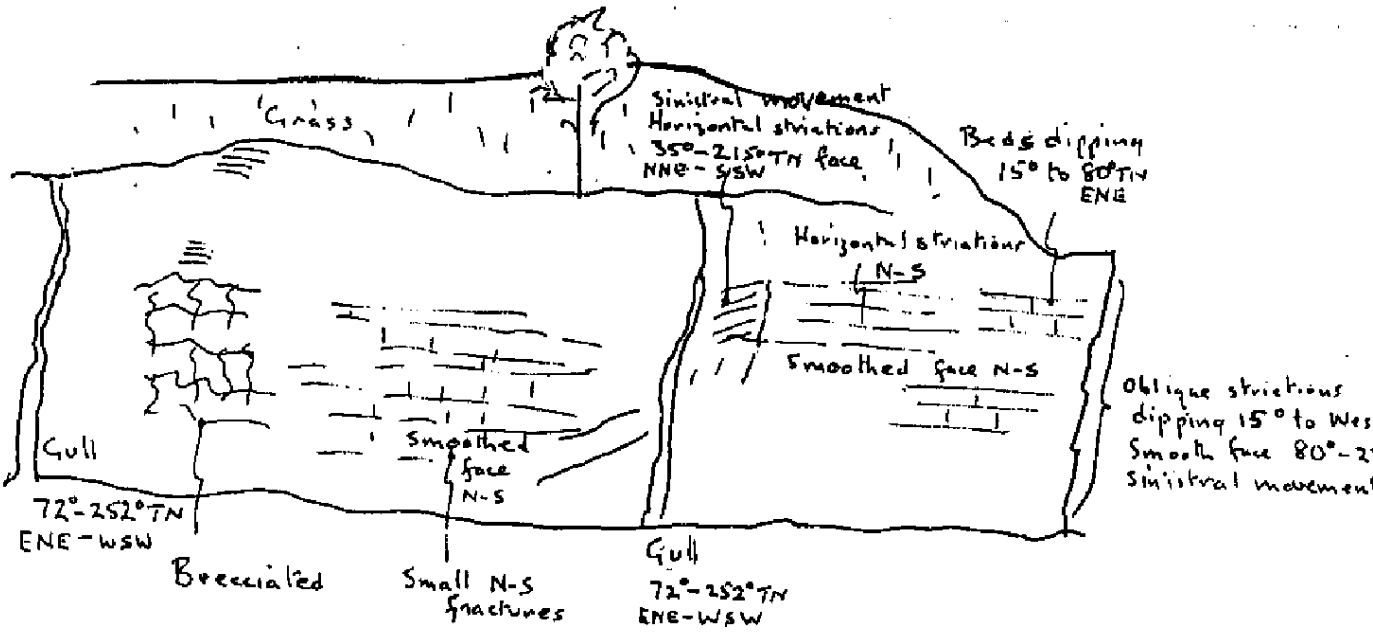


**Figure 13** Details of the limekiln quarry.

*Make for the edge of the hill, turn right and return to the start by following the footpath along the western edge of the hill.*

**Landforms**

The valley of the **River Parrett** runs north-south; the major E-W Coker Fault is offset by a N-S fault and this suggests that there is a N-S/NNW-SSE (?) strike-slip fault present. The Ham Hill plateau continues to the south and east and is fronted by a fine escarpment. The Ham Hill Stone and higher beds of the Yeovil Sands are both relatively resistant rock types and as a result they combine to form the undulating **plateau** edged by a steep escarpment. The Blackdown Hills can be seen to the SW; these are capped by Cretaceous Upper Greensand, Chalk, and Tertiary sediments.

**STRATIGRAPHY**

How does the Ham Hill Stone fit into the geological time frame? The answer lies in the occasional finds of the ammonite shown in Figure 11 which indicates the Moorei Subzone of the Levesque Zone (Toarcian Stage) which is part of the Jurassic Period and about 170Ma

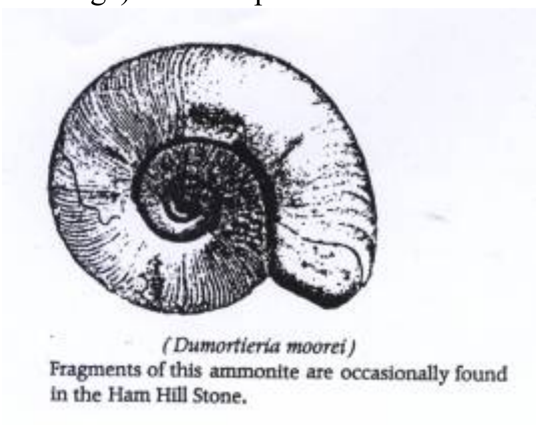


**Figure 14** *Dumortieria moorei* (From Prudden, 1995).

# WITCOMBE

*There is limited parking shown on Figure 15. A circular walk returning via the footpath alongside Norton Covert is recommended, where the footpath has eroded down to the Bridport Sands.*

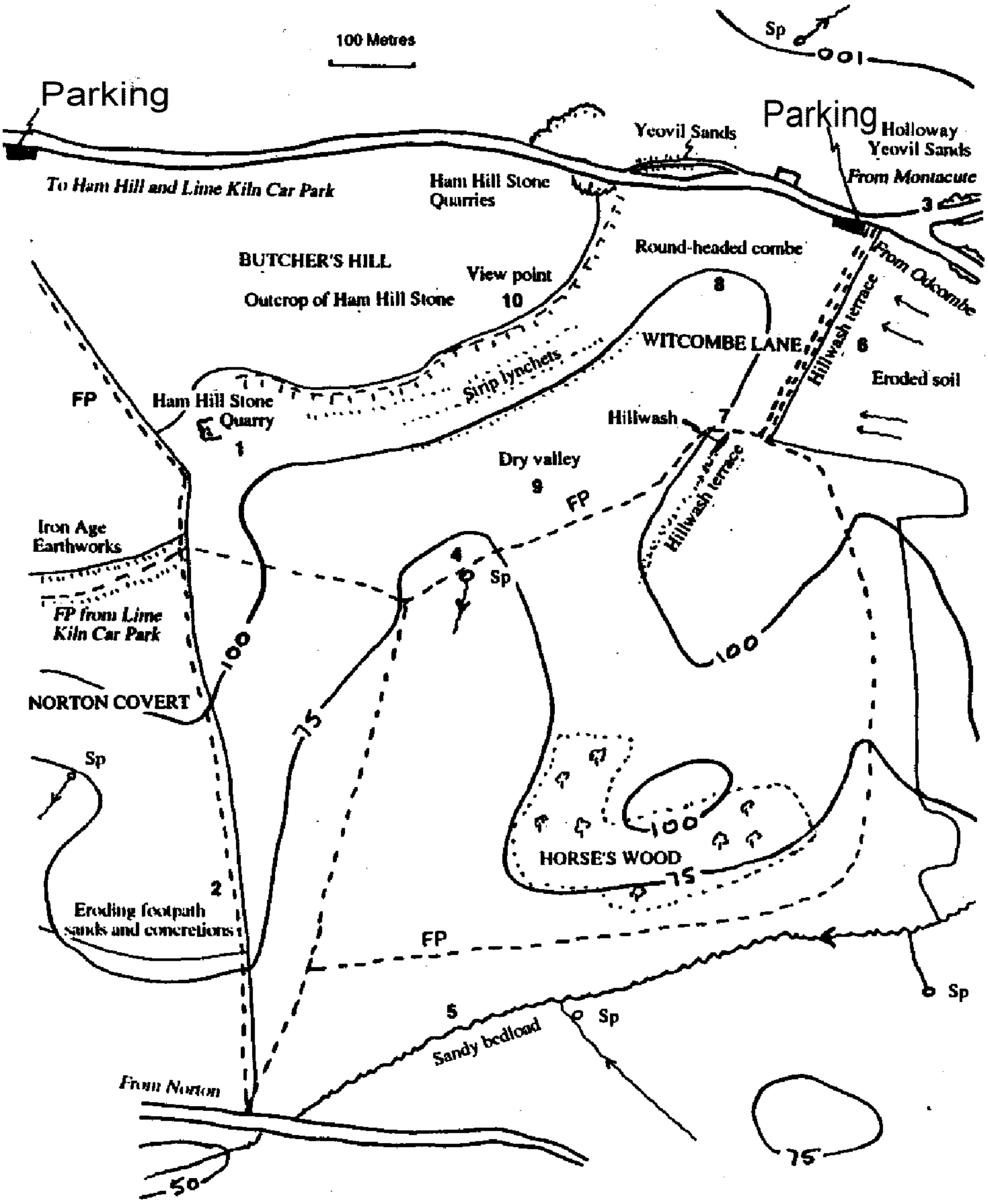


**Figure 15** Features of the Witcombe area (Prudden, n.d.). Numbers locations mentioned in the text.

**Witcombe,** part of the Country Park, is south of the Ham Hill-Odcombe road and has fine scenery where the landforms are developed on the Yeovil Sands. Figure 16 shows a number of **u-shaped, steep-sided valleys** with blunt ends (Locations 8 and 9). Most have north-westerly or north-easterly trends which may be related to zones of more densely fractured rock associated with strike-slip faults, as seen on Ham Hill, although the lack of exposures makes it difficult to demonstrate that there is a relationship. The fractures could have weakened the rock and facilitated the transmission of ground water. The location of springs, and hence excess groundwater when permafrost thawed, especially in summer months, may in part have been determined by these fracture zones in the bedrock. This in turn may have led to hillslope recession as a result of periglacial mass wasting acting on the steep slopes. This observation may well have more general application for understanding the pattern of valleys elsewhere as, for example, the combes in the Chalk country of Dorset. One cannot overestimate the effects of mass-wastage on hillslopes during periglacial periods.

In addition, Figure 16 shows two **NNW escarpments**, three NNW faults including the fracture zone running NNW-SSE through the hill. These parallel features suggest that geological structures may have influenced the development of the landforms. It is possible that structural weaknesses e.g. a fracture zone has led to mass wastage removing the rock between St Michael's Hill and Ham Hill

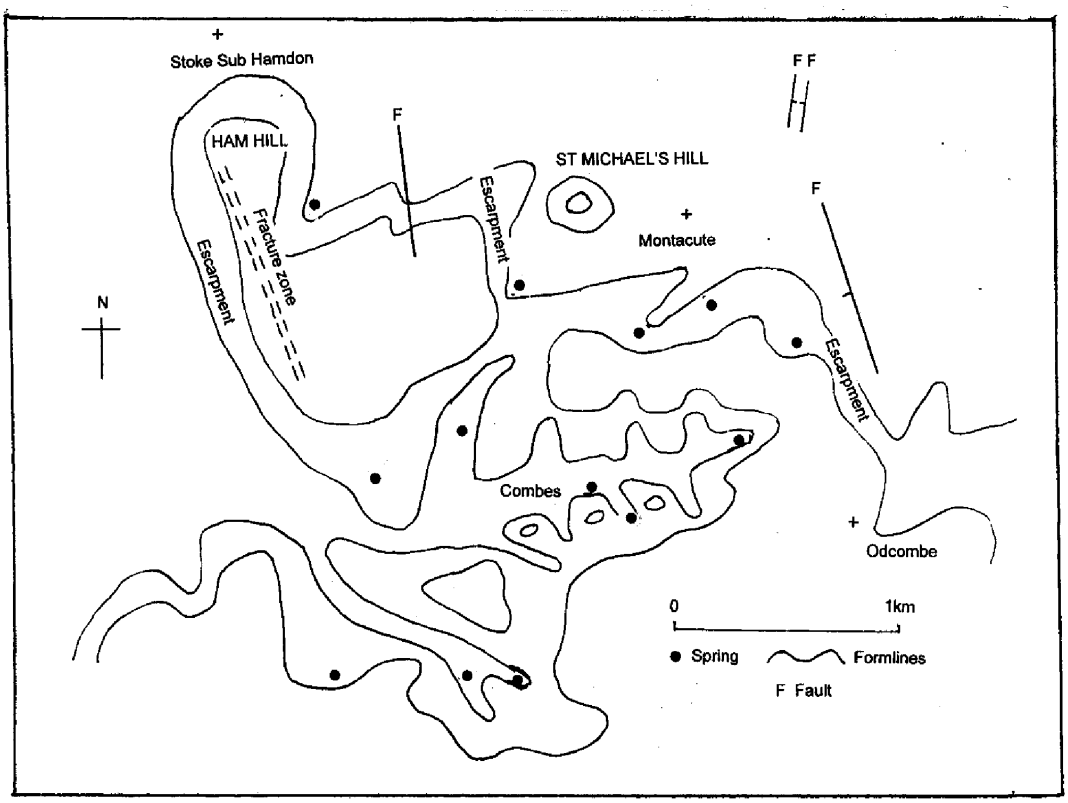


**Figure 16** Form lines to show the outline of Ham Hill and the pattern of combes.

The positions of present–day springs indicate today's water table (Figure 14). It would have been much higher during periglacial events. Holocene peats have been reported in the valley bottom (Figure 16 Location 5)

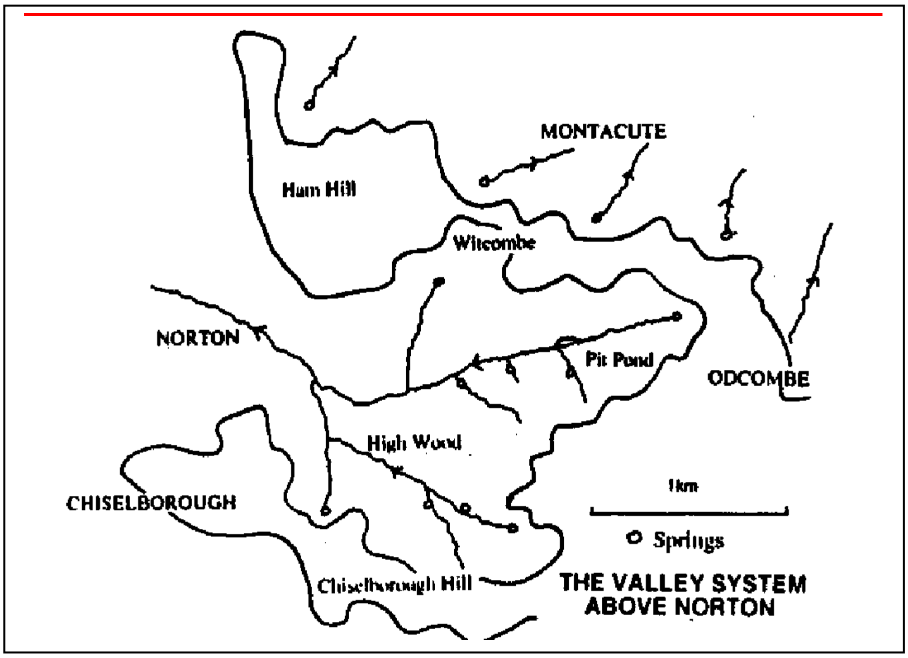


**Figure 17** Present-day pattern of springs and streams. (Prudden, n.d.).

**Figure 18**. Typical valley form in Witcombe. Note the yellow-brown soils on the Yeovil Sands in the distance.

# Montacute Holloway

A **holloway** (Figure 15 Location 3) leads down to Montacute where there are good exposures of the Bridport Sands (formerly Yeovil Sands). These are fine-grained, yellow sands and sandstones with nodular calcareous concretions of varying size. There are very few fossils. But the absence of sedimentary structures suggests that the sands have been heavily reworked by organisms (bioturbated).

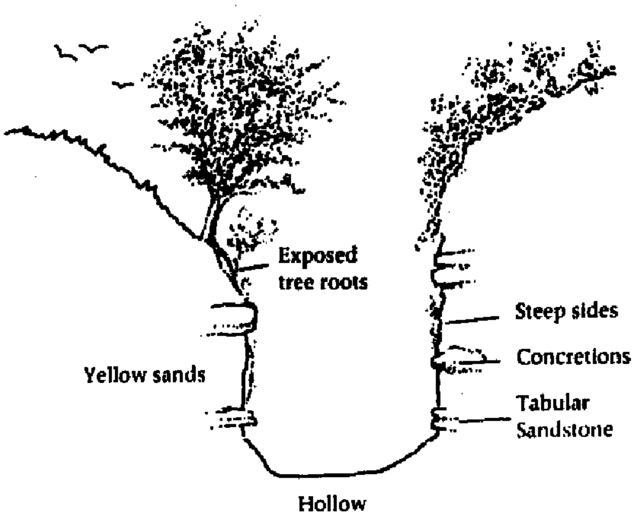


**Figure 18** Features in the Holloway (Prudden, n.d.).

The holloways are the result of the sands being readily eroded by traffic before the roads had a tarred surface. Soil erosion is a great problem and many of the arable fields have lost nearly a metre of topsoil (e.g. Figure 15 Location 6). The very fine grain size of the sands means that they are readily moved by surface run-off especially during periods of intense rainfall acting on steep slopes with a fine tilth and lacking vegetation cover. Tractor 'tramlines', surface capping and subsoil hardpans increase the risks of erosion.

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www.stoneroof.org.uk/jura.html Stonetiles for roofing

www.jncc.gov.uk/earthheritage/gcrdb/GCR.asp Geological Conservation Review See CGR block-Toarcian (TOH)

http://mysite.wanadoo-members.co.uk/hughprudden *Somerset Geology a Good Rock Guide*