
Gullet Quarry

[SO 7612 3811]

Introduction

Gullet Quarry is situated within the Malvern Hills at the southern end of Swinyard Hill, to the north of the Gullet Pass (Figure 3.9). The main quarry face is excavated in sheared and metamorphosed late Precambrian (Malvernian) diorites cut by pink granitic veins, but in 1959 quarrying activity in the top north-western corner of Gullet Quarry revealed a contact with the overlying Silurian strata (Reading, 1960). Further quarrying extended the exposures of the Wyche Formation, a sequence of shales, siltstones, sandstones and bioclastic limestone lenses dipping westwards at 60° near the contact and containing fossils demonstrating a Telychian age. Descriptions of the exposures, especially at the contact, have been provided by several authors, most of whom have interpreted the junction as an unconformity (among others Reading and Poole, 1961, 1962; Butcher, 1962; Shelford, 1964; Tucker, 1964; Ziegler, 1964; Brooks and Druce, 1965; Ziegler *et al.*, 1968b; Penn and French, 1971; Aldridge, 1972; Bullard, 1989; Worssam *et al.*, 1989). Whitworth (1962) and Phipps and Reeve (1964, 1969), however, regarded the contact as faulted, consistent with the regional view forwarded by Groom (1900), who believed that a Western Boundary Fault delimited all of the western margin of the Malvern Hills.

While slickensides and shear zones testify to faulting in the vicinity of the contact, the rounded boulders, some exotic, in the basal conglomeratic limestone and the presence of a neptunian dyke containing rounded pebbles within the Malvernian high in the quarry attest to the unconformable nature of the contact (Brooks and Druce, 1965). Movement along the contact zone has certainly occurred during adjustment to the tectonic tilting of the succession, but the evidence supports an original sedimentary contact between the Precambrian and Llandovery rocks. This is, therefore, a key locality in displaying the nature of the eastern margin of the Welsh Basin during the late Llandovery epoch and in demonstrating that an early Silurian shoreline existed in this area.

Description

The basal conglomerate is discontinuous, occurring as patches up to 1 m thick along the Malvernian surface (Figure 3.10). It is extremely variable, with a matrix of limestone, sand or clay, but is generally non-calcareous and haematite-stained immediately above the contact. Boulders are up to at least 80 cm in size and include diorite, dolerite, granite and quartz, consistent with derivation from the adjacent Malvernian. Some pebbles of fine-grained tuff are probably derived from the nearby Warren House Volcanic Group, also of late Precambrian age (Brooks and Druce, 1965). The limestone matrix contains shelly layers with a diverse assemblage of corals, brachiopods, stromatoporoids, bryozoans and crinoid ossicles. Ziegler *et al.* (1968a) regarded this fauna as a mixture of rocky bottom and soft bottom forms. Conodont elements have been recovered by dissolution of the limestone (Brooks and Druce, 1965; Aldridge, 1972), and include the stratigraphically useful taxa *Ozarkodina gulletensis* and *Aulacognathus kuehni*, indicative of a position low in the *Pterospathodus celloni* Biozone. The stratigraphically important brachiopod *Eocoelia curtisi* occurs in the basal conglomerate and in the beds immediately above (Ziegler *et al.*, 1968b).

The section in the Wyche Formation (Figure 3.11) is dominated by shales and siltstones, with some thicker sandstone beds, mostly 8–20 cm thick, but with one prominent bed of 80 cm. Thin limestone lenses occur sporadically and the bases of some of the sandstones are uneven with patches of calcareous bioclastic material. Scours, groove casts and prod marks are common on the lower surfaces of many of the sandy beds, and some of the upper surfaces display ripple marks.

Fossils are abundant, particularly in shelly lags at the bases of sandstone units and in decalcified sandy limestones. Corals and brachiopods dominate the macrofauna, with crinoid ossicles, nautiloids, gastropods, bryozoans, trilobites and rare graptolites also recorded. The trace fossil *Chondrites* is common. Ziegler *et al.* (1968b) reported two benthic marine communities in the rocks above the basal unit: a *Pentameroides* Community in the beds immediately above the

conglomerate and a *Costistricklandia* Community in higher strata. One horizon in the quarry, about 9 m above the base of the Wyche Formation, was selected by Ziegler *et al.* (1968a) as providing the typical collection for the *Costistricklandia* Community (Figure 3.12). The stratigraphically important brachiopods *Costistricklandia lirata alpha* and *Eocoelia curtisi* occur at this level (Ziegler *et al.*, 1968a). Conodont elements occur sporadically in the shale and are abundant and diverse in the limestone lenses. Aldridge (1972) recorded the important taxa *Icriodella inconstans*, *Kockelella ranuliformis* and *O. gulletensis* in the main face, with the addition of *Pterospathodus celloni* and *Apsidognathus tuberculatus* in an isolated lens found above the main sequence (Figure 3.13). All the exposed beds are referable to the *P. celloni* conodont biozone.

As well as providing a representative section for Telychian fossil biotas on the eastern shelf of the Welsh Basin, the quarry is the type locality for the stratigraphically important conodont species *I. inconstans* Aldridge, 1972, and *O. gulletensis* (Aldridge, 1972), the brachiopod *Stricklandia laevis* (J. de C. Sowerby, 1839), and the possible medusoid *Duodecimedusina palmeri* Strachan, 1968.

Interpretation

The basal conglomerate represents the initial deposits of a transgressive pulse in the late Llandovery, with the Wyche Formation overstepping the underlying Cowleigh Park Formation (late Aeronian) to onlap directly onto the Malvernian. Reading and Poole (1962) noted that rounded boulders within the conglomerate are embedded in a matrix of undistorted, and often unbroken, brachiopods and corals and that the horizon could not represent a fault breccia. They interpreted the irregular surface of the Malvernian below the contact to represent the remains of sea stacks in front of a retreating cliffline. Fragments of various sizes would have fallen occasionally into the sea and become incorporated into whatever sediment was being deposited in the immediate vicinity of the stack (Brooks and Druce, 1965). Some rounding of the blocks may have been caused by weathering processes before they became detached.

The overlying strata of the Wyche Formation record the development of a shallow marine environment, into which pulses of silty and sandy sediment were delivered, perhaps during storms. The presence of a *Costistricklandia* Community a few metres above the basal conglomerate suggests fairly rapid deepening of the sea.

Gullet Quarry is one of two local exposures that show an unconformable contact of Telychian strata on the Malvernian; the other, less well exposed, is at Sycamore Tree Quarry [SO 7646 4594] at West Malvern, 8 km to the north of Gullet Quarry. Other temporary exposures of the contact that have been reported from time to time have been variously interpreted as unconformable or faulted; a full summary of all the literature on these localities was provided by Barclay *et al.* (1997). As pointed out by Reading and Poole (1962), it is beside the point that some localities may display a faulted junction; the demonstration of an unconformity at any one locality is sufficient to establish the case for an original sedimentary contact. Some authors (e.g. Brooks, 1970), indeed, have considered that there is little evidence for major faulting of the contact along much of the western Malvern margin, largely upholding the original interpretation by Phillips (1842, 1848) of the boundary as an unconformity for its entire 9 km length.

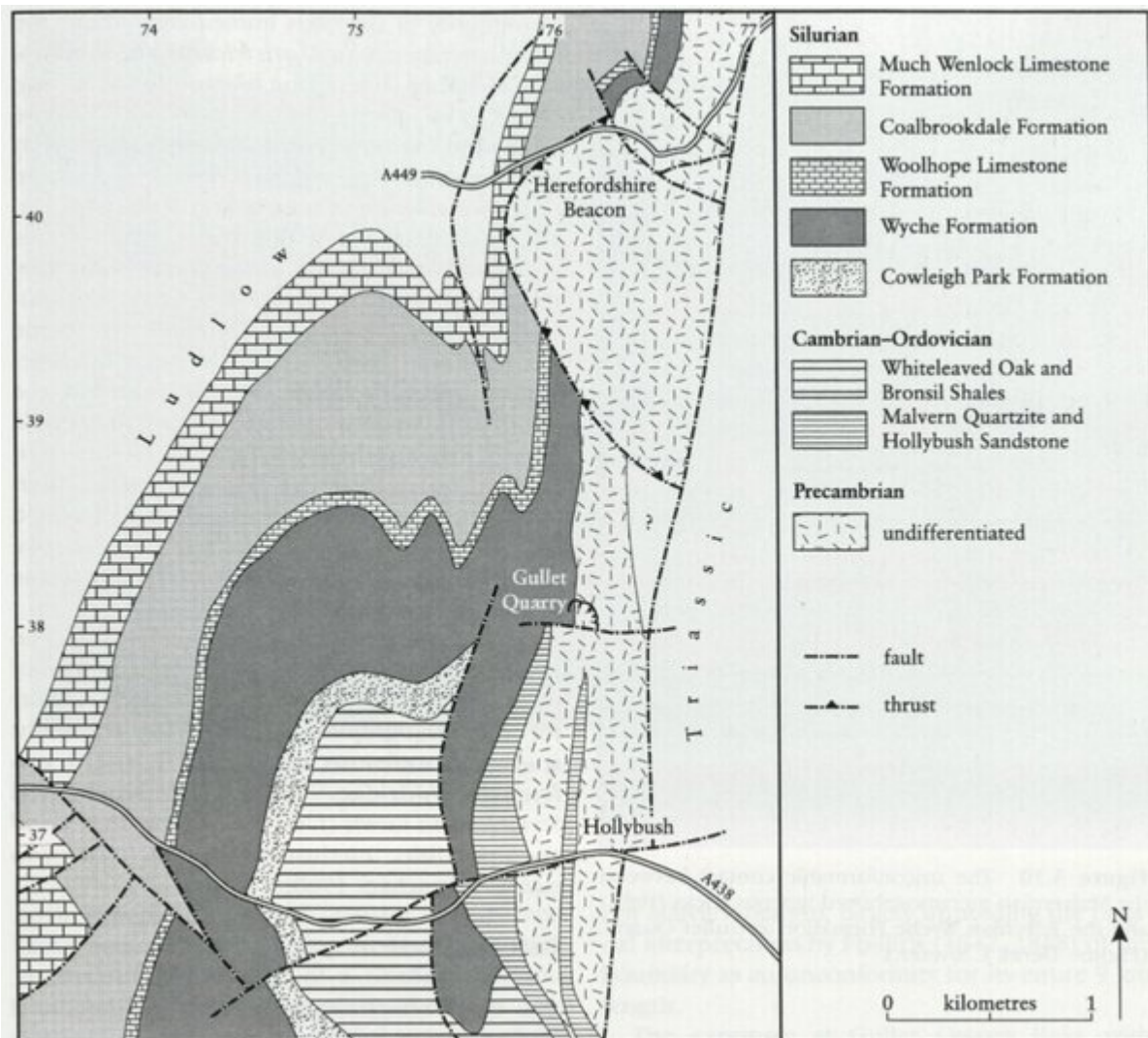
The exposure at Gullet Quarry links with other sites in the Welsh Borderland (Hope Quarry, Hillend Farm, Wistanstow) to provide evidence of the position and nature of the eastern margin of the Welsh Basin during late Llandovery time. Open marine shelf deposits are also exposed to the south in the Tortworth Inlier at Damery Bridge, where two lava flows testify to volcanic activity in that area (e.g. Cullimore's Quarry); the only evidence for Telychian volcanicity in the Malverns, including Gullet Quarry, comes from occasional thin bentonite (volcanic ash) beds.

Conclusions

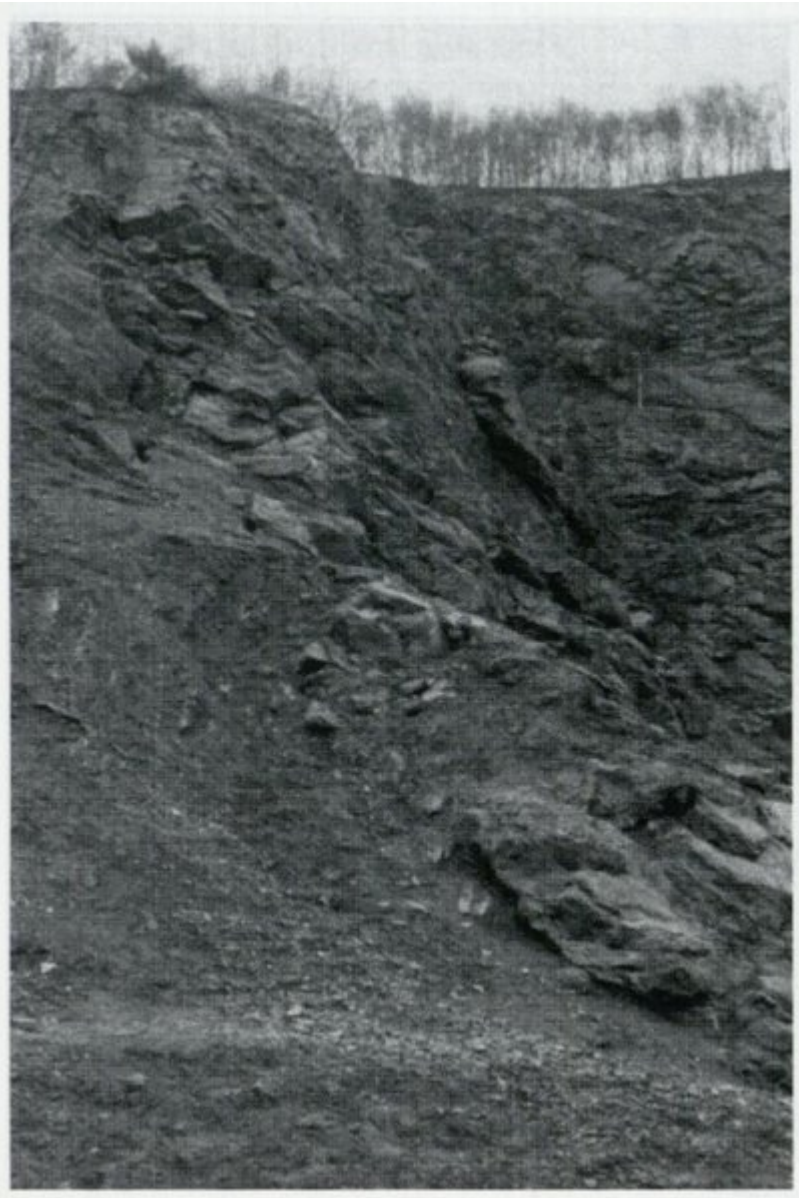
As well as displaying the unconformable contact between the Malvernian igneous rocks and the Telychian sediments, Gullet Quarry provides the largest exposure of the Wyche Formation in the Malvern Hills. The locality, therefore, has considerable local importance in demonstrating the nature of the Early Silurian sediments and their stratigraphical relationships. On a regional scale, the quarry provides significant evidence for the position of the late Llandovery eastern shoreline of the Welsh Basin and for the development of the eastward transgression of the Early Silurian sea. Gullet

Quarry has also provided a major focus for the debate on the nature of the Malvernian–Llandovery contact and, consequently, on the structural evolution of the Malvern Hills and surrounding areas of the Welsh Borderland. It is a site of major scientific and historical importance and has a very high conservation value.

References



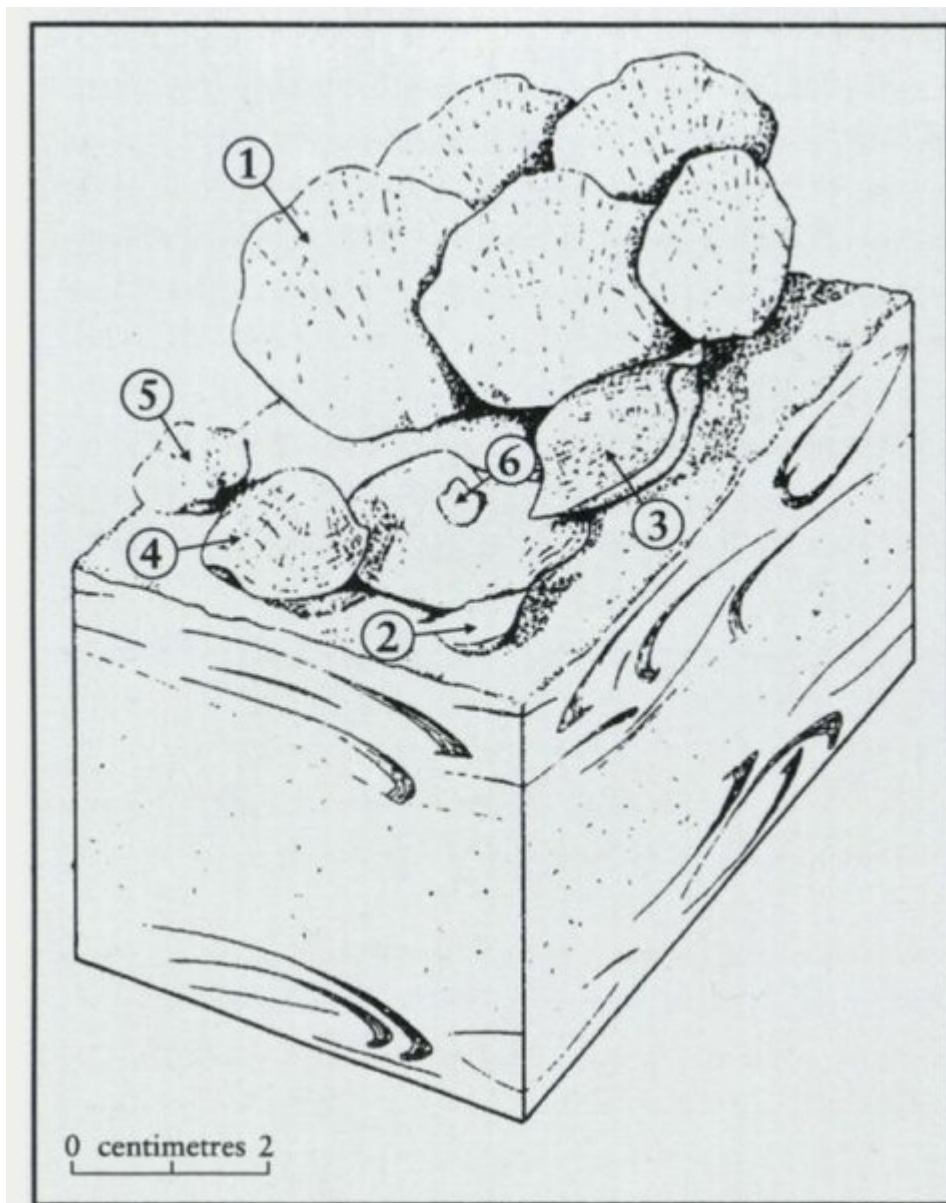
(Figure 3.9) Outline geological map of the southern Malvern Hills, showing the location of Gullet Quarry (after Aldridge and Smith, 1985).



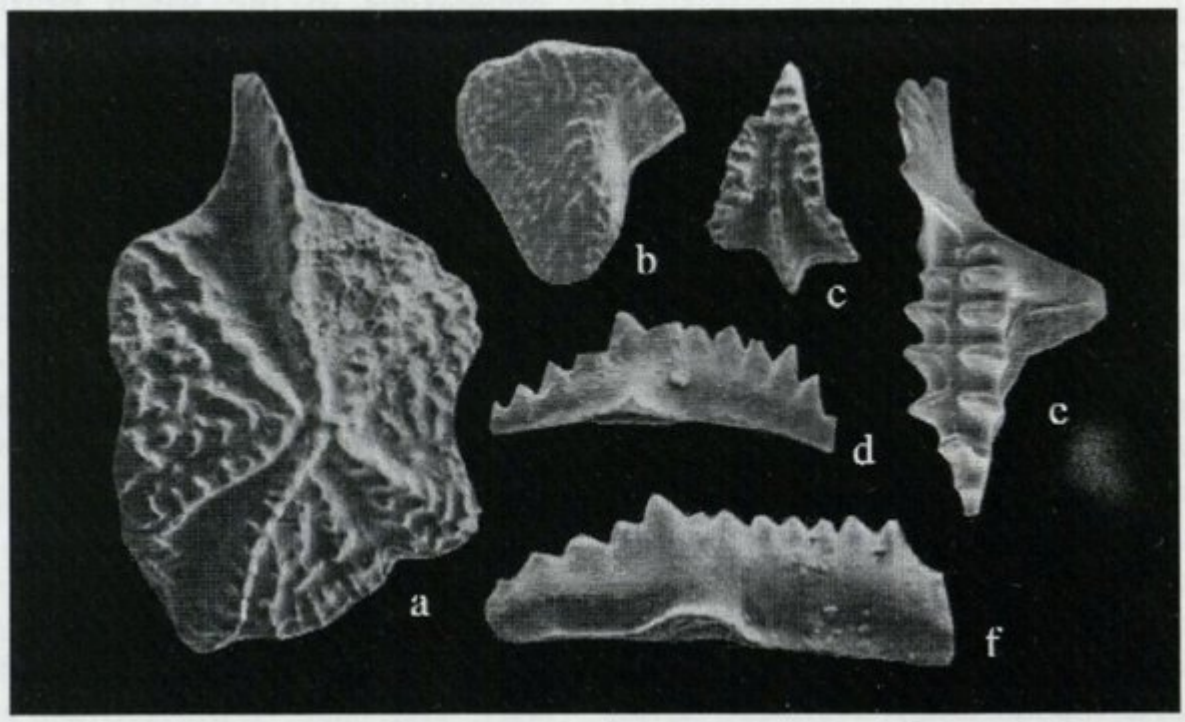
(Figure 3.10) The unconformable contact between the Malvernian metamorphosed igneous rocks (right) and the Telychian Wyche Formation at Gullet Quarry. (Photo: Derek J. Siveter.)



(Figure 3.11) The Wyche Formation at Gullet Quarry (Photo: Derek J. Siveter).



(Figure 3.12) Reconstruction of the *Costistricklandia* benthic community, based on a collection from Gullet Quarry (after Ziegler et al., 1968a). The fossils represented are: (1) *Costistricklandia lirata alpha*; (2) *Pholidostrophia salopiensis*; (3) *Eospinter radiatus*; (4) *Atrypa reticularis*; (5) *Clorinda globosa*; (6) *Protathyris* sp.



(Figure 3.13) Representative conodont elements from Gullet Quarry (a-c) *Apsidognathus tuberculatus*, platform, lenticular and lyriform elements, x 40; (d) *Pterospathodus celloni*, Pa element, x 40; (e) *Icriodella inconstans*, Pa element, x 50; (f) *Ozarkodina gulletensis*, Pa element, x 40. (Photos: from Aldridge, 1975.)