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# Sunnyhill, Mary Knoll Valley

[SO 4950 7255]–[SO 4973 7244]

## Introduction

This site is located adjacent to a track in Mary Knoll Valley, Mortimer Forest, about 2.7 km SSW of Ludlow, Shropshire (Figure 5.6), (Figure 5.10). The north-west face of the disused Sunnyhill Quarry contains a section that defines part of the chronostratigraphy of the type Ludlow Series in the area of the Ludlow Anticline (Holland *et al.*, 1959, 1963; see also Cocks *et al.*, 1971, 1992). 'Sunny Hill Bank' was a locality noted by Murchison himself (1839, p. 203). The geology of the quarry was first treated in modern terms by Holland *et al.* (1963) and has been highlighted in many subsequent papers (Lawson, 1973a; White and Lawson, 1978; Bassett *et al.*, 1979; Watkins, 1979; Cherns, 1988; Lawson and White, 1989; Siveter *et al.*, 1989, locality 3.6, figs. 48–50, 47 [*non* 51, in error], 53D).

Sunnyhill Quarry [SO 4953 7255] displays the lower part of the Lower Leintwardine Formation (Leintwardine Group, Ludfordian Stage) resting on the underlying Upper Bringewood Formation (Bringewood Group, Gorstian Stage) (Figure 5.10), (Figure 5.11), (Figure 5.12). Holland *et al.* (1963) designated this section as the standard locality for the base of the then Leintwardinian Stage and the Lower Leintwardine Beds, at a level coincident with the base of their lithological Unit C in the section.

Following rationalization of Ludlow stratigraphy, which established two rather than the previous four stages for the Series, the Subcommittee on Silurian Stratigraphy of the International Union of Geological Sciences endorsed the work of Holland and co-workers by selecting Sunnyhill Quarry as the global boundary stratotype section for the base of the Ludfordian Stage, at a level there coincident with the base of the Lower Leintwardine Formation (Bassett *et al.*, 1979; Holland, 1980a, b; Holland *et al.*, 1980; Martinsson *et al.*, 1981; see Lawson and White, 1989). Sunnyhill Quarry is also the nominated standard basal boundary reference section for the latter lithostratigraphical unit (Holland *et al.*, 1963; Lawson and White, 1989). A 20 cm thick bentonite (Bed C4 of White and Lawson, 1978) occurring 3.45 m from the top of the Upper Bringewood Formation in Sunnyhill Quarry has been radiometrically dated at  $407 \pm 14$  Ma (Ross *et al.*, 1982; Bassett, 1984).

The contiguous trackside outcrop to the south-east of the quarry has, for some 250 m, more or less continuous exposure. It displays (Lawson and White, 1989) a body stratotype of the Lower Leintwardine Formation ([SO 4950 7255]–[SO 4969 7246]) and a basal boundary reference section and a body stratotype for both the Upper Leintwardine Formation [SO 4969 7246] and, in Overton Quarry, the Lower Whitcliffe Formation [SO 4973 7244].

## Description

All strata dip gently ESE. The Upper Bringewood Formation exposure, seen at the western end of the quarry, consists of about 4.7 m of grey, fossiliferous, dominantly nodular silty limestones (the 'Aymestry Limestone' of earlier nomenclature). This facies also characterizes the basal 2.3 m of the Lower Leintwardine Formation, above which the latter consists of some 30 m of relatively thinly bedded, flaggy and laminated calcareous siltstones extending from the quarry itself into adjacent trackside exposures (Figure 5.13). Bed C of Holland *et al.* (1963), forming the basal lithological unit of the Lower Leintwardine Formation, is a 6 mm thick shale parting, 48 cm and 91 cm above which are a 5 cm shale (possible bentonite) and 8 cm bentonite respectively.

Precise faunal definition of the base of the Ludfordian at the stratotype is currently difficult. Bivalve, gastropod, coral, bryozoan and especially (mostly long-ranging) articulate brachiopod species, together with fewer cephalopod, trilobite, graptolite and annelid species, comprise the main, generally diverse macrofaunal assemblages in the two formations at Sunnyhill Quarry (for a full macrofaunal list see Holland *et al.*, 1963; Watkins, 1979; Cherns 1988; Lawson and White, 1989). Although there are clear, overall shelly macrofaunal changes between the Upper Bringewood and Lower Leintwardine formations (see Cherns, 1988; Lawson and White, 1989), such changes are not as marked at Sunnyhill

Quarry (partly because of the comparatively sparse nature of its high Upper Bringewood Formation 'residual' assemblages) as elsewhere in the type Ludlow area. Indeed, the macrofaunas 2 m either side the boundary at Sunnyhill Quarry are substantially similar (Holland *et al.*, 1963, p. 143). That said, it should be noted that Watkins (1979, p. 258, fig. 16) logged a faunal change in benthic invertebrates, from his *Mesopholidostrophia laevigata* Association to his *Sphaerirhynchia wilsoni* Association, at a level just below the base of the Lower Leintwardine Formation at Sunnyhill Quarry. Elliott's (1995) study recognized rich palynofloral assemblages at the stratotype section at Sunnyhill Quarry.

Based on shelly macrofossil evidence it is the reduced abundance or disappearance of several species at or just below the base of the Lower Leintwardine Formation that most obviously flags that level at Sunnyhill Quarry (Holland *et al.*, 1963; Lawson and White, 1989). This applies to the brachiopods *Kirkidium knightii*, *Strophonella euglypha* and *Eospirifer radiatus*, the trilobite *Dalmanites myops*, the gastropod *Poleumita globosa* and to solitary rugose (e.g. *Palaeocyclus*) and tabulate (e.g. heliolitid and favositid) corals. Based on local macrofossil correlation the Gorstian–Ludfordian boundary at Sunnyhill Quarry approximates to the base of the *Saetograptus leintwardinensis* Biozone. The latter taxon occurs in the basal parts of the Lower Leintwardine Formation in, for example, the nearby areas of Leintwardine and Aymestrey but is uncommon in the Ludlow area itself until the upper half of the formation (see Lawson and White, 1989). Sparse material of *S. leintwardinensis* subspp. indet. is recorded from various parts of the Lower Leintwardine Formation at Sunnyhill Quarry (Cherns, 1988).

The junction of Dorning's acritarch zones L2 and L3 appears to coincide with the Gorstian–Ludfordian boundary but the stratigraphical details needed to confirm this are not given (Dorning, 1981b, table 1; cf. Lawson and White, 1989, p. 86). The base of chitinozoan Biozone 9 of Sutherland (1994) is drawn at the appearance of his *Gotlandochitina?* sp. A, just below the Gorstian–Ludfordian boundary at Sunnyhill Quarry. Conodont faunas from both formations present at Sunnyhill Quarry are dominated by *Ozarkodina confluens*, *Ozarkodina excavata* and *Panderodus* spp.; the basal Lower Leintwardine Formation also contains *Kockelella variabilis* and *Coryssognathus dubius* (Aldridge and Smith, 1985). Although only very sparse ostracods are recorded from Sunnyhill Quarry itself, a fauna with *Neobeyrichia nutans* and *Hemsiella cf. loensis* characterizes the Lower Leintwardine Formation and its correlatives in the type Ludlow and other Welsh Borderland districts and Baltic sequences (Siveter, 1978, 1989; see also Lawson and White, 1989).

## Interpretation

The rocks at Sunnyhill represent sedimentation on the relatively shallow-water shelf of the Midland Platform, which occupied much of present day central England and contiguous areas in the Welsh Borderland throughout most of the Silurian (Siveter *et al.*, 1989, fig. 10; Bassett *et al.*, 1992, figs S4b, S5a). To the west lay the deeper areas of the Anglo-Welsh depositional basin.

The Upper Bringewood impure biocalcarenites and calcilitites, yielding brachiopods and corals, are thought to have formed in relatively low to moderate energy, muddy carbonate back-barrier shelf conditions (Watkins and Aithie, 1980). At Sunnyhill Quarry carbonate dominated deposition persists into earliest Ludfordian times and is succeeded by predominantly clastic silt sedimentation, which signals a general lowering of depositional energy levels on the shelf (Cherns, 1988). These calcareous (and in some cases nodular and laminated) siltstones of the Lower Leintwardine Formation reflect subtidal, sometimes storm-influenced, shelf environments with diverse, level-bottom, benthic macro-epifauna. Interbedded with the carbonate-rich muddy silts are mud- and grain-supported skeletal sand, representing lag deposits and episodes of higher current energy (Cherns, 1988).

Many other GCR sites in the Welsh Basin have strata recording the level of the middle Ludlow, Gorstian–Ludfordian boundary; most of these occur in the Welsh Borderland. Those of marine shelf aspect include Goggin Road, Deer Park Road, Wigmore Road, Aymestrey Quarries, Mocktree Quarries and Bow Bridge in the Ludlow to Leintwardine area of Shropshire; Woodbury Quarry in the Abberley Hills; Perton Road in the Woolhope Inlier; Wood Green at May Hill; Linton Quarry at Gorsley; and Turner's Hill in central England. In contrast the Sawdde Gorge section in southern Wales reflects a more basin margin environment.

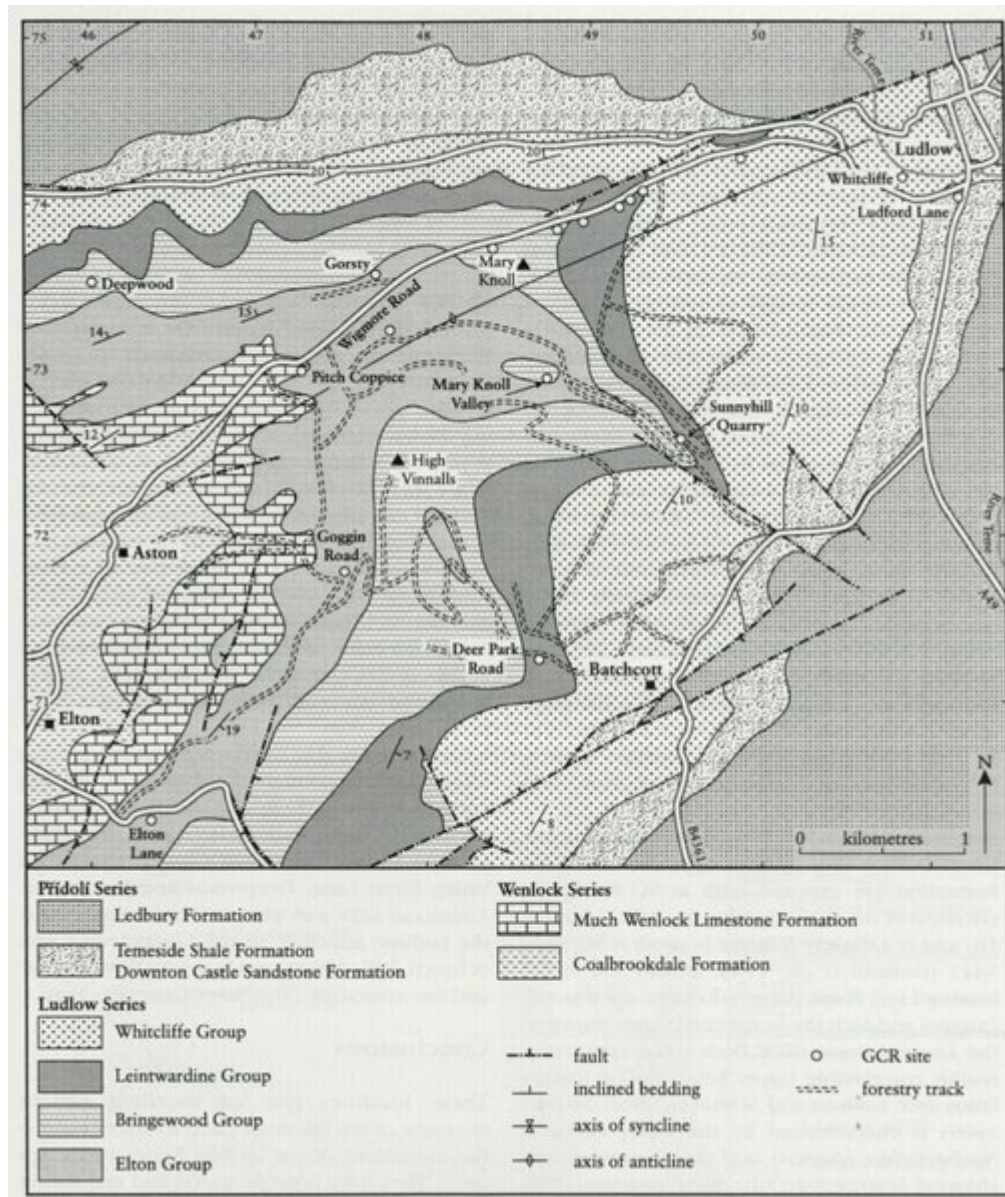
## Conclusions

An important time plane in global history is drawn in the fossiliferous marine sediments of Sunnyhill Quarry, a site that provides several important reference sections in type Ludlow stratigraphy. It is a site of international importance.

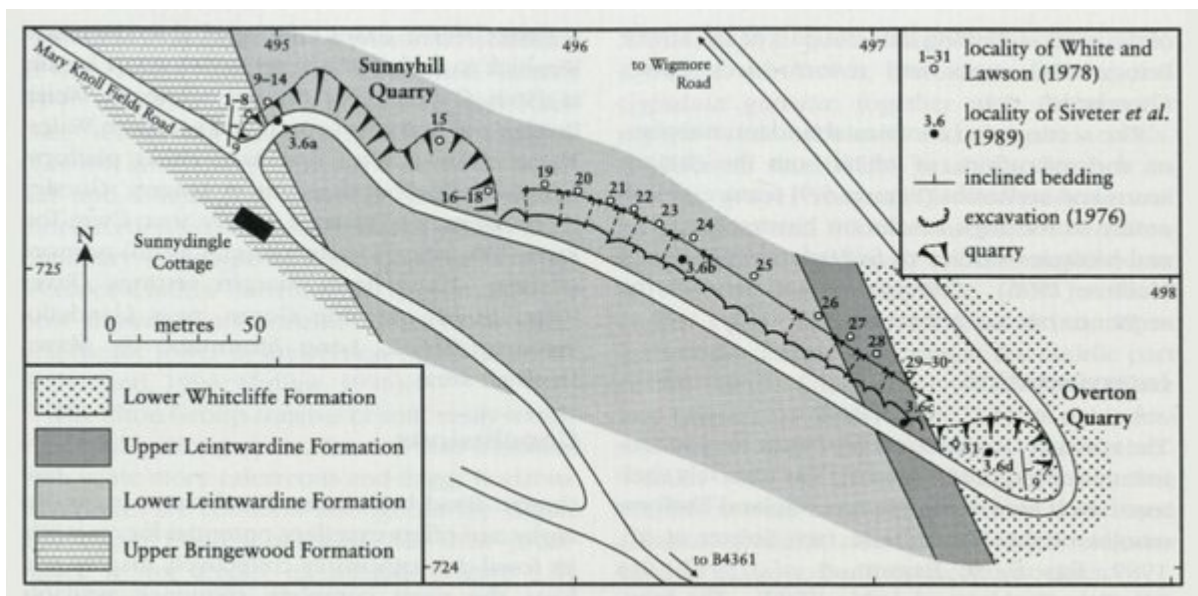
Sunnyhill Quarry has the global boundary stratotype for the base of the Ludfordian Stage of the Ludlow Series. The quarry is also the basal boundary stratotype section for the Lower Leintwardine Formation. The contiguous track-side sequence exposes a body stratotype of the Lower Leintwardine Formation and basal boundary reference sections and body stratotypes for both the Upper Leintwardine and Lower Whitcliffe formations.

The site is extensively studied by geologists, especially for research purposes. A very high priority should be given to conservation of the site.

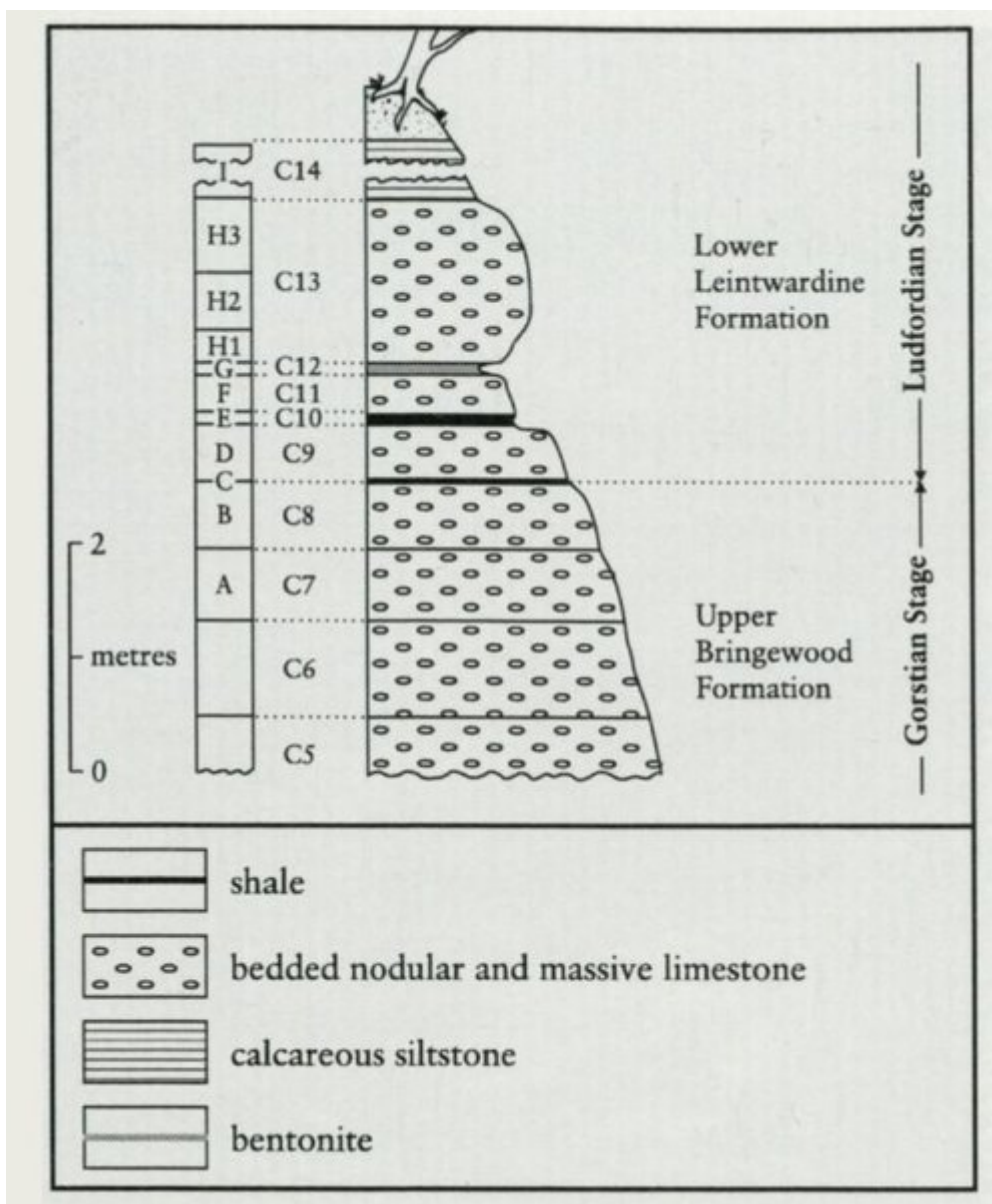
## References



(Figure 5.6) Map of the geology south-west of Ludlow, showing GCR sites along the Wigmore Road and elsewhere in the eastern part of the Ludlow Anticline (after Holland et al., 1963; Lawson, 1977; Lawson and White, 1989).



(Figure 5.10) Geology of Sunnyhill Quarry and contiguous trackside section, Mary Knoll Valley, Mortimer Forest, near Ludlow, Shropshire (after White and Lawson, 1978, with modifications from Siveter *et al.*, 1989; localities 14 and 31 are repositioned after Lawson and White, 1989, p. 90, fig. 58).



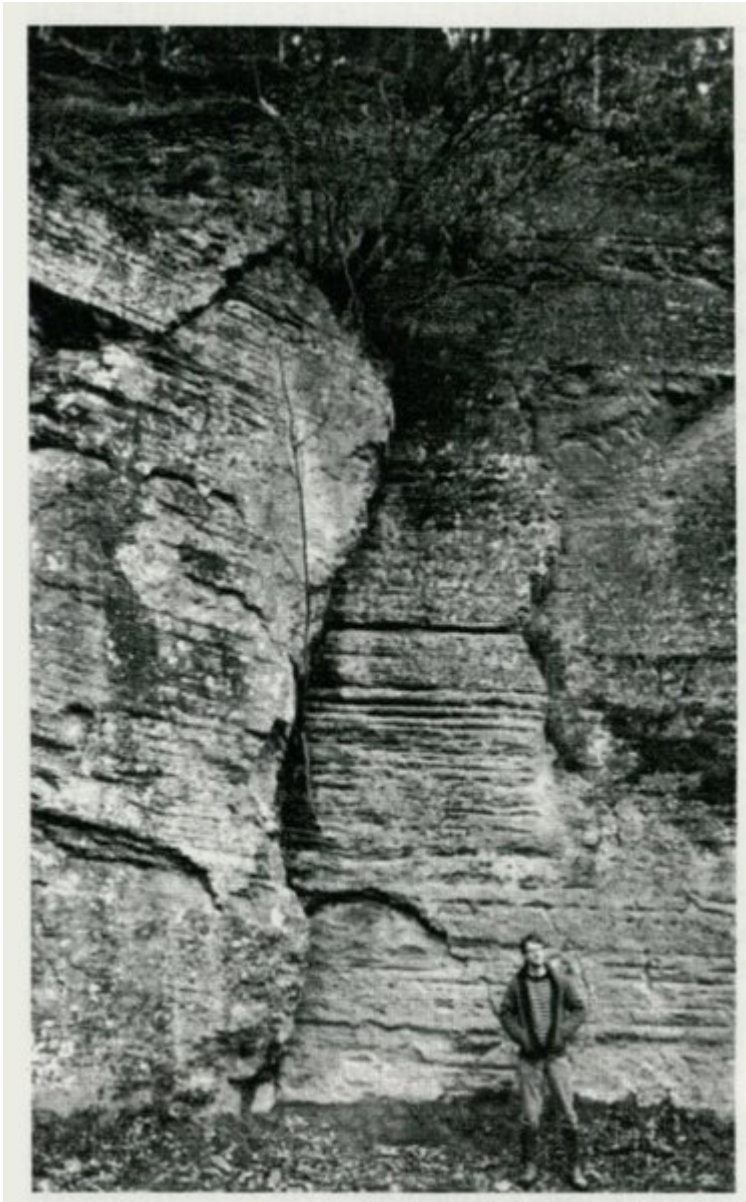
(Figure 5.11) Log through the boundary stratotype section for the base of the Ludfordian Stage at Sunnyhill Quarry, Mary Knoll Valley, Mortimer Forest, near Ludlow, Shropshire (after Holland *et al.*, 1963, A-I = lithological divisions; and



*Lawson and White, 1989, C5–14 = combined locality and collection numbers).*



*(Figure 5.12) The boundary stratotype section for the base of the Ludfordian Stage at Sunnyhill Quarry, Mary Knoll Valley, Mortimer Forest, near Ludlow, Shropshire. The recessed horizon is 'C12' of (Figure 5.11). (Photo: David J. Siveter.)*



*(Figure 5.13) Flaggy, calcareous siltstones; Lower Leintwardine Formation, east part of Sunnyhill Quarry, Mary Knoll Valley, Mortimer Forest, near Ludlow, Shropshire. (Photo: David J. Siveter.)*