

## The type Ludlow Series: Biostratigraphy - graptolites

Rickards (1989, fig. 169, 1995, fig. 2) published a list of Ludlow graptolite zones as part of a compilation of Silurian zones ([see: Ludlow graptolite zonations](#)). These zones do not represent a formally agreed standard, but Rickards (1995, fig. 2) described them as comprising part of a widely recognized suite of Silurian graptolite biozones, and as being zones that are used most widely in international correlation.

**Standard reference zones** (Koren' 1989) and **primary biozones** (Cocks & Nowlan 1993) have also been proposed for the Ludlow Series ([see: Ludlow graptolite zonations](#)). **Standard reference zones** are intended to provide greater potential for global correlation, but in establishing them it may be necessary to subsume a number of local biozones into one standard reference zone. For example, the three biozones recognized in the British Gorstian succession (*nilssoni*, *scanicus* and *tumescens/incipiens*) are equivalent to two standard reference zones (*nilssoni* and *scanicus-chimaera*). Rickards (1995) questioned the usefulness of standard reference zones, noting especially that they did not improve (the precision of) correlation. He recommended that they should be used with caution and should not be regarded as inviolable, but should be subject to redefinition as biostratigraphical correlation progressed. He acknowledged, however, that standard reference zones might, under certain circumstances, form the basis of chronozones.

**Primary biozones** were proposed for the standard left-hand side of national and international correlation charts produced by the Silurian Subcommittee. Like standard reference zones, the primary biozones are primarily a means of communication, proposed as global standards that subsume zonations of more local value. Rickards (1995) considered them to have the same limitations as standard reference zones and recommended that they be treated in the same way.

The Ludlow graptolite zones shown in the left-hand column of the revised Geological Society Silurian correlation charts (Cocks *et al.* 1992) are, in upwards succession, the zones of *nilssoni*, *scanicus*, *incipiens*, *leintwardinensis* and *bohemicus*. No zone is identified for the uppermost Ludlow.

Cocks, L.R.M., Holland, C.H. & Rickards, R.B. 1992. *A revised correlation of Silurian rocks in the British Isles*. Geological Society, London, Special Report No. **21**, 32 pp.

Cocks, L.R.M. & Nowlan, G. 1993. New left hand side for correlation diagrams. *Silurian Times*, **1**, 6-8.

Koren', T.N. 1989. Graptolite zones and standard stratigraphic scale of the Silurian. *Proceedings of the 27th International Geological Congress*, **1** (Stratigraphy), 47-66.

Rickards, R.B. 1989. Exploitation of graptoloid cladogenesis in Silurian stratigraphy. In Holland, C.H. & Bassett, M.G. (eds) *A global standard for the Silurian System*. National Museum of Wales, Geological Series No. **9**, Cardiff. 267-274.

Rickards, R.B. 1995. Utility and precision of Silurian graptolite biozones. *Lethaia*, **28**, 129-137.

See: [Ludlow graptolite zones of the Welsh Borderland, The stratigraphical distribution of Ludlow graptolites.](#)

[Return to beginning of 'Methods of correlation'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## Ludlow graptolite zones of the Welsh Borderland

Graptolites are not prominent in the fauna from the Ludlow rocks of the type area. Nevertheless, the following zones have been recognized:

*Neodiversograptus nilssoni* Biozone (lowest)

*Lobograptus scanicus* Biozone

*Pristiograptus tumescens*/*Saetograptus incipiens* Biozone

*Saetograptus leintwardinensis* Biozone (highest)

The *Pristiograptus tumescens*/*Saetograptus incipiens* Biozone merges two independently defined zones. The type area of the *tumescens* Biozone is at Ludlow, where *Pristiograptus tumescens* (Wood) forms an essentially monotypic assemblage in the Upper Elton Formation; the type area of the *incipiens* Biozone is at Long Mountain on the margin of the Welsh Basin, 40 km NNW of Ludlow (Rickards 1976, p. 171 and references therein). The *incipiens* Biozone has been recognized in northern England and north Wales whereas the *tumescens* Biozone is known from the Ludlow area and the shelf successions to the south-east (e.g. at Perton Quarry in the Woolhope Inlier; Watkins 1979, p. 224).

In north Wales, Warren (1971, p. 456) reported a monotypic assemblage of pristiograptids, of the *Pristiograptus vicinus*/*P. tumescens* type, in the upper part of the *Lobograptus scanicus* Biozone, below a rapid increase in abundance of forms belonging to the *Saetograptus leintwardinensis* group, marking the base of the *incipiens* Biozone. He concluded (Warren 1971, p. 457) that the upper part of the *scanicus* Biozone in north Wales might be equivalent to part or all of the *tumescens* Biozone in the Welsh Borderland ([see: Ludlow graptolite zonations](#)).

Rickards, R.B. 1976. The sequence of Silurian graptolite zones in the British Isles. *Geological Journal*, **11**, 153-188.

Warren, P.T. 1971. The sequence and correlation of graptolite faunas from the Wenlock-Ludlow rocks of north Wales. *Mémoires du Bureau de Recherches géologiques et minières*, No. **73**, 451-460.

Watkins, R. 1979. Benthic community organization in the Ludlow Series of the Welsh Borderland. *Bulletin of the British Museum (Natural History)*, Geology, **31**, 175-280.

See: [Lobograptus scanicus Biozone](#), [Neodiversograptus nilssoni Biozone](#), [Pristiograptus tumescens/Saetograptus incipiens Biozone](#), [Saetograptus leintwardinensis Biozone](#).

[Return to 'Biostratigraphy - graptolites'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## The stratigraphical distribution of Ludlow graptolites

This page provides links to two tables showing the stratigraphical distribution of graptolite species in the Ludlow Series of the UK.

[‘Occurrence of graptolite species in Ludlow graptolite zones of the UK’](#) shows the general composition of faunas from each zone, based on data published by Rickards (1976) and Warren (1971).

[‘Occurrence of graptolite species in the type Ludlow Series’](#) shows the incidence of species in the type area. See the heading ‘Occurrence in the type Ludlow Series’ under the entry for each graptolite zone for sources of information.

Rickards, R.B. 1976. The sequence of Silurian graptolite zones in the British Isles. *Geological Journal*, **11**, 153-188.

Warren, P.T. 1971. The sequence and correlation of graptolite faunas from the Wenlock-Ludlow rocks of north Wales. *Mémoires du Bureau de Recherches géologiques et minières*, No. **73**, 451-460.

See: [Lobograptus scanicus Biozone](#), [Neodiversograptus nilssoni Biozone](#), [Pristiograptus tumescens/Saetograptus incipiens Biozone](#), [Saetograptus leintwardinensis Biozone](#).

[Return to ‘Biostratigraphy - graptolites’.](#)

[Return to ‘The Ludlow Series \(Upper Silurian\) of the type area - introductory page’.](#)

[Author: SGM]

## *Neodiversograptus nilssoni* Biozone

### Fauna

The base of the *Neodiversograptus nilssoni* Biozone coincides with a marked faunal change in Silurian graptolite faunas, and is recognized by the incoming of *Monograptus uncinatus orbatus* Wood, *Neodiversograptus nilssoni* (Barrande), *Saetograptus colonus* (Barrande) and *S. varians* (Wood), together with associates such as *Spinograptus spinosus* (Wood), *Bohemograptus bohemicus* (Barrande), *Pristiograptus dubius* (Suess) and *P. curtus* (Elles & Wood). In addition, species of the uppermost Wenlock *Pristiograptus? ludensis* Biozone either disappear at the base of the *nilssoni* Biozone, for example *Pristiograptus jaegeri* Holland, Rickards & Warren and *P. aff. jaegeri* (of Warren 1971), or range into the basal part of the *nilssoni* Biozone but no higher, as in the case of *P.? ludensis* (Murchison) itself (Rickards 1976).

In North Wales, Warren (1971) distinguished an upper *nilssoni* Biozone from a lower *nilssoni* Biozone, based on the appearance of the *Saetograptus chimaera* group, *Lobograptus scanicus* (Tullberg) and *Monoclimacis micropoma* (Jaekel), and the disappearance of *Monograptus uncinatus orbatus* and *Spinograptus spinosus*. Warren (1971) correlated the upper *nilssoni* Biozone with the *Lobograptus progenitor* Biozone of Poland (Teller 1969), interposed between the *nilssoni* and *scanicus* biozones there. In addition to *S. chimaera*, *L. scanicus* and *Mcl. micropoma*, the *progenitor* Biozone is marked by the appearance of *Lobograptus progenitor* Urbanek, *L. simplex* Urbanek, *L. crinitus* (Wood), *Saetograptus roemerii* (Wood), *S.? wandalensis* (Watney & Welch), *S. fritschi* (Boucek), *S.? incipiens* (Wood) and *Pristiograptus vicinus* (Perner) (Rickards 1976). *L. progenitor*, *L. crinitus* and *P. comis* (Wood)/*P. vicinus* are present in the upper *nilssoni* Biozone in North Wales; *S. incipiens* appears higher, at about the base of the *Lobograptus scanicus* Biozone (Warren 1971).

Rickards, R.B. 1976. The sequence of Silurian graptolite zones in the British Isles. *Geological Journal*, **11**, 153-188.

Teller, L. 1969. The Silurian biostratigraphy of Poland based on graptolites. *Acta geologica polonica*, **19**, 393-501.

Warren, P.T. 1971. The sequence and correlation of graptolite faunas from the Wenlock-Ludlow rocks of north Wales. *Mémoires du Bureau de Recherches géologiques et minières*, No. **73**, 451-460.

See: [The stratigraphical distribution of Ludlow graptolites, \*Neodiversograptus nilssoni\* Biozone - Occurrence in the type Ludlow Series.](#)

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## *Neodiversograptus nilssoni* Biozone

### Occurrence in the type Ludlow Series

The base of the *nilssoni* Biozone is generally correlated with the base of the Ludlow Series, based on the occurrence of graptolites in the stratotype section for the base of the series at Pitch Coppice Quarry and along Wenlock Edge. It should be noted, however, that the highest graptolite fauna from the underlying Wenlock Series, indicating the *ludensis* Biozone, is approximately 40 m below the series boundary in the type area (Holland *et al.* 1969; see also Lawson & White 1989, p. 84, and Siveter *et al.* 1989, p. 61, loc. 3.7e), so there is no evidence to indicate which zone correlates with the upper part of the Wenlock Series immediately below the base of the Ludlow.

Faunas assigned to the *nilssoni* Biozone in the Ludlow type area are from:

- **Pitch Coppice Quarry.** The occurrences of ?*Saetograptus* (*Colonograptus*) *varians* (Wood) and ?*Neodiversograptus nilssoni* (Barrande), respectively 0.03 m and within 0.23 m above the base of the Ludlow Series, have been taken as a strong indication of the *nilssoni* Biozone (Lawson & White 1989, pp. 81-82). The highest graptolite fauna from the underlying Wenlock Series comprises *Pristiograptus?* *ludensis* (Murchison) sensu Wood, indicating the *ludensis* Biozone, from approximately 25 m above the base of the Much Wenlock Limestone Formation in a lane section [SO 4417 7257], 3 km along strike to the west-south-west of the boundary section (Holland *et al.* 1969; see also Lawson & White 1989, p. 84, and Siveter *et al.* 1989, p. 61, loc. 3.7e). Although no graptolites have been recorded from the upper two thirds (c. 40 m) of the Much Wenlock Limestone Formation (Lawson & White 1989, p. 84), the base of the *nilssoni* Biozone is correlated with the base of the Ludlow Series on this evidence.
- **The Goggin Road section.** Graptolites assigned to the *nilssoni* Biozone occur at the base of the Middle Elton Formation, at locality A7, where *Spinograptus spinosus* (Wood) indicates the lower part of the zone. Faunas from higher in the Middle Elton Formation, from locality A15 and above, comprising *Saetograptus chimaera chimaera* (Barrande), *S. chimaera semispinosus* (Elles & Wood) and *Pristiograptus dubius* (Suess) (White & Lawson 1978, p. 3), may indicate the highest *nilssoni* but more probably the *scanicus* Biozone. Between these two localities, graptolites have been recorded from localities A12, A13 and A14 (unpublished BGS records), but none have been determined.

Siveter *et al.* (1989, p. 54) noted that graptolites are particularly common through the Middle Elton Formation along the Goggin Road, and indicate the *nilssoni*-*scanicus* biozones.

- Siveter *et al.* (1989, p. 49) also recorded a fauna with *N. nilssoni* and *Saetograptus colonus* (Barrande), indicative of the *nilssoni* Biozone, from their locality 3.3d [SO 4777 7329], a stream section exposing the Middle Elton Formation about 1.5 km NNE of the Goggin Road section.

(continued...)

## ***Neodiversograptus nilssoni* Biozone - Occurrence (continued)**

- Lawson & White (1989, p. 79) reported the lower part of the Middle Elton Formation to contain abundant graptolites indicative of the *nilssoni* Biozone, but gave no details.

See '[Occurrence of graptolite species in the type Ludlow Series](#)' for a tabulation of species' occurrences by zone and formation.

Holland, C.H., Rickards, R.B. & Warren, P.T. 1969. The Wenlock graptolites of the Ludlow district, Shropshire, and their stratigraphical significance. *Palaeontology*, **12**, 663-683.

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.

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: [Goggin Road, Holostratigraphical chart, \*Neodiversograptus nilssoni\* Biozone - Fauna, Pitch Coppice Quarry.](#)

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## ***Lobograptus scanicus* Biozone**

### **Fauna**

The *Lobograptus scanicus* Biozone is recognized by the abundance of the name species, together with *Lobograptus crinitus* (Wood), *Saetograptus chimaera chimaera* (Barrande), *S. c. semispinosus* (Elles & Wood), *Monoclimacis micropoma* (Jaekel) and *Bohemograptus bohemograptus tenuis* (Boucek) (Rickards 1976). With the exception of *B. b. tenuis*, all these forms appear in the underlying upper *nilssoni* (or *progenitor*) Biozone. (Taxa that are characteristic of the upper *nilssoni* Biozone, but which do not range into the *scanicus* Biozone, include *Lobograptus progenitor* Urbanek, *Saetograptus roemerii* (Wood), *S.?* *wandalensis* (Watney & Welch) and *S. fritschi* (Boucek) - Rickards 1976). Several species appear in the upper part of the *scanicus* Biozone, notably *Saetograptus clunensis* (Earp) (Warren 1971; Rickards 1976).

Warren (1971, p. 456) remarked upon the increased abundance (compared with underlying zones) of pristiograptids of the *Pristiograptus vicinus*/*P. tumescens* type in the *scanicus* Biozone of North Wales, culminating in a monotypic assemblage in the upper part of the zone. Although aware of the danger of using a monotypic assemblage for correlation, he (p. 457) thought it probable that the upper part of the *scanicus* Biozone in North Wales was equivalent to all or part of the *tumescens* Biozone in the Welsh Borderland.

Rickards, R.B. 1976. The sequence of Silurian graptolite zones in the British Isles. *Geological Journal*, **11**, 153-188.

Warren, P.T. 1971. The sequence and correlation of graptolite faunas from the Wenlock-Ludlow rocks of north Wales. *Mémoires du Bureau de Recherches géologiques et minières*, No. **73**, 451-460.

See: [The stratigraphical distribution of Ludlow graptolites, \*Lobograptus scanicus\* Biozone - Occurrence in the type Ludlow Series.](#)

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## ***Lobograptus scanicus* Biozone**

### **Occurrence in the type Ludlow Series**

Graptolite faunas assigned to the *scanicus* Biozone have been recorded from the Middle Elton Formation of the Goggin Road section in the Ludlow type area.

- White & Lawson (1978, p. 3) noted that *Saetograptus chimaera chimaera* (Barrande), *S. chimaera semispinosus* (Elles & Wood) and *Pristiograptus dubius* (Suess) occur 'in higher beds (locality A15 and above)' of the Middle Elton Formation on the Goggin Road. Lawson & White (1989, p. 79) considered faunas with these taxa to be assignable to the *scanicus* Biozone, although the ranges published by Rickards (1976) mean that the highest *nilssoni* Biozone cannot be excluded. The implication of Lawson & White's conclusion is that the Middle Elton Formation at locality A15 lies within the *scanicus* Biozone.
- The occurrence of *Saetograptus chimaera* at locality A19 on the Goggin Road suggests that the Middle Elton Formation at that locality may be no higher than the *scanicus* Biozone.

See '[Occurrence of graptolite species in the type Ludlow Series](#)' for a tabulation of species' occurrences by zone and formation.

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.

Rickards, R.B. 1976. The sequence of Silurian graptolite zones in the British Isles. *Geological Journal*, **11**, 153-188.

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: [Goggin Road, Holostratigraphical chart, \*Lobograptus scanicus\* Biozone - Fauna](#).

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]



## ***Pristiograptus tumescens*/*Saetograptus incipiens* Biozone**

### **Fauna**

The interval between the *Lobograptus scanicus* and *Saetograptus leintwardinensis* biozones is typified by an abundance of either *S. leintwardinensis incipiens* (Wood) or *Pristiograptus tumescens* (Wood), although both appear much earlier. Often only one of the two species is present, giving rise to either the *incipiens* Biozone or the *tumescens* Biozone (Rickards 1976).

In the type Ludlow area, the *tumescens/incipiens* Biozone is indicated by an almost monotypic fauna of *Pristiograptus tumescens* in the Upper Elton Formation. *P. tumescens* is rare in the Lower Bringewood Formation at Ludlow, but is more common in the Leintwardine area, about 10 km to the west, suggesting that the Lower Bringewood Formation lies within the *tumescens/incipiens* Biozone. A record of *Saetograptus leintwardinensis incipiens* from the Upper Bringewood Formation at Ludlow (Holland *et al.* 1963, p. 113) indicates that the Upper Bringewood Formation is still within the *tumescens/incipiens* Biozone (Lawson & White 1989, p. 79).

Where the *incipiens* Biozone is better developed, for example in north Wales, species that do not range from underlying zones include *Lobograptus scanicus* (Tullberg), *Lobograptus crinitus* (Wood), *Saetograptus chimaera chimaera* (Barrande), *S. c. salweyi* (Lapworth) and *Monoclimacis micropoma* (Jaekel), while *Saetograptus clunensis* (Earp) ranges from the upper part of the *scanicus* Biozone into the lower part of the *incipiens* Biozone (Warren 1971, fig. 1; Rickards 1976).

Holland, C.H., Lawson, J.D & Walmsley, V.G. 1963. The Silurian rocks of the Ludlow district, Shropshire. *Bulletin of the British Museum (Natural History)*, Geology, **8**, 95-171, pls 1-7.

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.

Rickards, R.B. 1976. The sequence of Silurian graptolite zones in the British Isles. *Geological Journal*, **11**, 153-188.

Warren, P.T. 1971. The sequence and correlation of graptolite faunas from the Wenlock-Ludlow rocks of north Wales. *Mémoires du Bureau de Recherches géologiques et minières*, No. **73**, 451-460.

See: [The stratigraphical distribution of Ludlow graptolites, \*Pristiograptus tumescens\*/\*Saetograptus incipiens\* Biozone - Occurrence in the type Ludlow Series.](#)

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

## ***Pristiograptus tumescens*/Saetograptus incipiens Biozone**

### **Occurrence in the type Ludlow Series**

*Pristiograptus tumescens* (Wood) is the most commonly occurring graptolite in the Upper Elton Formation, often in monotypic associations.

- Monotypic graptolite faunas comprising *Pristiograptus tumescens* occur along the Goggin Road at localities A24, A25, A27 and A28. These localities span most of the Upper Elton Formation in the Goggin Road section, from about 1 m above the formation's faulted base to about 1 m below the stratigraphical contact with the Lower Bringewood Formation. The base of the biozone must lie between localities A19 (assigned to the *scanicus* Biozone) and A24 on the Goggin Road section, encompassing the highest 20 m of the Middle Elton Formation and the lowest metre of the Upper Elton Formation across the faulted contact.
- Holland *et al.* (1963, p. 128) and Siveter *et al.* (1989, p. 49, loc. 3.3e) reported *Pristiograptus tumescens* from the Upper Elton Formation at Gorsty [SO 4760 7350], about 1.6 km north of the Goggin Road section.
- Holland *et al.* (1963, p. 141) noted that *Pristiograptus tumescens* was fairly common in basal beds of the Lower Bringewood Formation at the formation's original basal boundary stratotype in the Mary Knoll Valley.
- Holland *et al.* (1963, p. 113) reported *Saetograptus leintwardinensis incipiens* (Wood) to occur in higher beds of the Upper Bringewood Formation.

See '[Occurrence of graptolite species in the type Ludlow Series](#)' for a tabulation of species' occurrences by zone and formation.

Holland, C.H., Lawson, J.D & Walmsley, V.G. 1963. The Silurian rocks of the Ludlow district, Shropshire. *Bulletin of the British Museum (Natural History)*, Geology, **8**, 95-171, pls 1-7.

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: [Goggin Road, Holostratigraphical chart, \*Pristiograptus tumescens\*/Saetograptus incipiens Biozone - Fauna](#).

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## ***Saetograptus leintwardinensis* Biozone**

### **Fauna**

The *Saetograptus leintwardinensis* Biozone is recognized by the appearance of *Saetograptus leintwardinensis leintwardinensis* (Lapworth), either in monotypic assemblages or accompanied by few other forms such as *S. l.* aff. *incipiens* (Wood) and *S. l. primus* (Boucek) (Rickards 1976).

Rickards, R.B. 1976. The sequence of Silurian graptolite zones in the British Isles. *Geological Journal*, **11**, 153-188.

See: [The stratigraphical distribution of Ludlow graptolites, \*Saetograptus leintwardinensis\* Biozone - Occurrence in the type Ludlow Series.](#)

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## ***Saetograptus leintwardinensis* Biozone**

### **Occurrence in the type Ludlow Series**

Lawson & White (1989, p. 79) placed both the Lower Leintwardine and Upper Leintwardine formations in the *leintwardinensis* Biozone. Holland *et al.* (1963, p. 115) noted that *Saetograptus leintwardinensis leintwardinensis* (Lapworth) had not been found below the Lower Leintwardine Formation, while Cherns (1988, fig. 5) recorded *S. l. leintwardinensis* about 0.25 m above the base of the Lower Leintwardine Formation at Sunnyhill Quarry (locality C9), and therefore an equivalent distance above the base of the Ludfordian Stage. The subspecies is also present in the basal beds of the formation in the neighbouring Aymestrey and Leintwardine districts, 10-15 km W and SW of Ludlow (Lawson & White 1989, p. 86). On this evidence the base of the *leintwardinensis* Biozone is considered to approximate to the base of the Ludfordian (Lawson & White 1989, p. 86).

In addition to the record from locality C9 at Sunnyhill Quarry, Cherns (1988, fig. 5) recorded *S. l. leintwardinensis* from the Lower Leintwardine Formation at levels considered here to be equivalent to localities C17, C18, C23, C24, C25 and C26 in the track section between Sunnyhill and Overton quarries, and from the Upper Leintwardine Formation at levels equivalent to localities C29 and C30 along the same section. Siveter *et al.* (1989, locs 3.6b, 3.6c) reported the occurrence of the subspecies in the same section, noting that it continued into but not above the Upper Leintwardine Formation.

Other records are from:

- the upper part of the Lower Leintwardine Formation and the Upper Leintwardine Formation on The Whitcliffe (Holland *et al.* 1963, pp. 117-118, 125; Siveter *et al.* 1989, locs 3.1b, 3.1c);
- much of the Lower Leintwardine Formation in the Deer Park Road section, from locality B27 about 5.5 m above the base of the formation, to B37 at its top (see Siveter *et al.* 1989, loc. 3.5d);
- the Lower Leintwardine Formation of the Wigmore Road [SO 4912 7399] (Siveter *et al.* 1989, loc. 3.3i, Holland *et al.* 1963, p. 129);
- the upper part of the Lower Leintwardine Formation south-southwest of Deepwood (Holland *et al.* 1963, p. 116).

See '[Occurrence of graptolite species in the type Ludlow Series](#)' for a tabulation of species' occurrences by zone and formation.

(continued...)

## ***Saetograptus leintwardinensis* Biozone - Occurrence (continued)**

- Cherns, L. 1988. Faunal and facies dynamics in the upper Silurian of the Anglo-Welsh basin. *Palaeontology*, **31**, 451-502.
- Holland, C.H., Lawson, J.D. & Walmsley, V.G. 1963. The Silurian rocks of the Ludlow district, Shropshire. *Bulletin of the British Museum (Natural History)*, Geology, **8**, 95-171, pls 1-7.
- 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: [Boundary stratotype for the base of the Ludfordian Stage, Deer Park Road, Holostratigraphical chart, \*Saetograptus leintwardinensis\* Biozone - Fauna, Sunnyhill Quarry, The top of the \*leintwardinensis\* Biozone in the type Ludlow succession, The Whitcliffe.](#)

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## The top of the *leintwardinensis* Biozone in the type Ludlow succession

There are no records of identifiable graptolites from either the Lower Whitcliffe or Upper Whitcliffe formations in the type area, so no direct evidence for the vertical extent of the *leintwardinensis* Biozone. Holland & Palmer (1974), however, reported *Bohemograptus bohemicus tenuis* (Boucek), indicative of the *Bohemograptus bohemicus* Biozone, from beds above strata yielding *Saetograptus leintwardinensis*, the brachiopod *Aegiria grayi* (Davidson) and the ostracode *Neobeyrichia lauensis* (Kiesow) in Clun Forest, about 30 km WNW of Ludlow. This suggests correlation of the *bohemicus* Biozone with a level above the Upper Leintwardine Formation of the type area.

Holland, C.H. & Palmer, D.C. 1974. *Bohemograptus*, the youngest graptoloid known from the British Silurian sequence. *Special Papers in Palaeontology*, **13**, 215-236.

See: [Bohemograptus bohemicus Biozone \(Bohemograptus proliferation zone\)](#), The stratigraphical distribution of Ludlow graptolites, Holostratigraphical chart.

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]

## ***Bohemograptus bohemicus* Biozone (*Bohemograptus* proliferation zone)**

The *Bohemograptus* proliferation zone has been recognized in the Long Mountain and Clun Forest areas of the Welsh Borderland, 30-40 km NW of Ludlow, by Holland & Palmer (1974). Recognition of the zone is based on monotypic assemblages of *Bohemograptus*, identified as *B. bohemicus tenuis* (Boucek) at Long Mountain, above beds yielding *Saetograptus leintwardinensis leintwardinensis* (Lapworth) (*S. leintwardinensis* Biozone). The *Bohemograptus* proliferation zone is the highest graptolite zone recognized in the British Ludlow succession, although it is not of latest Ludlow age (see: [Ludlow graptolite zonations](#)).

Holland, C.H. & Palmer, D.C. 1974. *Bohemograptus*, the youngest graptoloid known from the British Silurian sequence. *Special Papers in Palaeontology*, **13**, 215-236.

See: [The stratigraphical distribution of Ludlow graptolites, Holostratigraphical chart](#).

[Return to 'Ludlow graptolite zones of the Welsh Borderland'.](#)

[Return to 'The Ludlow Series \(Upper Silurian\) of the type area - introductory page'.](#)

[Author: SGM]