Granham's Moor and Eastridge Wood and Linley Big Wood

[SD 392 00374]–[SD 3888 0360], [SJ 3400 9496]–[SJ 3422 9482]

Introduction

These two nationally significant localities are complementary and were selected to show the appearance of a conformable passage from the Tremadoc into the Arenig. Unlike the graptolitic passage beds at Trusmadoor in the Lake District, here the passage is in shallow-water facies at these localities. Until recently it had been thought that there was a break in the succession at Granham's Moor between the Tremadoc Habberley Formation and the Arenig Stiperstones Quartzite Formation, but now new work indicates that, if present, this is of insignificant duration.

The Habberley Formation, whose type area is in Habberley Brook immediately to the east of the present site, was introduced (as Habberley Shales) by Lapworth (1916, p. 37). However, the rocks had been noted long before, by Murchison (1872, p. 37), who described them as 'black schists' of '*Lingula*-Flags age', and by Callaway (1878, p. 333), who inferred, on the basis of their lithology and stratigraphical position, that their age was equivalent to the Shineton Shales of the Wrekin district. Although the term 'Habberley Shales' was retained by Watts (1925) and in earlier publications by Whittard (e.g. 1931a, 1955), Whittard later (1960, p. 144; 1979, p. 10) concluded that they were synonymous with the Shineton Shales. Stubblefield and Bulman (1927, p. 116) recorded *Rhabdinopora flabelliformis* (Eichwald) and *Adelograptus tenellus* (Linnarsson) from lower horizons, whilst Whittard (1931b, p. 344) reported the identification by Stubblefield of the trilobite '*Shumardia pusilla*'(now referred to *Shumardia* (*Conophrys*) *salopiensis*) in a trench [SJ 3894 0370] that had been excavated to expose the Tremadoc—Stiperstones Quartzite junction. The identification of that species in shales immediately below the Stiperstones Quartzite suggested the presence of the *pusilla* Zone of the Tremadoc and, by inference, the absence of later Tremadoc strata such as occur above it in North Wales. Whittard (1931a, p. 324, fig. 45) considered the unconformity to be marked by a conglomerate at the base of the Stiperstones Quartzite. Whitehead (in Pocock *et al.,* 1938, p. 72), however, believed that the junction could be conformable though 'not necessarily without a break in deposition', and because the dips of the quartzite and underlying siltstones are concordant, Whittard (1979, p. 10) described the junction as being disconformable.

Reinvestigation by Fortey and Owens (1992) of the Granham's Moor site, and of Linley Big Wood to the south (Figure 7.11), has shown that a far more complete succession of Tremadoc strata is present than was formerly supposed, and they revived the name 'Habberley Formation' for the higher, more arenaceous, part of the succession. By collecting the olenid trilobites *Angelina sedgwickii* Salter and *Peltocare olenoides* (Salter) they demonstrated the presence of the *sedgwickii* Zone in strata underlying those that had yielded the supposed *Shumardia* exposed in Whittard's trench; reexamination of the latter specimen by Rushton revealed that it is not a trilobite, but the bradoriid crustacean *Beyrichona* cf. *triceps* (Matthew) (compare (Figure 7.9)c; see Williams and Siveter, 1998), thereby removing evidence for the *salopiensis* Zone at that locality. Above the shales with *Angelina* and below the Stiperstones Quartzite, Fortey and Owens (1992) described a sequence of micaceous siltstones and flags with the trilobite *Asaphellus* cf. *graffi* (Thoral), which characterizes a level not seen in North Wales, in which the *sedgwickii* Zone is overlain unconformably by the Arenig Garth Grit. They demonstrated a similar sequence along the length of the outcrop, and the fine section in Linley Big Wood repeats that seen at Granham's Moor and includes a more complete succession. Fortey and Owens could find no evidence for any unconformity or disconformity, and they concluded that there was likely to be no break in the succession. The Linley Big Wood section was considered as a candidate for definition of the base of the Arenig Series in Britain (Fortey *et al.,* 1991, p. 10).

Description

Granham's Moor

The lowest beds of the Habberley Formation are seen along the north side of a forestry road leading from Habberley into Eastridge Wood (Figure 7.11), where some 50 m of black shales with thin turbidites, dipping at 80° to the west, crop out around [SD 3913 0373]. In the lane to the east [SD 3920 0374] these beds pass downwards into buff, micaceous shales lithologically not unlike those of the highest Shineton Shales, but here they have not proved fossiliferous. They demonstrate the lithological difference between the Shineton Shales (restricted) and the Habberley Formation. Beds some 20 m above the base of the Habberley Formation have yielded rare trilobites, including *Angelina sedgwickii* and *Peltocare olenoides,* and an orthoconic nau-tiloid, *Anguloceras sericeum* (Salter), all of them forms typical of the *sedgwickii* Zone in North Wales. These beds pass up into black, buff-weathering shales with siliceous nodules. Whittard's (1931b) trench [SJ 3894 0370] is still visible, although rather degraded. A forestry road immediately to the west is more instructive in showing the uppermost Habberley Formation. At several points between 3 m and 70 m below the Stiperstones Quartzite, sparse trilobites (*Asaphellus* cf. *graffi*) and lingulate brachiopods (*Lingulella bella* Walcott) have been recovered from a sequence of black, micaceous, rusty-weathering flags and silty shales. These are overlain by well-bedded sandstones that are characteristically green when freshly fractured, owing to the presence of a chloritic cement. Immediately below the Stiperstone Quartzite are about 2–3 m of black shales with flaser bedding picked out by paler, silty seams; these are seen near the entrance to a quarry. These shales yielded the *Asaphellus* and the '*Shunzardia*' in Whittard's trench. The Stiperstones Quartzite Formation, as exposed in, for example, the quarry centred on [SD 3888 0360], is typified by massive, compact, moderately well-bedded pale quartzite (Figure 7.12), which at some localities yields *Skolithos* tubes perpendicular to the bedding and other trace fossils. The only body fossils to have been recovered from the Stiperstones are poorly preserved lingulate brachiopods (Williams, 1974, p. 11) and two specimens of the characteristically Arenig trilobite *Neseuretus ramseyensis* Hicks, one of which is from a loose block at Upper Vessons, about 1.5 km south of this site.

Linley Big Wood

A more extensive section through the Habberley Formation, also showing its upward passage into the Stiperstones Quartzite, was cleared by English Nature along a forestry road [SJ 3400 9496]–[SJ 3422 9482] in Linley Big Wood, south of Black Rhadley Hill, at the southern end of the outcrop (Figure 7.11); this section complements the Granham's Moor site, and between them they expose most of the Habberley Formation succession (Fortey and Owens, 1992). The lower part of the section [SJ 3418 9442] shows turbiditic sandstones interbedded with shales, dipping west at about 60°; Fortey and Owens (1992) correlated these with the uppermost division of the Shineton Shale Formation. The base of the Habberley Formation is taken at the overlying black, flaggy, micaceous siltstones. The mid-part of the Habberley Formation, faulted out at Granham's Moor, is present at Linley Big Wood and consists of 150 m or more of black flags. It is almost unfossiliferous but nearby, at Nipstone Rock, has yielded a single specimen of *Angelina sedgwickii.* The upper beds of the formation comprise shales with rare olenids (*Angelina, Beltella, Leptoplastides*) , overlain by bioturbated flaggy sandstones and shales with *Lingulella bella* and *Asaphellus* cf. *graffi.* These beds underlie the Stiperstones Quartzite, which is taken as the local base of the Arenig, and lithologically they much resemble the Mytton Formation, which overlies that formation. Further details of the section are recorded in Cave and Haim (in press).

Interpretation

In other outcrops of the Tremadoc Series in the Welsh Basin there is a break at the top of the succession prior to the deposition of the earliest Arenig sediments. It is possible that deposition became restricted later in the Tremadoc Epoch, and conditions possibly became dysaerobic at times, since an olenid trilobite biofacies, indicative of such conditions, became established both here and in North Wales. Some horizons of flaggy beds near the top of the Habberley Formation well-seen in Linley Big Wood are virtually unfossiliferous, perhaps signalling a completely anaerobic regime. Restricted circulation and regional unconformity may both be a result of basin inversion or of local tectonics. A barrier to the open sea to the west may have produced a largely stagnant basin. The presence near the top of the Habberley Formation of bioturbation and of a restricted fauna (*Asaphellus* and *Lingulella*) suggests a return to more normal oxygenation. Most of the Habberley Formation sequence was interpreted by Fortey and Owens (1992) as a shallowing-upwards sequence, possibly related to a regression event at the end of the Tremadoc. There may be a slight hiatus below the overlying Stiperstones Quartzite Formation that represents prograding sands deposited at the initiation of the subsequent transgression. The presence of *Skolithos* 'pipe-rock' in the overlying Stiperstones indicates deposition

in shallow water (Droser. 1991).

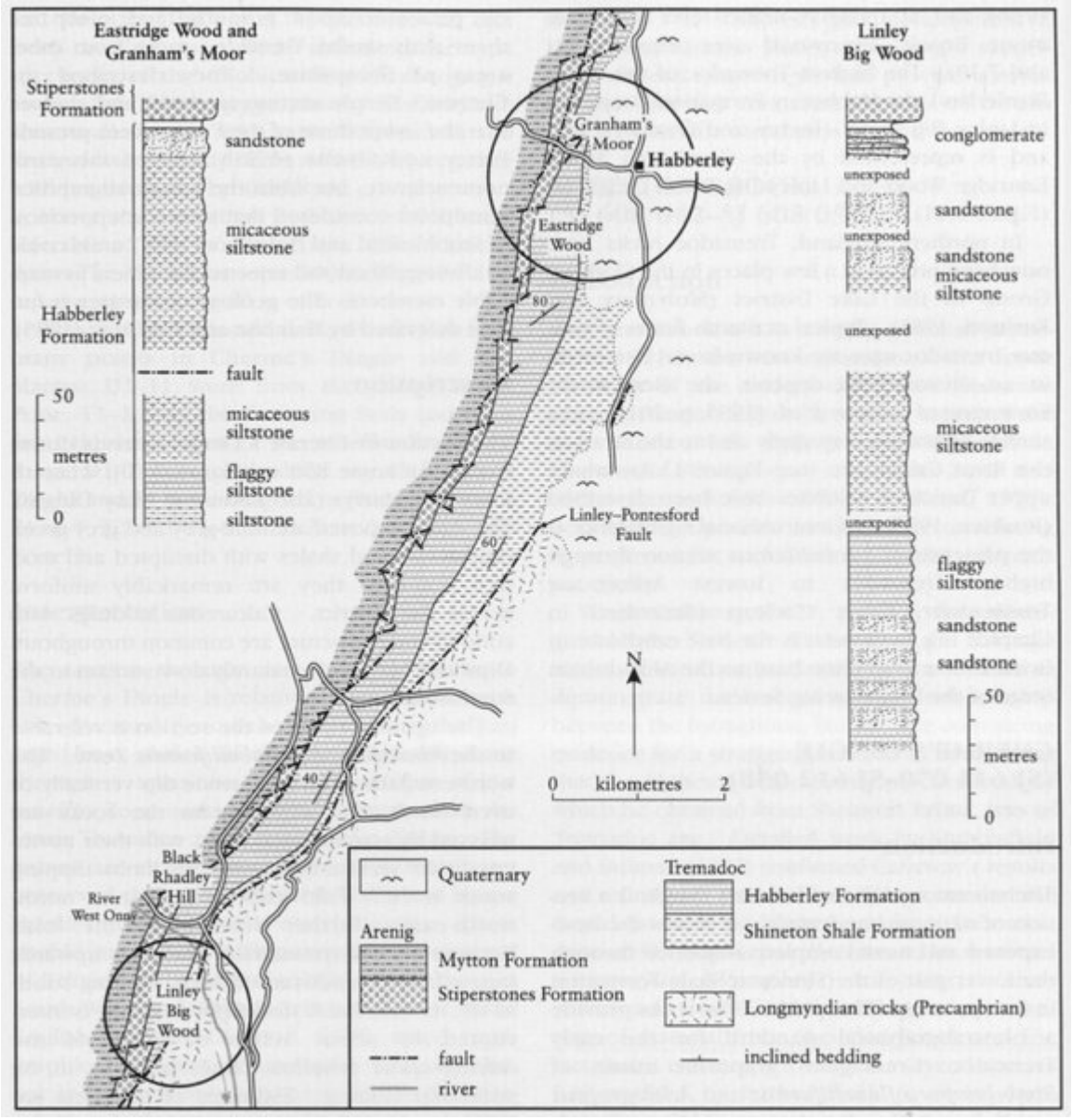
Although the fauna of the Habberley Formation is sparse, the presence of the trilobites *Angelina sedgwickii* and *Peltocare olenoides is* crucial in affording correlation with the uppermost Tremadoc rocks seen in the North Wales sequence; this constrains the age of the upper part of the Habberley Formation, which has so far afforded no fossils diagnostic for correlation, as *Lingulella bella* seems to have quite a long range in Newfoundland (Rushton, in Fortey and Owens, 1992), and the specimens that Fortey and Owens (1992, p. 563) assigned to *A*. cf *graffi* show differences from the Lower Arenig species *A. graffi.*

The stratigraphical position of the Habberley Formation may well correspond, at least in part, to the Hunnebergian Stage in Scandinavia (Fortey and Owens, 1992). It is also homotaxial with the Watch Hill Formation and the base of the Hope Beck Formation in the Lake District (see site report for Trusmadoor), but there the strata are graptolitic and can be correlated only indirectly with the Habberley Formation.

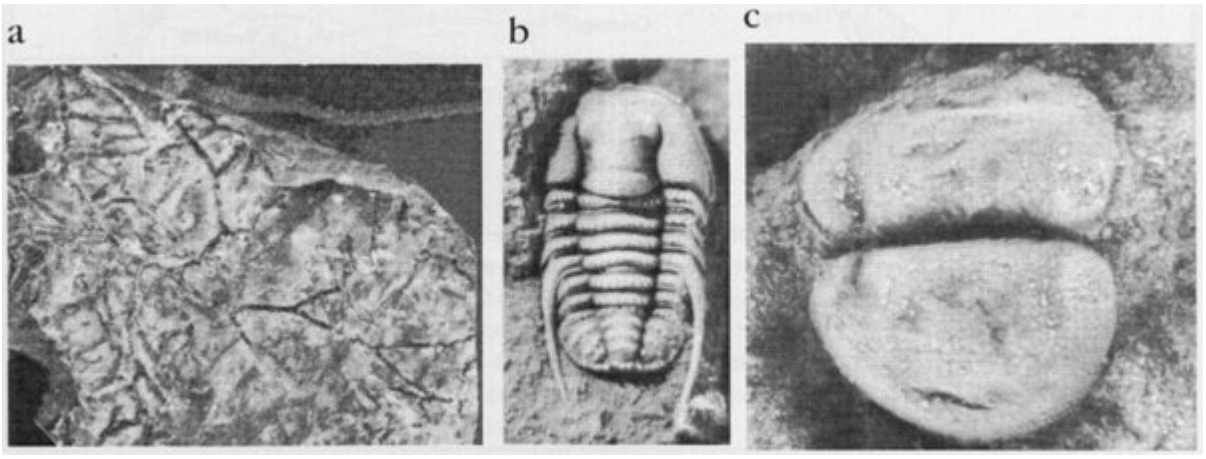
Conclusions

Granham's Moor and Linley Big Wood are of national importance, being the only places in Wales and the Welsh Borderland showing a transition from the Tremadoc to the Arenig series and the only sites in which this transition can be seen in a trilobite-bearing facies.

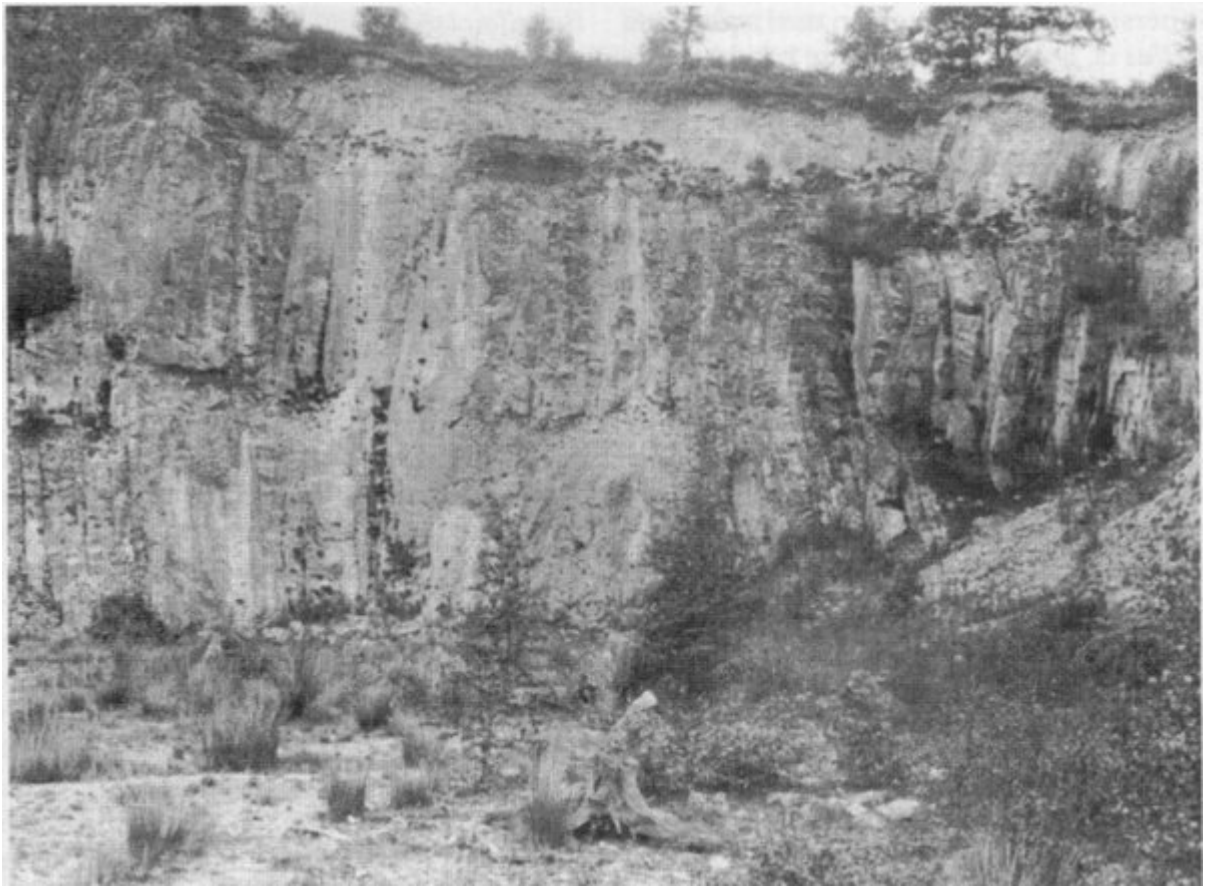
References



(Figure 7.11) Geological sketch-map of the Tremadoc rocks from the area of Granham's Moor to Linley Big Wood, with vertical sections exposed in each area, after Fortey and Owens (1992, fig. 1).



(Figure 7.9) Fossils from Tremadoc sites. (a) Adelograptus tenellus (Linnarsson), x 3, Cwm Crymlyn. (b) Shumardia (Conophrys) salopiensis Callaway, x12, Sheinton Brook. (c) Beyrichona triceps Matthew, x 25, Coundmoor Brook, Evenwood.



(Figure 7.12) Granham's Moor Quarry, 1 km east of Habberley [SJ 3886 0350]. The vertical beds of the Stiperstones Quartzite Formation (Arenig) strike SSW. The underlying flaggy beds of the uppermost Habberley Formation (Upper Tremadoc) are just beyond the left edge of the photograph. (Photo: British Geological Survey photographic collection, A4808.)