

## The type Ludlow Series: Biostratigraphy - acritarchs

Five acritarch zones have been identified in the Ludlow Series (Dorning & Bell 1987, fig. 15.2, after Dorning 1981a). In upwards succession, these are the zones of *Leptobrachion longhopense*, *Tylotopalla pyramidalis*, *Florisphaeridium castellum*, *Leoniella carminae* and *Visbysphaera whitcliffensis*. According to Dorning (1981a, p. 202), the zones can be recognized over the whole of the Welsh Basin, but little information has been published. Furthermore, the zonation has only been presented in general terms. It is impossible, from published information, to relate zonal boundaries to precise stratigraphical levels in described sections.

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

Dorning, K.J. 1981a. Silurian acritarchs from the type Wenlock and Ludlow of Shropshire. *Review of Palaeobotany and Palynology*, **34**, 175-203.

Dorning, K.J. & Bell, D.G. 1987. The Silurian carbonate shelf microflora: acritarch distribution in the Much Wenlock Limestone Formation. In Hart, M.B. (ed.) *Micropalaeontology of carbonate environments*. Ellis Horwood, Chichester, 266-287.

See: [Florisphaeridium castellum Biozone](#), [Leoniella carminae Biozone](#), [Leptobrachion longhopense Biozone](#), [Tylotopalla pyramidalis Biozone](#), [Visbysphaera whitcliffensis Biozone](#).

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## ***Leptobrachion longhopense* Biozone**

### **Microflora**

The *Leptobrachion longhopense* Biozone of Dorning & Bell (1987) is equivalent to the lower half of Zone L1 of Dorning (1981a). The latter was described as the (total) range zone of *Leptobrachion longhopense* Dorning. The *L. longhopense* Biozone *sensu* Dorning & Bell (1987) is a partial range zone of *L. longhopense*. Its base is defined by the first appearance of *L. longhopense*, and its top by the first appearance of *Tylotopalla pyramidalis* (Lister) Dorning.

Other taxa that appear at the same level as *Leptobrachion longhopense* include *Cymatiosphaera eltonensis* Dorning, *Dateriocradus tribrachiata* (Lister) Dorning, *Leiofusa exilata* Dorning, *Leiofusa thomissa* Loeblich, *Neoveryhachium mayhillense* Dorning and *Veryhachium pertonense* Dorning (Dorning 1981a, table 1).

A number of other taxa range upwards into or through the zone ( Dorning 1981a, table I).

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

### **Occurrence**

The *Leptobrachion longhopense* Biozone is reported to occur at the base of the Ludlow Series, and to correlate with the Lower Elton Formation of the type Ludlow area (Dorning & Bell 1987, fig. 15.2). Dorning & Bell (1987, fig. 15.2) equated the base of the *Leptobrachion longhopense* Biozone with the base of the Ludlow Series, although Dorning (1981a, table I) had earlier depicted the base of his Zone L1 as being slightly above the base of the series. There is no indication of where the base of the zone might be located in a particular section. Neither is there any indication of where the zone has been recorded, although Dorning (1981a, p. 202) reported his acritarch zones to be recognizable over the whole of the Welsh Basin.

Dorning, K.J. 1981a. Silurian acritarchs from the type Wenlock and Ludlow of Shropshire. *Review of Palaeobotany and Palynology*, **34**, 175-203.

Dorning, K.J. & Bell, D.G. 1987. The Silurian carbonate shelf microflora: acritarch distribution in the Much Wenlock Limestone Formation. In Hart, M.B. (ed.) *Micropalaeontology of carbonate environments*. Ellis Horwood, Chichester, 266-287.

See: [Distribution of acritarch species in the type Ludlow Series](#), [Holostratigraphical chart](#).

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## ***Tylotopalla pyramidalis* Biozone**

### **Microflora**

Although never formally defined, the base of the *Tylotopalla pyramidalis* Biozone of Dorning & Bell (1987) is assumed to be at first the appearance of *T. pyramidalis* (Lister) Dorning. The *T. pyramidalis* Biozone is equivalent to the upper half of Zone L1 of Dorning (1981a), and is believed to be a total range zone. Other species that appear at the same level include *Cymatiosphaera gorstia* Dorning and *Multiplicisphaeridium josefae* (Cramer) Eisenack, Cramer & Díez. A number of other species range into, through, or appear within the zone (see Dorning 1981a, table I).

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

### **Occurrence**

The *Tylotopalla pyramidalis* Biozone is reported to occur in the lower part of the Ludlow Series, and to correlate with the Middle Elton Formation of the type Ludlow area (Dorning & Bell 1987, fig. 15.2). There is no indication of where the base of the zone might be located in a particular section, however, and no indication of where the zone has been recorded. Dorning (1981a, p. 202) reported his acritarch zones to be recognizable over the whole of the Welsh Basin, but no details have been published.

Dorning, K.J. 1981a. Silurian acritarchs from the type Wenlock and Ludlow of Shropshire. *Review of Palaeobotany and Palynology*, **34**, 175-203.

Dorning, K.J. & Bell, D.G. 1987. The Silurian carbonate shelf microflora: acritarch distribution in the Much Wenlock Limestone Formation. In Hart, M.B. (ed.) *Micropalaeontology of carbonate environments*. Ellis Horwood, Chichester, 266-287.

See: [Distribution of acritarch species in the type Ludlow Series, Holostratigraphical chart](#).

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## ***Florisphaeridium castellum* Biozone**

### **Microflora**

The *Florisphaeridium castellum* Biozone of Dorning & Bell (1987) is equivalent to Zone L2 of Dorning (1981a). The latter was described as the (total) range zone of *Ammonidium ludloviense* Lister *ex* Dorning, *Florisphaeridium castellum* Lister and *Gorgonisphaeridium bringewoodense* Dorning, its base being placed at the first appearance of these taxa and its top at their last appearance (see Dorning 1981a, table I). A number of other taxa appear at the same level, or at higher levels within the zone (Dorning 1981a, table I). *Cymatiosphaera ledburica* Dorning and *Dilatisphaera laevigata* Lister were reported by Dorning (1981a, p. 202) to be common.

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

### **Occurrence**

The *Florisphaeridium castellum* Biozone was equated with the whole of the upper Gorstian Stage by Dorning & Bell (1987, fig. 15.2), from the base of the Upper Elton Formation to the top of the Upper Bringewood Formation. There is no indication of where either the base or the top of the zone might be located in a particular section, however, and no indication of where the zone has been recorded. Dorning (1981a, p. 202) reported his acritarch zones to be recognizable over the whole of the Welsh Basin, but no details have been published.

Dorning, K.J. 1981a. Silurian acritarchs from the type Wenlock and Ludlow of Shropshire. *Review of Palaeobotany and Palynology*, **34**, 175-203.

Dorning, K.J. & Bell, D.G. 1987. The Silurian carbonate shelf microflora: acritarch distribution in the Much Wenlock Limestone Formation. In Hart, M.B. (ed.) *Micropalaeontology of carbonate environments*. Ellis Horwood, Chichester, 266-287.

See: [Distribution of acritarch species in the type Ludlow Series](#), [Holostratigraphical chart](#).

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## ***Leoniella carminae* Biozone**

### **Microflora**

The *Leoniella carminae* Biozone of Dorning & Bell (1987) is equivalent to Zone L3 of Dorning (1981a). The base of Zone L3 was placed by Dorning (1981a) at the appearance of *Cymbosphaeridium pilar* (Cramer) Lister, *Leiofusa estrecha* Cramer, *Leoniella carminae* Cramer, *Multiplicisphaeridium paraguaferum* (Cramer) Lister and *Veryhachium leintwardinense* Dorning. All these species range into the overlying zone. Several other species appear at about the same level (Dorning 1981a, table I), including *Eupoikilofusa missurensis* Cramer & Díez, *Onondagella deunffii* Cramer, *Piliferosphaera pertonensis* Dorning, *Pterospermella pertonensis* Dorning, *Tylotopalla maraca* Díez & Cramer and *Visbysphaera whitcliffensis* Dorning. *Onondagella* was reported by Dorning (1981a) to be more common than in lower zones.

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

### **Occurrence**

The *Leoniella carminae* Biozone was correlated with the lower Ludfordian Stage by Dorning & Bell (1987), from the base of the Lower Leintwardine Formation to the top of the Upper Leintwardine Formation. There is no indication of where the base of the zone might be located in a particular section, however, and no indication of where the zone has been recorded. Dorning (1981a, p. 202) reported his acritarch zones to be recognizable over the whole of the Welsh Basin, but no details have been published.

Dorning, K.J. 1981a. Silurian acritarchs from the type Wenlock and Ludlow of Shropshire. *Review of Palaeobotany and Palynology*, **34**, 175-203.

Dorning, K.J. & Bell, D.G. 1987. The Silurian carbonate shelf microflora: acritarch distribution in the Much Wenlock Limestone Formation. In Hart, M.B. (ed.) *Micropalaeontology of carbonate environments*. Ellis Horwood, Chichester, 266-287.

See: [Distribution of acritarch species in the type Ludlow Series, Holostratigraphical chart](#).

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## ***Visbysphaera whitcliffensis* Biozone**

### **Microflora**

The *Visbysphaera whitcliffensis* Biozone of Dorning & Bell (1987) is equivalent to Zone L4 of Dorning (1981a). The latter was described as the *Polyedrixium tetrahedroide* Cramer and *Elektoriskos brevispinosum* (Lister) Vanguetaine (total) range zone, its base being placed at the first appearance of these species. Many species from the underlying zone range into the *V. whitcliffensis* Biozone. *Visbysphaera* spp., including *V. whitcliffensis* Dorning, are common.

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

### **Occurrence**

The *Visbysphaera whitcliffensis* Biozone was equated with the upper Ludfordian Stage by Dorning & Bell (1987), its base being placed at the base of the Lower Whitcliffe Formation. There is no indication of where the base of the zone might be located in a particular section, however, and no indication of where the zone has been recorded. Dorning (1981a, p. 202) reported his acritarch zones to be recognizable over the whole of the Welsh Basin, but no details have been published.

The top of the zone is currently placed at the top of the Ludlow Series although acritarchs, including *Visbysphaera*, persist in low numbers into the base of the Downton Castle Sandstone Formation, of Prídolí age (Richardson & Rasul 1990, table 3). Farther west, *Elektoriskos brevispinosum*, *Polyedrixium tetrahedroide* and *Visbysphaera whitcliffensis* occur close to the Ludlow-Prídolí boundary near Clun (Miller *et al.* 1997). Their occurrence at Clun may correlate with a break in the succession at Ludlow.

Dorning, K.J. 1981a. Silurian acritarchs from the type Wenlock and Ludlow of Shropshire. *Review of Palaeobotany and Palynology*, **34**, 175-203.

Dorning, K.J. & Bell, D.G. 1987. The Silurian carbonate shelf microflora: acritarch distribution in the Much Wenlock Limestone Formation. In Hart, M.B. (ed.) *Micropalaeontology of carbonate environments*. Ellis Horwood, Chichester, 266-287.

Miller, C.G., Sutherland, S.J.E. & Dorning, K.J. 1997. Late Silurian (Ludlow-Prídolí) microfossils and sedimentation in the Welsh Basin near Clun, Shropshire. *Geological Journal*, **32**, 69-83.

Richardson, J.B. & Rasul, S.M. 1990. Palynofacies in a Late Silurian regressive sequence in the Welsh Borderland and Wales. *Journal of the Geological Society, London*, **147**, 675-686.

See: [Distribution of acritarch species in the type Ludlow Series, Holostratigraphical chart](#).

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