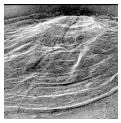
New insights on the Lower Ordovician linguliformean brachiopods of the Anglo–Brabant Massif and the Stavelot–Venn Inlier (Belgium)

Yves Candela, David A.T. Harper, Thomas Servais & Bernard Mottequin



The Lower Ordovician (Tremadocian) linguliformean brachiopods of the southeastern part of the Anglo-Brabant Massif are documented systematically for the first time. The material belongs to a single Belgian locality (La Roche-en-Brabant), situated in one of the few valleys that incise the Mesozoic–Cenozoic cover, and more precisely from the topmost part of the siliciclastic Mousty Formation (Tangissart Member). Here, minute, poorly diverse linguliformeans are associated with planktic graptolites (*Rhabdinopora*) and nileid trilobites (*Platypeltoides*). They consist of three species belonging to three genera (Obolidae and Elkaniidae), of which only *Broeggeria* is known with certainty, due to the poor preservation of the material. In the Belgian part of the Stavelot–Venn Inlier, the presence of linguliformean brachiopods within the Floian Les Plattes Member of the Ottré Formation, which were reported more than 150 years ago, remains unconfirmed. The genus *Broeggeria*, known from several Belgian Tremadocian localities, is a relic from the Cambrian brachiopod fauna. By the Tremadocian it is well established globally between the Low-Latitude and High-Latitude provinces. The Belgian assemblage has strong similarities with assemblages from Baltica reflecting the early Palaeozoic changing palaeogeography. • Key words: Brachiopoda, Linguliformea, Tremadocian, Floian, Avalonia.

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Brachiopods are one of the most common elements of the macrofauna collected from the thick siliciclastic Ordovician succession of Belgium in which they were first reported in the first half of the 19th century (Anonymous 1835). Nevertheless, many lithostratigraphic units are devoid of brachiopod fossils and each new discovery deserves to be documented in detail. In Belgium, Ordovician rocks are known from six Caledonian massifs (or inliers), namely (broadly from north to south) the Brabant Massif, the Condroz Inlier, the Stavelot–Venn, Rocroi, Serpont and Givonne inliers (Figs 1, 2). Until now, Ordovician brachiopods are only known from the first three inliers listed (*e.g.* Sheehan 1987, Candela & Mottequin 2022, Candela *et al.* 2025).

The Brabant Massif consists of a thick series of Cambrian–Silurian siliciclastic deposits known in the subsurface of central and northern Belgium (Fig. 1) (see references in Herbosch & Debacker 2018). It covers a surface area of *c.* 10,000 km^2 but only crops out in the incised valleys that cut into its south-eastern margin (*e.g.* Senne valley; Fig. 1) (Legrand 1968); elsewhere, it is exclusively known from boreholes. This massif, which extends northwestwards to the concealed Caledonides of East Anglia beneath the North Sea (Verniers *et al.* 2002), constitutes the SE part of the Anglo–Brabant Massif (*e.g.* Pharaoh *et al.* 1993, 1995; Pharaoh 2018) (Fig. 2). The Condroz Inlier (also called historically 'Bande de Sambre et Meuse') is a *c.* 65 km long inlier, that is only a few km wide (Verniers *et al.* 2002). It has a close geological relationship with the Brabant Massif, with several sedimentological facies in common. The Stavelot–Venn Inlier (Fig. 1), on the other hand, is the largest of the four Ardenne inliers (formerly 'massifs'). It covers more than 1000 km^2 (Graulich 1963) and thus is the second largest Caledonian massif in Belgium. Mostly outcropping in eastern Belgium, it also extends to Germany (Geukens 1999).

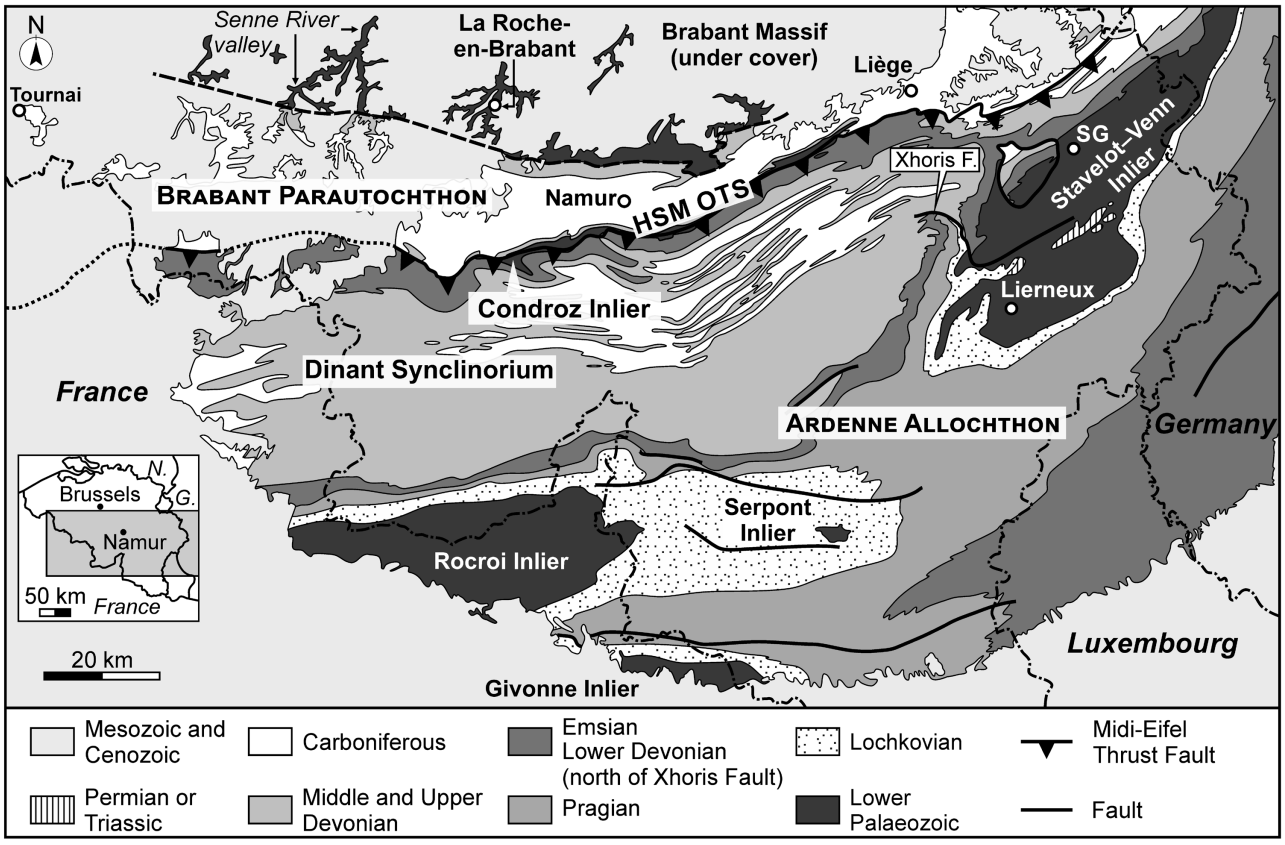


Figure 1. Location and schematic geological map of southern Belgium and adjacent countries (modified from de Béthune 1954 and Mottequin 2021). Abbreviations: F. – Fault; G. – Germany; HSM OTS – Haine–Sambre–Meuse Overturned Thrust sheets (Belanger *et al.* 2012); N. – the Netherlands; SG – Solwaster (Gospinal).

During the Ordovician, the Brabant Massif was situated in high southern latitudes. It has definitively been attributed to Avalonia, a separate microcontinent with a Gondwanan origin, located offshore from high latitude Gondwana (Amazonia–North-West Africa) (*e.g.* Servais & Sintubin 2009, Torsvik & Cocks 2017, Herbosch 2021). The palaeogeographical situation of the Stavelot–Venn Inlier is debated, but some authors consider it as being also part of Avalonia during the early Palaeozoic (Herbosch *et al.* 2020).

Recent studies on linguliformean brachiopods from the Ordovician of the Brabant Massif and the Condroz and Stavelot–Venn inliers have led to the recognition of several distinct, but not very diverse, assemblages (Candela *et al.* 2021, 2025; Candela & Mottequin 2022, 2023). One of the most striking features of these assemblages is undoubtedly the large size of the lingulids from the Katian of the Brabant Massif (Candela & Mottequin 2023). In comparison, the Tremadocian and Floian linguliformean faunas are composed of minute species belonging to a limited number of genera. While the linguliformean and craniiformean brachiopods from the Ordovician Belgian inliers have recently been documented (see the aforementioned references), representatives including lingulids, discinids and craniids from the Belgian Devonian and Carboniferous succession (Lochkovian–Moscovian) deserve to be re-investigated taxonomically, supplementing numerous recent re-illustrations of type material (Mottequin 2019, 2021; Mottequin *et al.* 2019, 2023; Mottequin & Poty 2022). Furthermore, no linguliformeans and craniiformeans have been reported so far in the Silurian deposits of the Brabant Massif and the Condroz Inlier, despite the extensive development of graptolitic shaly facies in which these nonarticulates can sometimes be abundant, compared to the sparsity of rhynchonelliformeans (Mottequin & Jansen, 2025).

The present paper aims to document, for the first time, the brachiopods reported by Van Tassel (1986) from the lower Tremadocian of the Thyle valley in the Brabant Massif. They are the oldest brachiopods recognized in this region and are compared with those identified in the boreholes that reached Tremadocian rocks in England (*e.g.* Bulman & Rushton 1973). It also complements Candela & Mottequin's (2022) study on the Ordovician linguliformeans from the Stavelot–Venn Inlier discussing further their palaeoecology and Malaise's (1878a, b) dubious '*Lingula*' reports from this area.

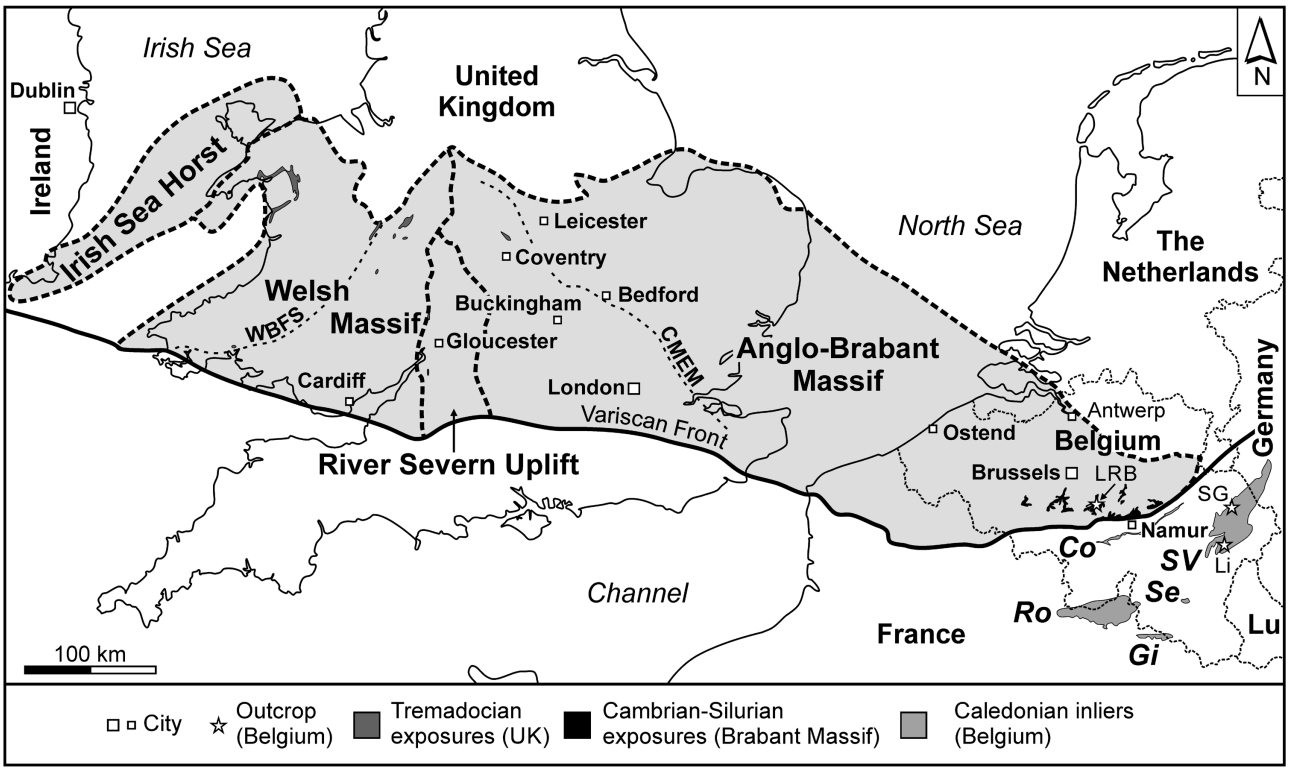


Figure 2. Location of the Anglo-Brabant Massif (modified and simplified from Pharaoh 2018) with indication of the surface outcrops of Tremadocian rocks in central England and Wales (Bulman & Rushton 1973, Cope & Rushton 1992). Outcrop areas of Cambrian–Silurian rocks in the Belgian part of the Anglo-Brabant Massif are indicated (de Béthune 1954, Verniers *et al.* 2002) as well as the other Belgian inliers. Abbreviations: CMEM – Conjectured Microcraton Eastern Margin (see Pharaoh 2018); Co – Condroz Inlier; Gi – Givonne Inlier; Li – Lierneux; LRB – La Roche-en-Brabant; Lu – Luxembourg; Ro – Rocroi Inlier; Se – Serpont Inlier; SG – Solwaster (Gospinal); SV – Stavelot–Venn Inlier; WBFS – Welsh Borderland Fault System (see Pharaoh 2018).

Geological setting

The Lower Ordovician lithostratigraphy of the Brabant Massif was summarized by Verniers *et al.* (2002) and Herbosch & Verniers (2013). The reader is referred to Candela & Mottequin (2022) for information related to the geological context of the brachiopods originating from the Stavelot–Venn Inlier. Correlations between both massifs were recently discussed by Herbosch (2021) (Fig. 3).

The linguliformean brachiopods cited as 'lingules' by Van Tassel (1986) are from the uppermost part of the Mousty Formation (Ottignies Group), known as the Tangissart Member (Herbosch & Lemonne 2000) (Fig. 3). The Mousty Formation consists of dark shales and siltstones, the thickness of which varies considerably according to the authors: from *c.* 500 m (Delcambre & Pingot 2002) to *c.* 1500 m (Herbosch & Verniers 2013) (see also Herbosch 2023). The Tangissart Member (formerly named 'X' formation by André *et al.* 1991) includes dark grey to black, bedded shales and grey shales with silty laminae to the top (André *et al.* 1991, Delcambre & Pingot 2002, Verniers *et al.* 2002, Herbosch & Verniers 2013) with a maximum thickness estimated at 100 m (Herbosch *et al.* 2002). It is currently the oldest unit of the lower Palaeozoic in the Brabant Massif to yield macrofossils. The presence of the planktic graptolite genus *Rhabdinopora* (Lecompte 1948, 1949; Van Tassel 1986; Wang & Servais 2015) within the Tangissart Member indicates a Tremadocian age (Fig. 3) whereas the rest of the Mousty Formation was attributed to the middle to upper Cambrian, based on acritarchs (*e.g.* Martin 1969, 1976; Vanguestaine 1992), but this age attribution should be revised (Laibl *et al.* 2023). André *et al.* (1991) interpreted the Tangissart Member as pelagic or hemipelagic deposits while the silty sequences correspond to fine-grained turbidites according to Herbosch & Verniers (2013) and Herbosch (2023).

The material from the Brabant Massif investigated in this paper is exclusively from the locality Chastre 106, situated in the trenches of road N275 (both sides), linking Court-Saint-Etienne and Villers-la-Ville (Van Tassel 1986, figs 1, 8; Herbosch *et al.* 2002, fig. 15; Laibl *et al.* 2023, fig. 2), north of the La Roche-en-Brabant station. The material was collected from the Tangissart Member in 1952 by Van Tassel. The outcrop is now concealed by a retaining stone wall on one side and overgrown on

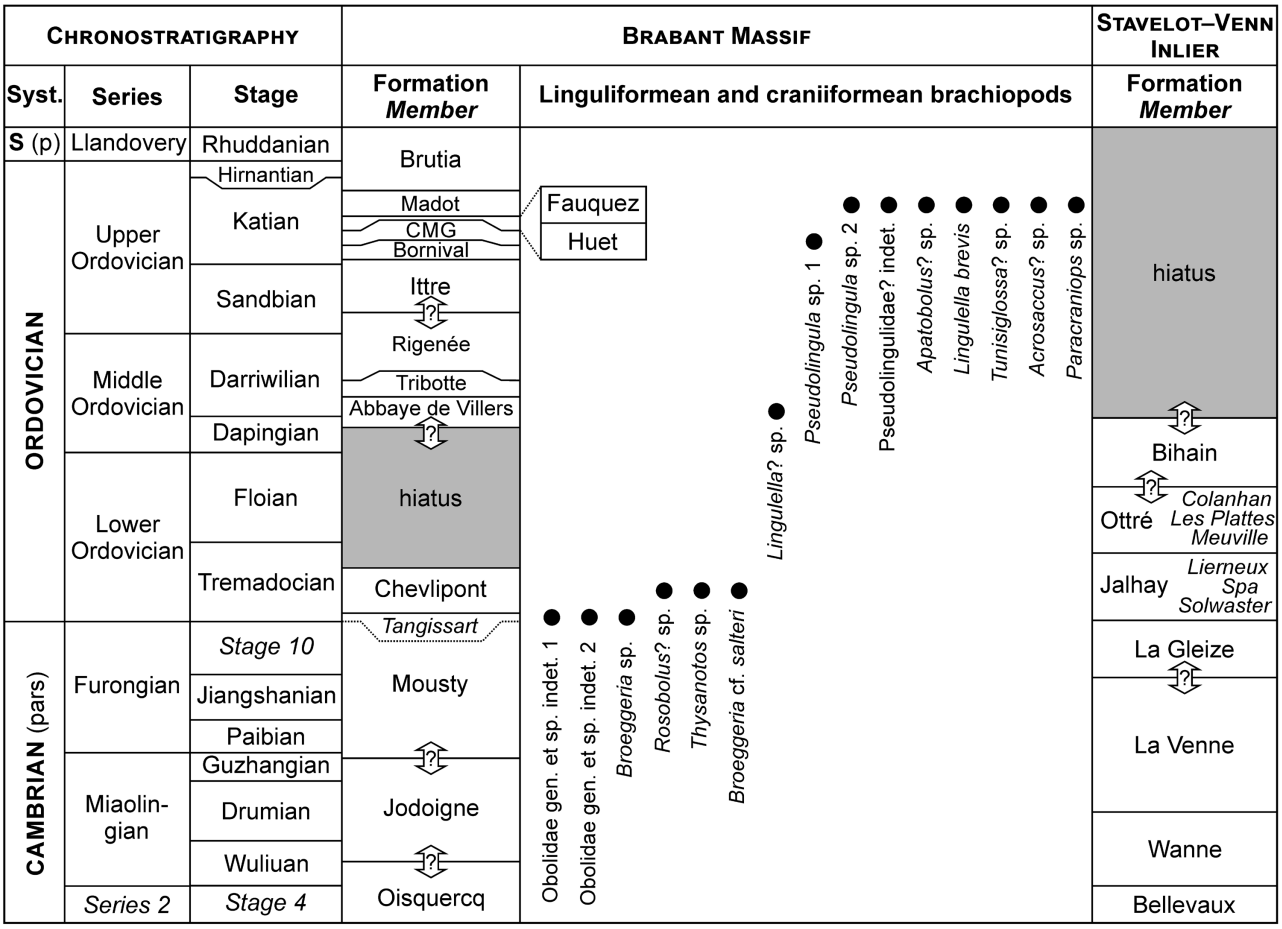


Figure 3. Upper Cambrian–lower Silurian chronostratigraphy and lithostratigraphy of the Brabant Massif and Stavelot–Venn Inlier (modified from Herbosch *et al.* 2020) with the distribution of the linguliformean and craniiformean brachiopods within the Ordovician of the Brabant Massif (modified from Candela *et al.* 2021, Candela & Mottequin 2023); for those from the Stavelot–Venn Inlier, see Candela & Mottequin (2022). The double arrows indicate boundaries between formations of uncertain age. Abbreviations: CMG – Cimetière de Grand-Manil; p – *pars*; S – Silurian.

the other where only a few exposures are still visible (April 2023). Brachiopods were collected at 46 and 51 m from the ESE extremity of the west road embankment, associated with graptolites (Wang & Servais 2015) and nileid trilobites (Laibl *et al.* 2023).

Material and methods

The bulk of the studied material is stored in the Royal Belgian Institute of Natural Sciences (Brussels; prefixed RBINS) and is complemented by specimens from the palaeontological collections of the University of Liège (Liège; prefixed PA.ULg). All the brachiopods available from the Tangissart Member are preserved as tectonically distorted internal and/or external moulds. Those selected for scanning electron microscopy were imaged with an ESEM FEI Quanta 200, under low vacuum; these specimens were uncoated. The remainder of the material was photographed using an Olympus OM-D E-M10 Mark IV digital camera equipped with the Olympus M.Zuiko Digital ED 60 mm macrolens and coated with ammonium chloride.

Brachiopod classification follows the revised edition of the Treatise on Invertebrate Paleontology (Holmer & Popov 2000, 2007).

Systematic palaeontology

Subphylum Linguliformea Williams *et al.*, 1996
Class Lingulata Gorjansky & Popov, 1985
Order Lingulida Waagen, 1885
Superfamily Linguloidea Menke, 1828
Family Obolidae King, 1846

Obolidae gen. et sp. indet. 1
Figure 4A–F

Material. – Eighteen dorsal valves.

Remarks. – The material available is poorly preserved and consists of small, elongated oval dorsal valves, about 130–145% as long as wide. The dorsal valve interiors are characterised by a fine median septum developed anteriorly for more than half of valve length. The exteriors show a concentric ornamentation of 20–25 lines per mm. The Tremadocian Belgian specimens bear some similarities with the middle to upper Cambrian taxa *Lindinella* Mergl & Šlehoferová, 1990 and *Westonia* Walcott, 1901 in their ornamentation and the presence of a dorsal median septum extending anterior to mid valve length. However, these taxa are characterised by large shells (dorsal valve maximum width 13 mm and 12 mm for *Lindinella* and *Westonia*, respectively), whereas the specimens studied here are rarely wider than 5 mm. The ornamentation in *Westonia* is also characterised by irregular, transverse lines intersecting with the concentric lines, forming a zigzag pattern in the posterior half of the valves. In *Lindinella*, the ornamentation consists of similar concentric lines, but it is coarser in *Lindinella*, numbering 10 per mm. These specimens are thus left under open nomenclature until better preserved material is collected.

Obolidae gen. et sp. indet. 2
Figure 4G–I

Material. – Six dorsal valves.

Remarks. – The material is not well preserved and consists of dorsal valves only; valves elongated elliptical, about 130–150% s long as wide; maximum convexity posterior to mid valve; posterior margin of valve subcircular; interior of valve characterized by a thin, long median septum, extending for almost two-thirds of the valve length; anterior projections of the visceral field extending to valve mid length; anterior central muscle scars, extending for 60% of valve length, flanking the anterior end of the median septum. Ornamentation consisting of fine concentric lines, numbering 30–35 per mm.

Comparison with relevant taxa is difficult due to the paucity and the poor preservation of the material. The main characters observable in the present Belgian specimens are the muscle scars and the projection of the visceral field. These are comparable with the same features in *Hyperobolus* Havlíček, 1982 and *Expellobolus* Havlíček, 1982 from the Middle Ordovician and the Tremadocian, respectively, of Bohemia. However, the projection is not as well developed in the Bohemian genera, and the dorsal valve in *Hyperobolus* is more isometric than in the Belgian specimens. The dorsal valve shape in *Expellobolus* is more similar to that of the Belgian specimens with a rough spatulate outline and lateral margins subparallel although curved. The interiors do not have as strong projections in the Bohemian species.

Family Elkaniidae Walcott & Schuchert *in* Walcott, 1908

Genus *Broeggeria* Walcott, 1902

Type species. – *Obolella salteri* Holl, 1865, by original designation; from the White-Leaved Oak Shale Formation (upper Cambrian) of the Malvern Hills, England.

***Broeggeria* sp.**
Figure 4J–O

Material. – Twenty-one valves, including four ventral valves, five dorsal valves and twelve undetermined valves.

Remarks. – Small shells, width ranging from 2.5 to 7.2 mm on thirteen valves. The majority of the valves are preserved as external moulds, and due to their poor preservation, it is very difficult to identify most of them as either a ventral or a dorsal valve. One valve is clearly a ventral valve interior (poorly defined visceral area restricted to posterior, not extending to mid valve length; posterior branch of *vascula lateralia* present). A poorly preserved dorsal valve interior has the visceral area weakly defined. The external ornament is characterized by fine rugellae numbering 18–24 per mm.

The poor preservation of the material does not allow comparisons with other species. The material is therefore left under open nomenclature.

Discussion

Brachiopods from the Tangissart Member

The lower Tremadocian Tangissart Member of the Mousty Formation has yielded the oldest brachiopod assemblage of the Brabant Massif; it is older than the assemblage from the overlying Tremadocian Chevlipont Formation (Fig. 3) described by Candela *et al.* (2021), in which three taxa have been reported: *Rosobolus*? sp., *Thysanotos* sp. and *Broeggeria* cf. *salteri*. The Tangissart Member has yielded *Broeggeria* sp. and two Obolidae taxa reported under open nomenclature. The genus *Broeggeria* is also known from Belgian and German Tremadocian localities of the Stavelot–Venn Inlier (Schmidt 1954, 1956; Schmidt & Geukens 1959; Candela *et al.* 2021; Candela & Mottequin 2022) and is one of the dominant taxa among the poorly diverse Tremadocian assemblages recovered so far in both massifs. From the taphonomic viewpoint, the brachiopods of the Tangissart Member are all preserved as

disarticulated valves occurring on bedding planes. Some are associated with fragments of *Rhabdinopora* whereas the nileid trilobite *Platypeltoides* cf. *croftii* (Callaway, 1877) also occurs within the same levels. The latter is represented by moulted exoskeletons that likely represent an autochthonous assemblage as transport would have disarticulated these fragile remains (Laibl *et al.* 2023). According to Laibl *et al.* (2023), the occurrence of this trilobite suggests that the Tangissart Member was deposited in a deep-water offshore environmental setting, which also conforms to the graptolite information (Wang & Servais 2015).

Tremadocian brachiopods from the Anglo-Brabant Massif

Curtis (1968) listed a diverse fauna from the most southerly occurrence of Tremadocian rocks in Britain. Brachiopods from the Breadstone Shales and the Micklewood Beds in the Tortworth Inlier include *Lingulella*, *Eurytreta*, *Broeggeria*, and *Eopaterula*. The latter was originally described as *Schmidtites* cf. *crassus* by Curtis (1968) but Sutton *et al.* (2000) reassigned this species to their new genus *Eopaterula*.

In the south-central Midlands and East Anglian regions of England, Tremadocian rocks are only known from boreholes (Bulman & Rushton 1973, Molyneux 1991). According to Bulman & Rushton (1973), 'inarticulate' brachiopods are the commonest shelly fossils in the Midlands boreholes, which yielded a poorly diverse fauna mainly including representatives of the genera *Lingulella* and *Eurytreta* whereas *Broeggeria* specimens are very rare. The species collected there are the same as those listed by Curtis (1968).

Tremadocian strata in the Welsh Massif (Llangynog area, South Wales) yielded eight brachiopod species (Rushton & Bassett *in* Owens *et al.* 1982, Cope & Rushton 1992). Owens *et al.* (1982) also recorded these three genera listed by Bulman & Rushton (1973), but they also added *Elliptoglossa*, *Divobolus* and *Torynelasma* from Cwm Crumlyn (*C. tenellus* Zone shales), and Clyn-côch (Lower Tremadoc shales). The Belgian fauna is less diverse than the fauna recovered in England and South Wales.

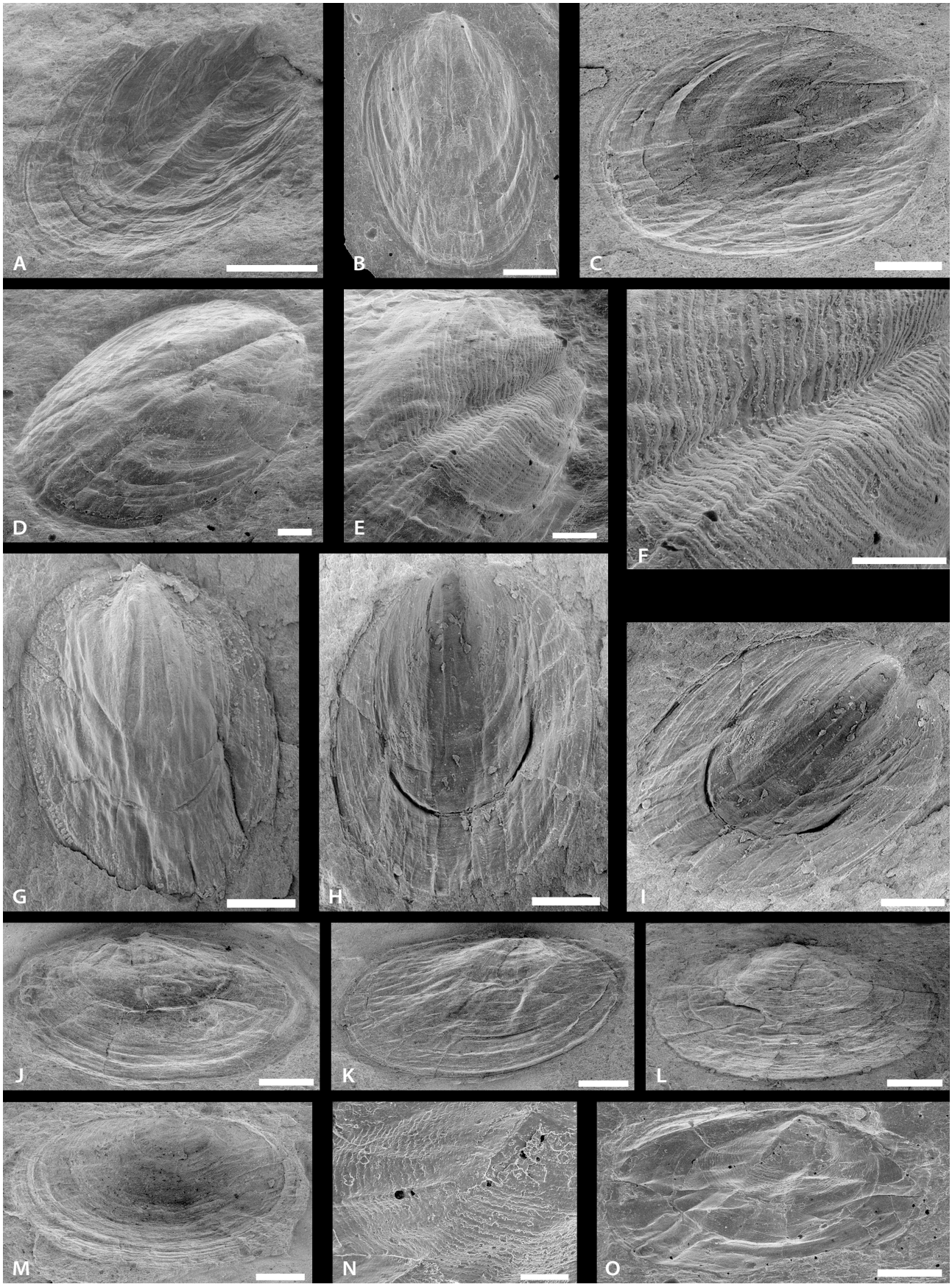
Comments on the palaeoecology of the brachiopods from the Solwaster Member (Stavelot–Venn Inlier)

Tremadocian linguliformeans from the Solwaster Member (Jalhay Formation) were previously described and illustrated by Candela *et al.* (2021) and Candela & Mottequin (2022). These dark coloured shales also yield planktic graptolites (e.g. *Rhabdinopora*) that form characteristic horizons (Bulmann 1970, Erdtmann 1986, Wang & Servais 2015, Candela *et al.* 2021). Brachiopods are scarce and generally found as dissociated valves lying on bedding planes. Nevertheless, one slab from the Solwaster (Gospinal) locality (Candela & Mottequin 2022) (Figs 1, 2) clearly displays three valves of possibly *Broeggeria*, aligned and closely spaced (Fig. 5). It is impossible to deduce whether the specimens are articulated or not. Two are similarly sized and have the tip of their umbones almost perfectly aligned horizontally whereas the third, which is smaller, is situated slightly set back, but has the same orientation. A fourth valve (external mould) is also present, with its umbo facing upwards. This arrangement is puzzling, and it is possible these minute shells were attached to a substrate that is not preserved. The presence of linguliformean brachiopods in graptolitic shales was generally interpreted as reflecting an epiplanktic mode of life (*e.g.* Ruedemann 1934, Havlíček 1967, Bergström 1968), but this idea was challenged by Sheehan (1977) who suggested that biological objects such as seaweed were run aground on the sea floor offering a firmer substrate than argillaceous deposits and thus more convenient for the attachment of epibenthic organisms.

Linguliformean brachiopods from the Floian Les Plattes Member (Stavelot–Venn Inlier)

In the Lierneux area (Fig. 1), Malaise (1878a, b) reported poorly preserved '*Lingula*' from the 'phyllades salmiens manganésifères' (Ottré Formation, formerly Sm2: 'Salmien 2', Les Plattes Member) that were submitted to the distinguished brachiopod worker Thomas Davidson for identification. The latter noted that the Cambrian species

Figure 4. Linguliformean brachiopods from La Roche-en-Brabant (locality Chastre 106, Brabant Massif), Mousty Formation (Tangissart Membert), Tremadocian. • A–F – Obolidae gen. et sp. indet. A – external mould of dorsal valve, RBINS a14179, tilt angle 40°. B, D – silicone cast of external mould of dorsal valve, RBINS a14180, in normal view and at a 35° tilt angle. C – counterpart of internal mould of dorsal valve, RBINS a14180, in normal view. E, F – detail of ornamentation on silicone cast of dorsal valve, RBINS a14182. • G–I – Obolidae gen. et sp. indet. 2. Internal mould of dorsal valve in normal view (G), counterpart of internal mould in normal view (H) and at a 30° tilt angle (I), RBINS a14183. • J–O – *Broeggeria* sp. J – internal mould of ventral valve, RBINS a14184. K – internal mould of dorsal valve, RBINS a14181. L – external mould of ventral valve, RBINS a14185. M – external mould of dorsal valve, RBINS a14186. N–O – detail of ornament and silicone cast of external mould of dorsal valve, RBINS a14187. All figures are SEM micrographs. Scale bars = 250 μm (E, F, N); 1 mm (A–D, G–O).


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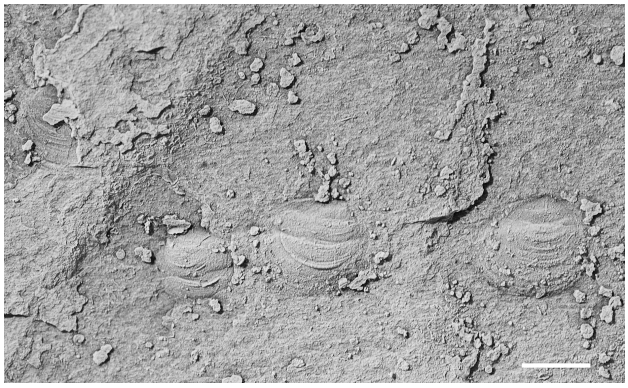


Figure 5. *Broeggeria* sp. External mould of three aligned shells – note a fourth external undetermined valve on the top left of the smaller left shell – (PA.ULg.2025.06.19-1) from Solwaster (Gospinal), Stavelot–Venn Inlier, Jalhay Formation (Solwaster Member), Tremadocian. Scale bar = 2 mm.

Lingulella primaeva Hicks *in* Harkness & Hicks, 1871 from South Wales displays somewhat the same outline as the Belgian material. Candela & Mottequin (2022) highlighted the fact that the material was not traced in the RBINS collections.

A careful examination of the Belgian literature reveals that Malaise (1911a) noted that the valves collected by him in 1874 and regarded as belonging to *Lingula*, should be identified as *Lingulocaris lingulaecomes* Salter, 1866, a phyllocarid from the upper Tremadocian of Garth (Wales). A decade earlier, Malaise (1899, 1901) had already written that the numerous fossil traces known from the Les Plattes Member were produced by *L. lingulaecomes*, notably those which were previously assigned by him to *Lingula* (fide Davidson). According to Malaise (1911a), these traces were regarded as crinoids by Dumont (1847, p. 37) and as possible plant remains by Dewalque (1868, p. 24); they could also correspond to the annelids mentioned by Malaise (1877) according to Mourlon (1880, p. 34). *Lingulocaris lingulaecomes* is the only fossil reported by Malaise (1911b) from the former 'Assise de Salm-Château' corresponding to the Salmian ('Salmien'), a disused regional Ordovician stage (Dejonghe *et al.* 2006). Moreover, the short discussion in Maillieux (1926) indicates that these traces were previously doubtfully assigned to *Caulerpites cactoides* Göppert, 1860 by Crépin (1873), and Seward (1898) noted that the material determined as such in the 'Brussels Museum', which is known as the Coemans' collection, probably reflects the activity of a burrowing animal. Re-examination of this material unambiguously refutes the interpretation proposed by Malaise (1899, 1901) and does not support Seward's (1898) statement as the samples display traces left by the dissolution of nodules, probably having coalesced, rather than to biotic traces (see Mottequin *et al.* in press). Nevertheless, as the fossils collected by Malaise in 1874 remain untraced and unillustrated, their true nature remains uncertain: whether brachiopods (Davidson

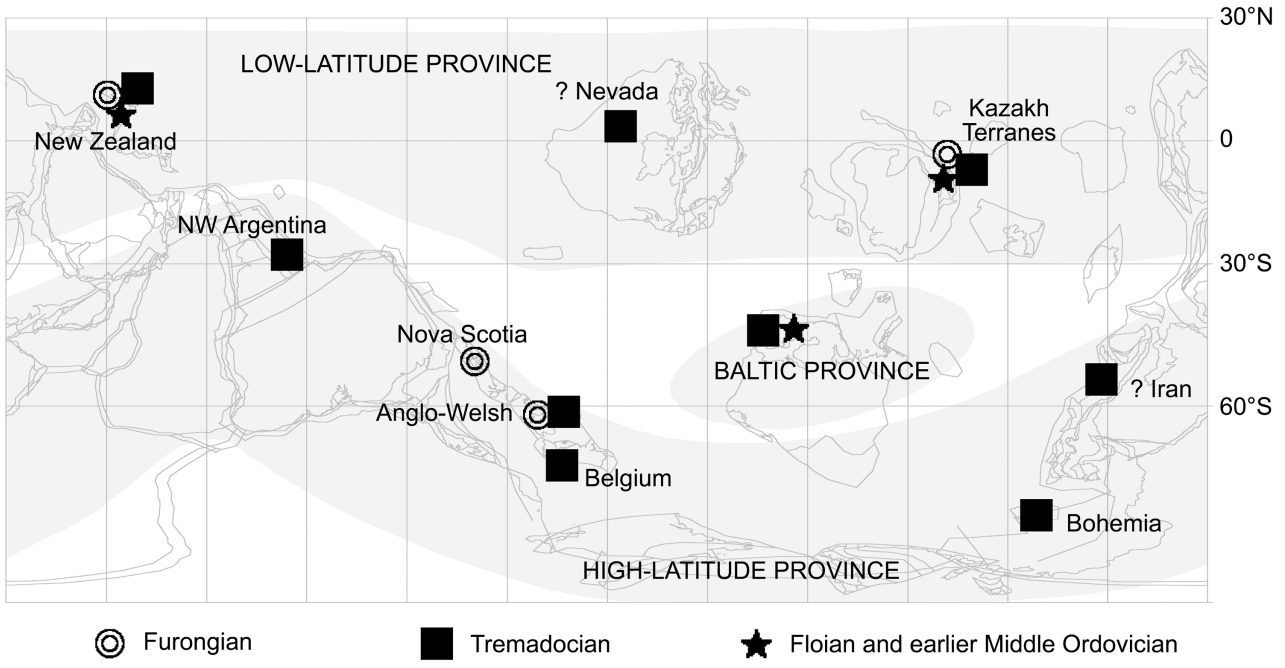


Figure 6. Palaeogeographic map for the Tremadocian (redrawn and adapted from Harper *et al.* 2013), showing the geographical occurrences of the genus *Broeggeria* through three time slices: Furongian (late Cambrian), Tremadocian (Early Ordovician), together with Floian and younger occurrences (Middle Ordovician).

in Malaise 1878a, b) or phyllocarids (Malaise 1899, 1901, 1911a).

In conclusion, the only brachiopods recovered so far from the Floian Les Plattes Member of the Ottré Formation are the few specimens of *Celdobolus* sp. reported from the basalmost part of this member by Candela & Mottequin (2022). These represent the youngest Ordovician brachiopods known from the Stavelot–Venn Inlier.

Palaeobiogeographic significance

The Tremadocian is a pivotal interval in the history of early animals (Candela *et al.* 2024) as it links the Cambrian and the Paleozoic evolutionary faunas (Saleh *et al.* 2022). The discovery of sites with exceptional preservation has opened a new window on our understanding of evolution, as taxa usually regarded as Cambrian (*e.g.* marellids andradiodonts) are also described from the Tremadocian and Floian (*e.g.* Fezouata Biota, Saleh *et al.* 2024a, and Cabrières Biota, Saleh *et al.* 2024b, both regarded as Burgess-type assemblages). Nevertheless, Early Ordovician macrofaunas are rare in the Brabant Massif (Wang & Servais 2015, Candela *et al.* 2021, Laibl *et al.* 2023). The Massif's thick lithostratigraphic succession consists of sediments deposited in relation to the Pan-African orogen, in an embayment of a large rift developed on the western margin of Gondwana (Linnemann *et al.* 2012). The present brachiopod assemblage recognized within the Tangissart Member of the Mousty Formation shows a low diversity and moderate abundance, similar to the assemblage described from the overlying Chevlipont Formation (Candela *et al.* 2021). Both assemblages are characterized by the presence of the elkaniid *Broeggeria*, with other lingulid taxa. Assemblages of linguliformean brachiopods with such low diversity are typical of assemblages in peri-Gondwanan terranes and may have their origin in the Cambrian (Popov *et al.* 2013). *Broeggeria* originated during the late Cambrian and by the Tremadocian, it was well established and palaeogeographically widely distributed, from the palaeoequator to high latitudes (Fig. 6). In the late Cambrian, *Broeggeria* is found in the Kazakh Terranes (Holmer *et al.* 2001) and in New Zealand (Percival *et al.* 2014) within the Low-latitude province of Harper *et al.* (2013), and along the margins of the peri-Gondwana terrane of Avalonia (Nova Scotia, Walcott 1902; Anglo-Welsh Basin, Owens *et al.* 1982) in the High-latitude province (Harper *et al.* 2013). By the Tremadocian, this taxon expanded its geographical spread to Belgium (in the eastern part of Avalonia), to other parts of Gondwana (NW Argentina: Harrington 1937, Benedetto *et al.* 2018) to the west, and to the east, possibly to Iran (Popov *et al.* 2009) and Bohemia (Mergl 2002, Kraft *et al.* 2013), the latter located closer to the South Pole. This taxon also invaded Baltica, including Scandinavia and Poland (Tjernvik 1956, Bednarczyk 1979, Popov & Holmer 1994, Hansen & Holmer 2011), during the Tremadocian.

Besides its aforementioned similarities with the brachiopod assemblage from the Chevlipont Formation (Candela *et al.* 2021), the fauna from the Tangissart Member is similar to those reported by Rønning *et al.* (2020) from the uppermost part of the Alum Shale Formation (Rafnes-Herøya, Skien-Langesund District, Norway), both from the taxonomic point of view and in displaying similar low-diversity. The Tangissart assemblage is also similar in composition (including *Broeggeria* and other lingulide brachiopods) to the coeval assemblage from the Solwaster Member of the Jalhay Formation in the Stavelot–Venn Inlier in eastern Belgium and western Germany (*e.g.* Schmidt 1956, Candela & Mottequin 2022), but the latter is more diverse with nine species described.

Conclusions

The oldest linguliformean brachiopods recognized in the southwestern part of the Anglo-Brabant Massif have been described for the first time more than seventy years after their discovery in the early 1950s (discussed in Van Tassel 1986) from the Tremadocian Tangissart Member of the Mousty Formation. Three taxa, including *Broeggeria* and two left in open nomenclature (due to their poor preservation) have been identified. The assemblage, also comprising the graptolite *Rhabdinopleura* and a nileid trilobite (*Platypeltoides*) is similar to that from the uppermost part of the Alum Shales in Norway, indicating a dynamic and changing palaeogeographical configuration of palaeocontinents.

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