Moons Hill Quarry

[ST 665 460]

Introduction

The most southerly exposures of Silurian rocks in Britain are to be found in the east Mendips, where they comprise an inlier in the form of an E–W trending asymmetrical anticline flanked by Devonian and Carboniferous rocks. Moons Hill Quarry is situated just north of the axial region of the anticline, about 0.5 km south of Stoke Lane. It contains Wenlock age volcanic rocks and also, around its southern margins, Wenlock sediments.

Moore (1867) was the first to discover the igneous rocks of the east Mendips, which were later the subject of a short report by Geikie and Strahan (1899). For most of the present century the most detailed work on the inlier was done by Reynolds (1907, 1912a, 1912b) and by Woodward *et al.* (1909), who assessed its structure, stratigraphy, fauna and volcanics. Subsequently, brief notes on the Silurian here were given by Green (1962) and Green and Welch (1965) and the igneous rocks received specific treatment by Van de Kamp (1969) with further comment from Ponsford (1970). Bassett (1974a) gave a summary of the Wenlock strata in the inlier, but his stratigraphical scheme was based on the structure of the area as understood by earlier authors, which is now believed to be incorrect.

In 1982 Hancock re-investigated the inlier and produced a revised stratigraphy and structural model for it together with a new map of the area. He recognized for the first time that the 'Wenlock Shale' (Coalbrookdale Formation) near the southern margin of the inlier, which was formerly thought to be the youngest unit, is in fact part of an inverted, northern, limb to the anticline and forms the lowest part of the Silurian succession, which here youngs to the north. This means that the tuffs which lie above these shales are Wenlock (Ziegler *et al.,* 1968b; Bassett, 1974a), not Llandovery (Reynolds, 1907, 1912b; Green, 1962), in age. The southern margin of the inlier is marked by a Hercynian thrust fault, which carries gently southerly dipping Old Red Sandstone from the south to the north to lie over both the inverted and normal limbs of the anticline (Figure 4.18).

The Silurian of the Moons Hill site is contained entirely in the overturned (to vertical), northwardly younging, northern limb of the East Mendips Anticline. The site is very distinct in having substantial volcanics of Wenlock age and its southernmost position in terms of Silurian rocks lends it palaeogeographical importance.

Description

Hancock (1982) identified 12 stratigraphical units in the Silurian of the East Mendips Inlier. Units 4–12 are specifically noted by him as occurring within Moons Hill Quarry; at that time units 1–3 lay outside the limits of the main quarry, but are included within the GCR site boundary, which was extended in particular to the south of this quarry so as to include the fossiliferous Wenlock shales and siltstones (unit 1) at the base of the succession.

Unit 12, a vent agglomerate, exhibits a crosscutting relationship to all the other Silurian beds in the inlier. The agglomerate consists of blocks of various lavas and tuffs up to 30 cm, mostly well rounded, together with quartz–siltstone pebbles, in a matrix of tuff. The rest of the sequence, in descending stratigraphical order, is shown in (Table 4.2).

The occurrence of *E. angelini* in the upper part of unit 1 places an age limit on this part of the sequence as this species is the latest member of the *Eocoelia* lineage and on Gotland is known only from the *riccartonensis* Biozone (Ziegler, 1966; Bassett and Cocks, 1974). Grading in several tuffs of unit 4 indicates that the sequence youngs northwards. The position in the sequence of these tuffs thus indicates a Wenlock, not Llandovery, age for them. The whole shale–volcanic Silurian sequence of the East Mendips Inlier has recently been given as spanning the *centrifugus* to *lundgreni* biozones (Cocks *et al.,* 1992), but the precise age of both the bottom and top of the succession is still open to some uncertainty.

(Table 4.2) Stratigraphy of the East Mendips Inlier (after Hancock, 1982).

Unit	Lithology/fossils	Thickness (m)
11.	Top andesite.	
10.	Agglomerate, contains well-rounded boulders up to 1 m in matrix of tuff.	18
9.	Upper andesites, basal 2 m flow has reddened top, though possibly also has pillowing, followed by massive lava.	70
8.	Tuff and bedded agglomerate, include red and locally blue-black mudstones, with angular and some rounded boulders up to 23 cm in the agglomerates.	20–29
7.	Main andesites, abruptly overly unit 6, top reddened and eroded below unit 8.	90–135
6.	Tuffs with red and green mudstones, finely interbedded, some tuffs with graded bedding and evidence of cross-bedding.	18
5.	Andesites.	50
4.	Tuffs and sandy tuffs, with fragments up to 2.5 cm, showing graded bedding, together with red and green mudstones, locally fossiliferous. Shelly fauna comprises mainly brachiopods, e.g. *Craniops* sp., *Salopina conservatrix,* '*Camarotoechia*' *tripartita,* '*Camarotoechia*' aff. *llandoveriana, Rhynchotreta cuneata* and *Sphaerirhynchia davidsoni.* Also remains of trilobites, bivalves, gastropods and ostracods (see also Reynolds, 1907; Woodward *et al.,* 1909).	105–135
3.	Andesites, no surface exposure, possibly absent in eastern part of inlier.	30
2.	Tuffs, fine-grained, no surface exposure, possibly absent in eastern part of inlier.	34–60
1.	Shales and siltstones, with brachiopod-dominated shelly fauna, including *Salopina conservatrix,* '*Camarotoechia*' *tripartita,* '*Camarotoechia*' *llandoveriana, Eocoelia angelini, Eoplectodonta duvalii, Coolinia applanata, Resserella canalis, Atlypa reticularis, ?Isorthis clivosa, Eospirifer radiatus* and *Protochonetes* sp.. Trilobite, ostracod, bivalve, coral and *Tentaculites* remains also occur in these Wenlock Shale sediments (see also Reynolds, 1907; Bassett, 1974a).	95+

The presence of cross-bedding in one tuff of unit 6 suggests the existence of currents and a waterlain origin, though the interbedded mudstones of this unit are unfossiliferous. The andesites of unit 7 are the main rocks worked in the quarry and four flows were recognized by Van de Kamp (1969). The boundary between unit 8 (tuff and agglomerate) and unit 12 (vent agglomerate) is uncertain as rounded boulders characterize both. A reddened top to unit 9 suggests subaerial conditions, yet if pillowing really is present in the bottom of this unit, this would indicate eruption into water. The top of unit 9 is cut out in most places, with slight angular unconformity, by the base of the overlying Old Red Sandstone. Units 10 (agglomerate) and 11 (top andesite) are limited in extent, both having been largely removed by pre-Old Red Sandstone erosion. The vent agglomerate (unit 12) is the 'Coarse Ashy Conglomerate' of Reynolds (1907), who interpreted this lithology as that of a volcanic neck. The rounded nature of many of the fragments in this unit has been explained by their erosion by gas-fluidized tuff and agglomerate.

Interpretation

In terms of the depth related brachiopod communities established for the Wenlock Series (Calef and Hancock, 1974; see also Hancock *et al.,* 1974), species from the lower shales of unit 1 indicate an *I. clivosa* Community, those from the middle and top of this unit a *S. conservatrix* Community. A low diversity *S. conservatrix* Community has been broadly attributed to the tuffs of unit 4, indicating some sort of restricted depositional environment. The upward shift of communities, in *riccartonensis* Biozone times, reflects a local regressive episode that was probably related to tectonics that preceded the volcanic activity (Hancock, 1982).

There is no evidence of marine conditions after unit 4 was laid down and the overlying lavas and pyroclastics were probably deposited onto a continental landscape of short-lived pools or flowing streams (Hancock, 1982).

The igneous rocks here represent an extremely rare occurrence in the Wenlock Series of the British Isles of true volcanic rocks; moreover they comprise a moderately thick pile. The Dingle Peninsula in Co. Kerry is the only other area in these islands to have a notable Wenlock volcanic–volcaniclastic sequence (e.g. Sloan and Bennett, 1990). Wenlock volcanic activity elsewhere in the Anglo-Welsh area may have been present in the Bishop's Castle district, where three small igneous intrusions have been identified as possible volcanic feeders, but here they are not accompanied by lava flows. In the same district, tuffs have been identified from the borehole sunk at Eaton Farm (Haim, 1962; Cocks and Rickards, 1969; Sanderson and Cave, 1980). Also, an acid tuff of possible late Wenlock, *ludensis* Biozone age has been reported from near Welshpool (Sanderson and Cave, 1980). Apart from these examples, Wenlock age volcanic activity is recognized in Wales and the Welsh Borderland only by the presence of bentonites (e.g. Teale and Spears, 1986). The east Mendips volcanic centre may have been involved in sourcing some of these bentonites.

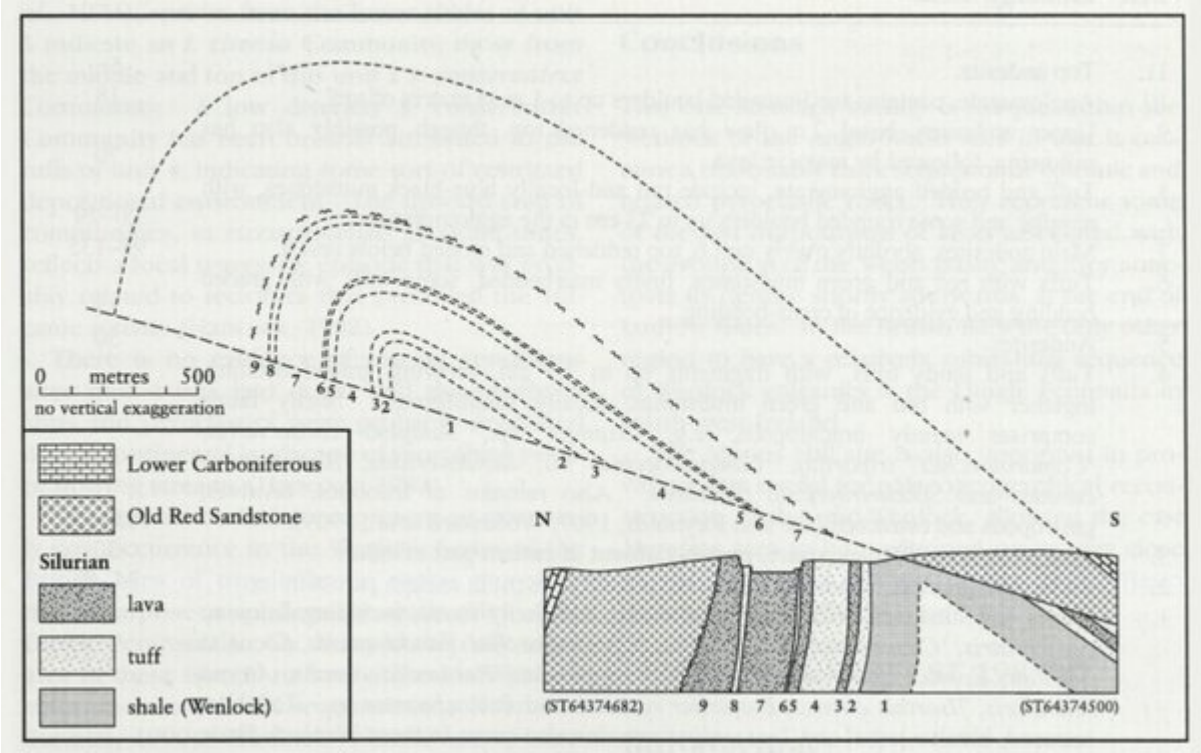
Overall, the nature of the faunas, volcanics and volcaniclastics of the Moons Hill site suggest that this east Mendips area was variously located near or on the south-east margin of the Welsh Basin throughout mid-Wenlock times (Bassett, 1974a; Hurst *et al.,* 1978; Holland, 1992). In the Tortworth Inlier 50 km to the north, the Brinkmarsh Quarry and Buckover Road Cutting GCR sites indicate marine, nearshore conditions there in the early and late Wenlock respectively, but that area was positioned slightly more distally with respect to the shoreline than the east Mendips.

Conclusions

This east Mendips locality is unique within the Wenlock of the Anglo-Welsh area in that it contains a reasonably thick sequence of volcanic and related pyroclastic rocks. They represent some of the last outpourings of lavas associated with the evolution of the Welsh Basin, and they anticipate its demise shortly afterwards, at the end of Ludlow times. In the British Isles the only other region to have a relatively substantial sequence of Wenlock volcanics is the Dingle Peninsula in south-west Ireland.

The Moons Hill site is also important in providing data useful for palaeogeographical reconstruction of the mid-Wenlock, allowing the east Mendips area to be positioned on or very close to the south-east margin of the Welsh Basin throughout this time.

References



(Figure 4.18) Diagrammatic cross-section across the East Mendips (Silurian) Inlier, running southwards from Stoke Lane (after Hancock, 1982).

Unit	Lithology/fossils	Thickness (m)
11.	Top andesite.	5+
10.	Agglomerate, contains well-rounded boulders up to 1 m in matrix of tuff.	18
9.	Upper andesites, basal 2 m flow has reddened top, though possibly also has pillowing, followed by massive lava.	70
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