

The type Ludlow Series: Deer Park Road

The Deer Park Road section [SO 4849 7129 to SO 4898 7111] is situated along a forestry road in Mortimer Forest, about 4 km SW of Ludlow, and exposes strata from the Lower Bringewood Formation to the Lower Whitcliffe Formation. Numbers bearing the prefix 'B' refer to localities of White & Lawson (1978). Select '[Deer Park Road - vertical section](#)' to display the section, '[Deer Park Road - map](#)' for a plan of the section, and '[Ludlow Anticline](#)' for the location of the section.

The Deer Park Road section has yielded shelly faunas, graptolites, chitinozoa and ostracodes, and so provides evidence to link these biostratigraphically important groups. Bentonites are also present, but their stratigraphical utility has not been tested.

The Deer Park Road section is a Site of Special Scientific Interest. Permission to study the section (researchers only) should be obtained from the Forestry Commission at Ludlow. Other visitors (school and undergraduate parties) are directed towards specially prepared exposures along the Wigmore Road. See Siveter *et al.* (1989) for details.

Siveter, D.J., Owens, R.M. & Thomas, A.T. 1989. *Silurian field excursions: a geotraverse across Wales and the Welsh Borderland*. National Museum of Wales, Geological Series No. **10**, Cardiff, 133pp.

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Deer Park Road - bentonites, chitinozoa, graptolites, lithostratigraphy, map, ostracodes, shelly faunas, vertical section, Ludlow Anticline](#).

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[Author: SGM]

Deer Park Road - lithostratigraphy

Beds of the Lower Bringewood, Upper Bringewood, Lower Leintwardine, Upper Leintwardine and Lower Whitcliffe formations are exposed in the Deer Park Road section. Select '[Deer Park Road - map](#)' and '[Deer Park Road - vertical section](#)' for graphic displays.

The **Lower Bringewood Formation** of the Deer Park Road section comprises irregularly bedded, light olive grey, calcareous siltstones. Limestone nodules are common, and are particularly abundant in the upper part of the succession. A 10 cm thick bentonite occurs 4 m below the top of the formation (locality B5). The formation is estimated to be at least 21 m thick in the Deer Park Road section (White & Lawson 1978).

The basal part of the **Upper Bringewood Formation** comprises hard, light olive-grey to medium grey and silty limestones, passing upwards into light olive-grey, rubbly and nodular limestones with thin shaly siltstone beds at the top of the formation. Upper and lower stratigraphical contacts are both sharp. The contact with the Lower Bringewood Formation is at locality B7; the upper contact with the Lower Leintwardine Formation lies between localities B20 and B21. The formation is estimated to be 17.5 m thick in the Deer Park Road section (White & Lawson 1978).

The **Lower Leintwardine Formation** consists of thinly flaggy, light olive-grey, calcareous siltstones with irregularly bedded silty coquinas in the lower part, succeeded by more thickly bedded siltstones with scattered calcareous nodules. There is a sharp lithological contact with the Upper Bringewood Formation. The formation is estimated to be about 20 m thick in the Deer Park Road section (White & Lawson 1978).

The **Upper Leintwardine Formation** comprises flaggy, light olive-grey, calcareous siltstones, and is 3.5 m thick (White & Lawson 1978).

The **Lower Whitcliffe Formation** consists of medium grey to greenish grey, thickly flaggy calcareous siltstones, more thinly bedded higher in the succession. The lowest 23 m are seen (White & Lawson 1978).

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Deer Park Road - map](#), [vertical section](#), [Lower Bringewood Formation](#), [Upper Bringewood Formation](#), [Lower Leintwardine Formation](#), [Upper Leintwardine Formation](#), [Lower Whitcliffe Formation](#).

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Deer Park Road - shelly faunas

Shelly faunas of the *Mesopholidostrophia laevigata*, *Kirkidium knightii*, *Sphaerirhynchia wilsoni*, *Shaleria ornatella* and *Protochonetes ludloviensis* associations occur in the Deer Park Road section.

Mesopholidostrophia laevigata Association

The Lower Bringewood Formation of the Deer Park Road section contains taxa that are characteristic of the *Mesopholidostrophia laevigata* Association, including large strophomenid brachiopods (*Amphistrophia funiculata* (M'Coy), *Leptaena* cf. *depressa* (J. de C. Sowerby), *Mesopholidostrophia lepisma* (J. de C. Sowerby), *Pholidostrophia*? and *Strophonella euglypha* (Hisinger)), accompanied by *Atrypa reticularis* (Linnaeus), *Shagamella minor* (Salter), bryozoans, tabulate and solitary corals, and *Dalmanites* (White & Lawson 1978, BGS records). *A. reticularis*, *Sphaerirhynchia wilsoni* (J. Sowerby) and *S. euglypha* are reported to be common, and large brachiopods and corals are particularly common in the limestone nodule horizons (White & Lawson 1978, p. 7). Faunas characteristic of the *M. laevigata* Association are also present in the Upper Bringewood Formation, for example at locality B12 (BGS records).

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Deer Park Road - map, vertical section, *Mesopholidostrophia laevigata* Association.](#)

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***Kirkidium knighti* Association**

The *Kirkidium knightii* Association, introduced by Watkins & Aithie (1980), represents a community that occupied high-energy, shelf-edge environments west of Ludlow. It shares most of its taxa with the *M. laevigata* Association, but is characterized by coquinas of *Kirkidium knightii* (J. Sowerby). White & Lawson (1978) reported *K. knightii* to be very common in a 10 cm band, 1.2 m above the base of the Upper Bringewood Formation, at locality B8 of the Deer Park Road section. This may represent an instance of the *Kirkidium knightii* Association east of Watkins & Aithie's (1980) records.

Watkins, R. & Aithie, C.J. 1980. Carbonate shelf environments and faunal communities in the Upper Bringewood Beds of the British Silurian. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **29**, 341-368.

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Deer Park Road - map, vertical section, *Kirkidium knightii* Association.](#)

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***Sphaerirhynchia wilsoni* Association**

The boundary between the *Mesopholidostrophia laevigata* and *Sphaerirhynchia wilsoni* associations in the Deer Park Road section is positioned to coincide with the lithostratigraphical (and lithological) change from the Upper Bringewood Formation to the Lower Leintwardine Formation. There is, however, a stratigraphical gap of about 2 m between the highest faunas assigned to the *M. laevigata* Association (localities B12-B20) and the lowest fauna assigned to the *Sphaerirhynchia wilsoni* Association (locality B21, 2 m above the base of the Lower Leintwardine Formation). Notable absentees from the *S. wilsoni* Association are the large strophomenid and other brachiopods (*Amphistrophia funiculata* (M'Coy), *Mesopholidostrophia lepisma* (J. de C. Sowerby), *S. euglypha* (Hisinger) and *K. knightii* (J. Sowerby)) and the corals that are characteristic of the *M. laevigata* Association. Although these forms do not persist into the *S. wilsoni* Association, they do not disappear at a single level in the Upper Bringewood Formation, but instead through an extended interval of the formation. For example, *A. funiculata* has its last appearance at locality B13, *M. lepisma* at B20, *K. knightii* at B8 and *S. euglypha* at B12, and the tabulate corals *Favosites?* and *Heliolites* have their last appearances at localities B10 and B11 respectively (BGS data; White & Lawson 1978).

The fauna from the lower part of the Lower Leintwardine Formation is typical of the *S. wilsoni* Association, the most persistent brachiopod species being *Dayia navicula* (J. de C. Sowerby), *Howellella elegans* (Muir-Wood), *Isorthis orbicularis* (J. de C. Sowerby) and *Microsphaeridiorhynchus nucula* (J. de C. Sowerby) (White & Lawson 1978). More diversity is introduced in the upper part of the Lower Leintwardine Formation, from about the level of locality B31, coinciding with the stratigraphical interval studied by Cherns (1988); locality B31 is estimated to be 12 m above the base of the formation (White & Lawson 1978) while the section studied by Cherns (1988, text-fig. 6, 'Haye Park') commences about 10 m above its base. Notable taxa from the upper part of the Lower Leintwardine Formation include *Aegiria grayi* (Davidson), *Leptaena depressa* (J. de Sowerby), *Fuchsella amygdalina* (J. de C. Sowerby), *Calymene*, *Encrinurus* and *Neobeyrichia* (White & Lawson 1978; Cherns 1988). *F. amygdalina* is a characteristic bivalve of the upper part of the Ludlow. The other taxa perhaps herald the *Shaleria ornatella* fauna of the Upper Leintwardine Formation. *Aegiria grayi* and species of *Calymene*, *Encrinurus* and *Neobeyrichia* are particularly characteristic of the latter, although it should be noted that the species of *Calymene*, *Encrinurus* and *Neobeyrichia* in the Lower Leintwardine Formation were not recorded by Cherns (1988).

(continued...)

***Sphaerirhynchia wilsoni* Association (continued)**

Cherns, L. 1988. Faunal and facies dynamics in the upper Silurian of the Anglo-Welsh basin. *Palaeontology*, **31**, 451-502.

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Deer Park Road - map, vertical section, *Sphaerirhynchia wilsoni* Association \(upper phase\)](#)

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Shaleria ornatella Association

The *Shaleria ornatella* Association is the characteristic faunal association of the Upper Leintwardine Formation, and is identified by the presence of the trilobites *Calymene puellaris* Reed and *Encrinurus stubblefieldi* Tripp, the ostracode *Neobeyrichia lauensis* (Kiesow), and certain brachiopods such as *Aegiria grayi* (Davidson), abundant *Shaleria ornatella* (Davidson), and species of *Leptaena* and *Isorthis*. In the Deer Park Road section, *Calymene*, *Encrinurus* and *Neobeyrichia* were recorded by Cherns (1988, text-fig. 6) from the Lower Leintwardine Formation (see '[Sphaerirhynchia wilsoni](#) Association'), as were *Aegiria grayi* and *Leptaena*. The persistent occurrence of *A. grayi* and *Neobeyrichia* starts in the uppermost Lower Leintwardine Formation (<1 m below the base of the Upper Leintwardine Formation), although the species of *Neobeyrichia* was not recorded by Cherns. *Aegiria grayi*, *Shaleria ornatella*, *Encrinurus stubblefieldi* and *Neobeyrichia lauensis* occur at locality B38 in the Upper Leintwardine Formation, along with other taxa (White & Lawson 1978).

Cherns, L. 1988. Faunal and facies dynamics in the upper Silurian of the Anglo-Welsh basin. *Palaeontology*, **31**, 451-502.

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Deer Park Road - map, vertical section, *Shaleria ornatella* Association](#).

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***Protochonetes ludloviensis* Association**

The fauna from the Lower Whitcliffe Formation of the Deer Park Road section is less varied than the fauna from underlying beds. The fauna from locality B39 includes *Microsphaeridiorhynchus nucula* (J. de C. Sowerby) and *Protochonetes ludloviensis* Muir-Wood (BGS records). White & Lawson (1978, pp. 8-9) noted that these species were abundant in the Lower Whitcliffe Formation of this section. In these aspects, the fauna from the Lower Whitcliffe Beds is typical of the *Protochonetes ludloviensis* Association. *Aegiria grayi* (Davidson) and *Neobeyrichia lauensis?* (Kiesow) have been recorded from locality B39 (BGS records), but other characteristic taxa of the *Shaleria ornatella* Association are missing. The base of the *Protochonetes ludloviensis* Association can be considered to approximate to the base of the Lower Whitcliffe Formation in the Deer Park Road section.

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Deer Park Road - map, vertical section, *Protochonetes ludloviensis* Association](#).

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Deer Park Road - graptolites

Saetograptus leintwardinensis leintwardinensis (Lapworth), indicative of the ***Saetograptus leintwardinensis* Biozone**, occurs throughout much of the Lower Leintwardine Formation of the Deer Park Road section, from locality B27, about 5.5 m above the base of the formation, to B37 at its top, and at the intervening localities B29, B30, B31, B32, B33, B34, B35 and B36 (BGS records; see also Cherns 1988, text-fig. 6 ('Haye Park') and Siveter *et al.* 1989, loc. 3.5d). The base of the *leintwardinensis* Biozone is considered to approximate to the base of the Ludfordian Stage (Lawson & White 1989, p. 86).

Cherns, L. 1988. Faunal and facies dynamics in the upper Silurian of the Anglo-Welsh basin. *Palaeontology*, **31**, 451-502.

Lawson, J.D. & White, D.E. 1989. The Ludlow Series in the Ludlow area. In Holland, C.H. & Bassett, M.G. (eds) *A global standard for the Silurian System*. National Museum of Wales, Geological Series No. **9**, Cardiff. 73-90.

Siveter, D.J., Owens, R.M. & Thomas, A.T. 1989. *Silurian field excursions: a geotraverse across Wales and the Welsh Borderland*. National Museum of Wales, Geological Series No. **10**, Cardiff. 133pp.

See: [Deer Park Road - map, vertical section, *Saetograptus leintwardinensis* Biozone](#).

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Deer Park Road - chitinozoa

The bases of chitinozoan biozones 7 and 8 are located in the Deer Park Road section.

The base of **Chitinozoan Biozone 7** is defined by the appearance of *Gotlandochitina* sp. aff. *villosa* Laufeld in sample DPR2. The sample point was estimated by Sutherland (1994) to be approximately 25 m below the top of the Lower Bringewood Formation in the Deer Park Road section, and is below White & Lawson's (1978) measured section (compare Sutherland 1994, text-fig. 9, with White & Lawson 1978, fig. 4).

The base of **Chitinozoan Biozone 8** is defined by the first occurrence of *Cingulochitina* sp. aff. *cingulata* (Eisenack) in sample DP15, estimated to be approximately 2.5 m below the top of the Lower Bringewood Formation in the Deer Park Road section. On this evidence, it is inferred to be 0.5 m below the top of strata at White & Lawson's (1978) locality B5. The highest chitinozoans recorded from the Deer Park Road section, estimated to be about 2.6 m above the base of the Upper Bringewood Formation and assigned to Biozone 8, are probably from localities B9-B10, between 1.3 and 4.7 m above the base of the formation.

Sutherland, S.J.E. 1994. Ludlow chitinozoans from the type area and adjacent regions. *Palaeontographical Society Monograph*, London, 1-104, pls 1-18 (publ. No. 594, part of vol. 148 for 1994).

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Chitinozoan Biozone 7](#), [Chitinozoan Biozone 8](#), [Deer Park Road - map, vertical section](#).

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Deer Park Road - ostracodes

The stratigraphically important species *Neobeyrichia lauensis* (Kiesow) occurs at locality B38 [SO 4882 7115] in the Upper Leintwardine Formation of the Deer Park Road section (White & Lawson 1978; Siveter *et al.* 1989, p. 56, loc. 3.5e).

Siveter (1980) recorded *Atterdagia versiculus* Siveter, *Embryotoxotis convallis* Siveter, *Hemsiella?* sp. A, *Lophoctonella* cf. *scanensis* (Kolmodin) and *Sleia equestris* Martinsson from the Upper Leintwardine Formation at his locality 62 [SO 4890 7109], close to the Deer Park Road section (although the grid reference puts this locality on the outcrop of the Lower Whitcliffe Formation; see 1:25,000 Geological Special Sheet *Leintwardine-Ludlow*, published by the Institute of Geological Sciences (now the British Geological Survey) in 1973).

Siveter, D.J. 1980. British Silurian Beyrichiacea (Ostracoda). *Palaeontographical Society Monograph*, London, part 1, 1-76, pls 1-27 (publ. No. 556, part of vol. 133 for 1979).

Siveter, D.J., Owens, R.M. & Thomas, A.T. 1989. *Silurian field excursions: a geotraverse across Wales and the Welsh Borderland*. National Museum of Wales, Geological Series No. **10**, Cardiff. 133pp.

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Deer Park Road - map, vertical section, Ludfordian ostracode faunas, *Neobeyrichia lauensis*](#).

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Deer Park Road - bentonites

White & Lawson (1978, p. 7) noted that a bentonite, up to 10 cm thick, occurred about 4 m below the top of the Lower Bringewood Formation in the Deer Park Road section. This level occurs within strata at locality B5.

White, D.E. & Lawson, J.D. 1978. The stratigraphy of new sections in the Ludlow Series of the type area, Ludlow, Salop, England. *Report of the Institute of Geological Sciences*, No. **78/30**, 1-10.

See: [Bentonites, Deer Park Road - map, vertical section.](#)

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