Supplementary Material

**Distribution and correlation of *Sabellidites cambriensis* (Annelida?) in**

**the basal Cambrian on Baltica**

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**Regional and global stratigraphical distribution of *Sabellidites***

The reference to the Figures 9 and 10 are those found in the main paper.

Note that Rovnian strata are missing in NE Poland, W Lithuania, W Latvia, and Estonia, whereas they are represented by the Rudamina Formation in E Lithuania, E Latvia, and Belarus (Mens & Pirrus, 1997; Gailīte *et al.* 2000; Jankauskas & Laškova, 2004; Zinovenko, 2009; Makhnach *et al.* 2010; Kirikov, 2011; Nielsen & Schovsbo, 2011). In Kaliningrad, the oldest Cambrian rocks unconformably overly the crystalline basement, and acritarchs indicate the considerably younger *Skiagia*–*Fimbriaglomerella* Zone (Kirikov, 2011).

*1.a. Newfoundland*

The GSSP for the base of the Cambrian is defined in a section of the lower Chapel Island Formation at Fortune Head on the Burin Peninsula in eastern Newfoundland, Canada (Narbonne *et al.* 1987; Brasier *et al.* 1994; Landing *et al*. 2007, 2013) (Figs 9a, 10). The formation is *c.* 1000 m thick and was initially divided into five informal members, now supplemented by the Quaco Road Member (members 1–3, 4 (partly)) and the Mystery Lake Member (upper part of member 4 and member 5) (Landing *et al*. 2013), although the identification of these members in Newfoundland, originally defined in New Brunswick, is not without problems. The boundary interval includes the *Treptichnus pedum* Ichnozone, with the Ediacaran–Cambrian boundary placed 2.4 m above the base of ‘member 2’ (Landing, 1994). Specimens of the trace fossil *T. pedum* occur as well in the upper 1.7 m of the underlying ‘member 1’. *Sabellidites cambriensis* ranges from the upper 2.5 m of ‘member 1’ and *c.* 150 m into ‘member 2’ (Narbonne *et al*. 1987), although with a single occurrence at the very top of ‘member 4’. A *Sabellidites cambriensis* Zone is recognized (Narbonne *et al.* 1987). The tubular foraminiferan *Platysolenites antiquissimus* occurs 8 m above the base of ‘member 4’ and the morphologically similar *P. cooperi* McIlroy *et al*., 2001, at 95 m above the base of ‘member 3’ (Landing *et al*. 1989; McIlroy *et al.* 2001). ‘Member 4’, and the upper part of ‘member 3’ corresponds to the *Watsonella crosbyi* Zone of provisional Stage 2 with specimens of the mollusc *Watsonella crosbyi* Grabau, 1900 appearing in the upper 41 m of ‘member 3’ (Landing *et al*. 1988, 1989). Conical calcareous tubes of *Ladatheca cylindrica* are found from the uppermost part of ‘member 2’ throughout ‘member 4’, with the *L. cylindrica* Zone ranging from the lowest occurrence until the appearance of *W. crosbyi* in the upper part of ‘member 3’ (Landing *et al*. 1989). The *T. pedum* Ichnozone lacks diagnostic acritarchs, with a *Granomarginata* assemblage appearing *c.* 150 m from the base of ‘member 2’ and *Asteridium* appearing first in the Random Formation (Palacios *et al.* 2018). The occurrence of *Granomarginata* without the index taxa of the *Asteridium–Comaspaheridium* Zone led to the erection of the *Granomarginata* Zone in Newfoundland (Palacios *et al.* 2018).

*1.b. Scandinavia*

Besides the Digermulen Peninsula, *Sabellidites* *cambriensis* is known from four other areas in Scandinavia (Fig. 98b). Føyn & Glaessner (1979) reported abundant fragments in a single shale sample at the river Basávžžejohka (Basavčče in Føyn, 1967), in eastern Tana on the Varanger Peninsula across from the Digermulen Peninsula (Fig. 9b, locality 2). The specimens were not from a measured section or associated with other fossils. Føyn (1967) reported *Platysolenites antiquissimus* from three localities near from where *Sabellidites* was found. *Platysolenites* is also recorded in the lower 30 m of the upper member of the Breidvika Formation (*c.* 240–270 m above its base) on the Digermulen Peninsula but not lower in the succession (McIlroy *et al*. 2001; McIlroy & Brasier, 2017). Other occurrences of *Platysolenites* in Scandinavia were documented by Hamar (1967), Føyn & Glaessner (1979), Tynni (1980), and McIlroy *et al*. (2001). Note that the much cited occurrence of *Platysolenites* in trilobite-bearing strata in the Mjøsa area is erroneous (see Section 7.c##). Føyn & Glaessner (1979) also reported the mollusc *Aldanella kunda* (Öpik) [= *A.* *attleborensis*](Shaler & Foerste, 1888) co-occurring with *Platysolenites* at Dorrovarre in northern Norway (Fig. 9b, locality 5).

*Sabellidites* *cambriensis* was also reported from the Lake Porojärvi area in Finland by Tynni (1980). Specimens were found in the lower 2 m of a 10 m section of shale and siltstone attributed to the Dividalen Group, exposed in a creek on the eastern tip of Mt Meekonvaara at Lake Meekonjärvi (Fig. 9b, locality 3). The beds are probably equivalent to the ‘Red and green siltstone member’ of the Torneträsk Formation in the Torneträsk area in Sweden (Systra & Jensen, 2006). In the upper part of the Mt Meekonvaara section, 3 m from the top, abundant specimens of *Platysolenites antiquissimus* were reported by Tynni (1980). *Platysolenites* was found in two other adjacent sections but further specimens of *Sabellidites* were not reported. Pirrus (2004) discussed the occurrence of vendotaenid or *Sabellidites* remains in sections at Kilpisjärvi to the southwest of Lake Porojärvi (Fig. 9b, locality 4).

Further south, in the Torneträsk area of Sweden, Jensen & Grant (1998) reported *Sabellidites* sp. (here treated as *S. cambriensis*) from a single rock sample from the upper part of the *c.* 18 m thick ‘Lower siltstone member’ of the Torneträsk Formation of the Dividalen Group at the Luobákti section, Mount Luovárri south of Lake Torneträsk (Fig. 9b, locality 6, horizon marked 2 in Fig. 10) together with *T. pedum*. *Platysolenites* was reported from the red siltstone in the lower part of the overlying ‘Red and green siltstone member’ (*c.* 25 m thick) (Moberg, 1908; Kulling, 1964). *Sabellidites* and *T. pedum* together suggest a basal Cambrian age (Jensen & Grant, 1998). Moberg (1908) reported abundant thread-like fossils with faint transverse striations from the same horizon, and his samples are here identified as *Sabellidites* *cambriensis* (Jan Ove R. Ebbestad, pers. observation). Vidal (1981, p. 39) also reported membrane-fragments in ‘large numbers’, from this level and assigned these to the filamentous *Vendotaenia* cf. *antiqua* Gnilovskaya, 1971. The tentative identification may have been influenced by the idea at the time that these beds were of late Vendian (Ediacaran) age. It may also be difficult to distinguish *Vendotaenia* from a poorly preserved *Sabellidites*, although *Sabellidites* specimens in this section are quite well-preserved. Furthermore, *Sabellidities* seem to co-occur with *Platysolenites* even in the ‘Lower siltstone member’ (Peter Cederström, pers. comm 2020), precluding an Ediacaran age for these beds.

At Strøby on Bornholm, Denmark, *Sabellidites cambriensis* occurs abundantly in the middle and lower part of the *c.* 17 m thick Hadeborg Member, the lowest member of the Hardeberga Sandstone Formation (Bromley, 2002; Nielsen & Schovsbo, 2007, 2011) (Fig. 9b, locality 7, marked H in Fig. 10). These rocks reflect a relative sea-level rise recorded as the Hadeborg Drowning, with the maximum flooding surface at top of the unit (Nielsen & Schovsbo, 2011). Based largely on the occurrence of *Sabellidites*, the member was tentatively correlated with the Lontovan Stage or older strata by Nielsen & Schovsbo (2011) with reference to occurrences in northern Norway and Eastern Europe. Acritarchs of the Stage 3 *Skiagia* –*Fimbriaglomerella* assemblageZonewere recorded in the overlying Brantevik and Tobisvik members in Scania of southern Sweden but without *Skiagia* itself (Moczydłowska & Vidal, 1986; Moczydłowska, 1998).

*1.c. White Sea*

Ediacaran and Cambrian strata are exposed in a large south–north area along the coastal expanses of the White Sea, while further east they are found subsurface and covered by younger Palaeozoic rocks (Stankovsky *et al.* 1985, 1990). In general, the thickness of the oldest strata increases towards the east-southeast (Maslov *et al.* 2008). The uppermost Ediacaran is represented by the *c.* 150 m thick Erga Formation, followed by the Cambrian(?) Padu Group (up to 300 m thick) which is subdivided into the Zolotitsa (*c.* 100 m thick), Nyugus (80–90 m thick) and Brusov (230 m thick) formations in ascending order (Grazhdankin, 2003; Maslov *et al.* 2008, 2009; Kuznetsov *et al.* 2014). The lower boundary of the Padun Group is at a maximum regression surface, and the entire Zolotitsa Formation forms a transgressive systems tract (Maslov *et al.* 2008, 2009). Grazhdankin & Krayushkin (2007) commented that the definition of a Vendian–Cambrian boundary is not well constrained in the White Sea area.

Sabelliditid remains were discovered in the Arkhangelsk area of the White Sea by Sokolov (1952) and identified in the upper part of the drill cores Obozerskaya (862–857 m) and Kamenny Pryluky (848–862 and 759–766 m) (Igolkina, 1956; Zoricheva, 1963; Kirsanov, 1974; Alekseev *et al.* 2005) (Fig. 9b, localities 8a, b). Acritarchs recovered from 758 m in the latter core included *A. tornatum* and *Granomarginata* cf. *squamacea* (Palij et al. 1979, 1983; Alekseev *et al.* 2005), although how the stratigraphy of the core relates to the Padu Group is unclear. Kuznetsov *et al.* (2014) reported the occurrence of *Platysolenites antiquissimus* in the middle part of the Nyugus Formation.

A number of drill cores retrieved from the area west of Arkhangelsk were studied by Alekseev *et al.* (2005) and Grazhdankin & Krayushkin (2007). In borehole Al318k (Fig. 9b, locality 8c), the lower part is attributed to the Zolotitsa Formation (61 m thick, 191–252 m in the core), and the middle part to the Nyugus Formation (100–191 m in the core), being lithologically consistent across the area and varying between 84.5–98.0 m in thickness. The upper part (17–100 m in the core) is attributed to the lower Brusov Formation which can be 230 m thick (Kuznetsov *et al.* 2014). Abundant *Sabellidites cambriensis* occur in a 2 cm thick interval at about 150 m in the core and higher up abundant *Diplocraterion* and *Skolithos* trace fossils were recorded (about 139–111 m) (Alekseev *et al.* 2005; Grazhdankin & Krayushkin, 2007; Maslov *et al.* 2008, 2009). The Nyugus beds in the drill cores studied by Alekseev *et al.* (2005) are uniform in thickness and appearance, with the *Sabellidites* level identified in all cores at about 38–46 m above the base of the formation. This level is traceable over an area of more than 30 km (Alekseev *et al.* 2005).

*1.d. Estonia and the St. Petersburg area and central Moscow Basin of Russia*

The lower Cambrian strata in Estonia are well-studied (Mens *et al*. 1987, 1990; Mens & Pirrus, 1977, 1997; Meidla, 2017). The base of the Cambrian is marked by a regional unconformity, cutting out the Rovnian Stage, while the ensuing Lontovan Stage encompasses the clay dominated Lontova Formation in NNW and SE Estonia and the sandier Voosi Formation in western Estonia.

The Voosi Formation is up to 90 m thick with a shelly fauna (Mens & Posti, 1984; Mens & Pirrus, 1997; Mens & Isakar, 1999). In the stratotype section at Kunda (NE Estonia) (Fig. 9b, locality 9a), the Lontova Formation is 74.3 m thick (Mens & Pirrus, 1977), and *S. cambriensis* ranges from roughly 1–17 m above the base of the formation, an interval encompassing the entire Sämi Member (16.8 m thick) (Fig. 10). *Platysolenites antiquissimus* is found from about 3 m above the base of the formation and ranges throughout the formation at this site and into the overlying Mahu and Kestla members (Mens & Pirrus, 1977; Mens & Posti, 1984); *A. tornatum*, *G*. *squamacea*,and *G. prima* occur throughout the formation. A similar distribution is seen in other sections, with *S. cambriensis* occurring in a basal 9–12 m interval and *Platysolenites* appearing with a slight overlap at 11–14 m in the sections and ranging to their top (Mens & Posti, 1984; Mens & Pirrus, 1997; Mens, 2003). *Sabellidites cambriensis* occur in the basal Taebla Member of the Voosi Formation along with a low diversity ichnofauna (Jensen & Mens, 2001; Slater *et al*. 2018), whereas *Platysolenites* is rare and found in the overlying members of the formation (Mens & Posti, 1984; Mens & Pirrus, 1997).

Mens & Posti (1984) attributed a slender and smooth form to *Sabellidites* sp. Its range overlaps with that of *S. cambriensis* but extends 2–6 m higher in the Kunda section. The molluscs *Aldanella attleborensis* and *Anabarella* sp. appear in the Kestla Member of the Lontova Formation in Estonia (Mens & Pirrus, 1997; Mens & Isakar, 1999; Isakar & Peel, 2007; see the last authors and Parkhaev *et al*. (2011) for synonyms of *Aldanella attleborensis*).

The Ediacaran–Cambrian succession of the northeastern Baltic area around St. Petersburg, Russia, is similar to that of Estonia albeit with a different stratigraphical terminology. The Kotlinian Stage (Ediacaran) is represented by the Voronka Formation (20 m thick). After a gap follows the Lomonosov Formation (4–23 m thick) and the Siverskaya Formation (70–120 m thick – the original ‘blue clay’) of the Lontovan Stage (Dronov *et al.* 2005; Yanovsky, 2012; Meidla, 2017; Podkovyrov *et al.* 2017). *Sabellidites* occurs together with *Platysolenites antiquissimus* in both formations (Mens & Pirrus, 1977; Mens *et al.* 1990; Kushim *et al*. 2016; Podkovyrov *et al.* 2017). *Granomarginata prima* is found in the Lomonosov Formation, while a more diverse assemblage with *Granomarginata prima*, *G. squamacea* and *A. tornatum* occur in the Siverskaya Formation (Yanovsky, 2012). Note that Podkovyrov *et al.* (2017) considered the Voronka Formation to encompass the Rovnian Stage, as opposed to Mens (1980, 1987) and Yakobson (2014). Mens & Pirrus (1977) suggested that the Lomonosov Formation is a basal member of the Lontova Formation.

The occurrence of sabelliditids and/or general ranges of sabelliditids and *Platysolenites* are shown in several cores along the western and central part of the Moscow Basin (eastern Latvia and Russia south of the St. Petersburg region, Fig. 9b) (Kirsanov, 1974; Aksenov, 1985, 1990; Brangulis 1985; Sokolov, 1997; Dmitrovskaya *et al.* 1995; Felitsyn *et al.* 1998) and only a selection is discussed here. Material from this region is well-preserved, and the ultrastructure of *Sabellidites cambriensis* specimens has been described by Urbanek (1979; see also Urbanek & Mierzejewska, 1983: English version of Urbanek, 1979) from the Ludza-15 and Vishki-25 cores and by Moczydłowska *et al.* (2014) from the Gavrilov-Yam borehole (Fig. 9b, localities 9d, e, j, respectively). Sokolov (1997) figured the holotype specimen of *S. cambriensis* from the Lontova Formation near St. Petersburg and other well-preserved specimens, some co-occurring with the tubular saarinid *Saarina* Sokolov, 1965, from boreholes south of the St. Petersburg region.

In the eastern part of the basin, the earliest Cambrian is represented by the Rovnian Nekrasovo Formation (80–100 m thick), unconformably overlying the late Ediacaran Reshm Formation. The overlying Lontovan Lezha Formation (52–85 m thick) is in most places followed by a substantial gap in the succession cutting out the remainder of the Terreneuvian and Series 2 (Urbanek & Rozanov, 1979, table 1; Mens, 1980, 1987; Dmitrovskaya *et al.* 1995; Kuzmenko & Burzin, 1996; Kirikov, 2016). Felitsyn *et al.* (1998) and Moczydłowska *et al.* (2014) identified *Sabellidites cambriensis* in both the Nekrasovo and Lezha formations. The latter unit was referred to as the Glebovo beds by Kirsanov (1974), who in addition to *Sabellidites cambriensis* listed other sabelliditids, *Platysolenites*, *A. tornatum*,and *Discinella*. Kuzmenko & Burzin (1996) refers to finds of sabelliditids and *Platysolenites* in the 587–632 m level of the Nevel core (just west of the Toropets well, Fig. 9a, locality 9f) that would correspond to the Kotlinian Reshm Formation (Kirsanov, 1974). In the central and western parts of the Moscow Basin, the Danilov and Rusanov beds correspond to the Nekrasovo Formation (Kirsanov, 1974; Mens, 1980, 1987; Kuzmenko & Burzin, 1996). The Rusanov beds may be considered as a junior synonym of the Nekrasovo Formation whereas the Danilov beds could correspond to either the entire or the lower Nekrasovo Formation or even the younger Lezha Formation (Kuzmenko & Burzin, 1996). The Danilov beds were identified by Kirsanov (1974) in the Toropets well (Fig. 9b, locality 9f), 834–799 m level (35 m thick), with *S*. ex. gr. *cambriensis* recorded at 832–831 m and 815–814 m, and a corresponding acritarch assemblage in the 814–832 m interval with *A. tornatum* and leiosphaerids (Kirsanov, 1974); *Platysolenites* is found in the upper range of the *Sabellidites* occurrence in this core. The Rusanov bed (6–37 m thick) has a more diverse assemblage of sabelliditids including *Paleolina* and the saarinid *Saarina* in addition to abundant *S. cambriensis* (level 798–789 m in the Toropets core) together with *Platysolenites*, in addition to *Granomarginata*, *A. tornatum* and leiosphaerids (792–783 m in the Toropets core) (Kirsanov, 1974; Volkova, 1996). The range of *Sabellidites* and *Platysolenites* overlap in the Rovnian and Lontovan of the Ludza core in eastern Latvia (Birkis et al. 1972) (Fig. 9b, locality 9d). Substantially younger occurrences of *Platysolenites* have been reported from western Latvia, occurring with *Strenueva primaeva* and other fossils indicative of the Vergalian Stage (Lieldiena & Fridrichsone, 1968; Brangulis 1985; Brangulis *et al*. 1989). Liepaya core (Fig. 9b, locality 9c). These occurrences, which to our knowledge have never been figured, are at odds with all other occurrences on the East European Platform.

In the Vishki and Vologod cores (Fig. 9b, localities 9e, g), the ranges of *Sabellidites* and *Platysolenites* are separated with sabelliditids below and *Platysolenites* above, whereas they co-occur through their entire range in the Aluksne, Galich, and Nekarsovo cores (Fig. 9b, locality 9b, h, i) (Kirsanov, 1974); in the western and central part of the basin, the range of these two taxa span strata attributed to the Rovnian and Lontovan, while in the eastern part the range is only within strata correlated with the Lontovan.

Volkova (1996) recognized the Rovno acritarch assemblage, by the presence of *Teophipolia lacerata* in the Buj Formation, and the Lontova acritarch assemblage in the Lezha and Galichka formations by the presence of *Granomarginata*.

Acritarchs are well-known in the Moscow Basin where several zones or subzones have been established for the lower Cambrian (and upper Vendian) (Raevskaya 2005, and references therein).

*1.e. Poland and Belarus*

The Ediacaran–Cambrian boundary in the Polish part of the East European Platform is recognized in a number of drill cores from the Lublin–Podlasie Basin in SE Poland (Moczydłowska, 1991; Nielsen & Schovsbo, 2011; Pacześna, 2014). The Kaplonosy IG-l drillcore was used as a reference section for the Vendian–Cambrian boundary in the detailed biostratigraphic study by Moczydłowska (1991) (Fig. 9b, locality 10a). The boundary is otherwise defined within the upper part of the 64.1–101 m thick Włodawa Formation, with the uppermost Vendian embracing the *Vendotaenia–Sabellidites* Zone and the lowermost Cambrian the *Platysolenites antiquissimus* Interval Zone and the *Asteridium* –*Comasphaeridium* acritarch Zone (Moczydłowska, 1991; Pacześna, 2008, 2014).

*Sabellidites, Treptichnus pedum*, *Platysolenites antiquissimus*, and *Aldanella* are found in a number of drill cores, but very few cores have two or more of these taxa present or have detailed acritarch records. Areń & Lendzion (1974, 1978) reported the presence of *Sabellidites* in the Radzyń IG-1 and Krowie Bagno IG-1 cores, while Lendzion (1986) showed the distribution of *Sabellidites* in the Łopiennik IG-1 core and Pacześna (2011) in the Parczew IG-10 core. Acritarch data published by Moczydłowska (1991) are available from the Łopiennik IG-1, Radzyń IG-1, and Parczew IG-10 cores (Fig. 9b, localities 10b, c, d, respectively). See also Moczydłowska (2008) and Moczydłowska *et al.* (2015) regarding small carbonaceous fossils (SCF) in the Łopiennik IG-1 core.

In the Łopiennik IG 1 core (Lendzion, 1986; Moczydłowska, 1991; Pacześna, 2008) (Fig. 9b, locality 10b), the base of the Cambrian was defined at 5306.7 m, 4.7 m below the top of the Włodawa Formation (101 m thick). The lowest occurrence of *T. pedum* is at 5288.8–5297.8 m in the core, 4.2 m in the Mazowsze Formation, while *P. antiquissimus*, *Aldanella attleborensis*, and *Anabarella* sp. occur in the basal beds of the Mazowsze Formation (5297.8–5306.8 m). *Sabellidites cambriensis* is identified at 5361.0–5370.0 m in the core, 59–68 m below the top of the Włodawa Formation and in the basal beds of the Mazowsze Formation along with *Platysolenites* and *Aldanella* (Lendzion, 1986). Additional organic-walled microfossils (OWM) and SCF are found at 5376.7–5385.6 m in the core (Moczydłowska, 2008; Moczydłowska *et al.* 2015), while acritarchs of the *Asteridium*–*Comasphaeridium* Zone (assemblage 3 of Moczydłowska, 1991) occur from the uppermost Włodawa Formation and through the Mazowsze Formation (5198.0–5306.7 m; Moczydłowska, 1991; Pacześna, 2008) with *Granomarginata squamacea* (5305.8 m) and *Asteridium tornatum* (5210 m).

In the Radzyń IG-1 core (Areń & Lendzion, 1974, 1978; Moczydłowska, 1991) (Fig. 9b, locality 10c), the upper boundary of the Włodawa Formation (31.7 m thick in the core) is at 1593.7, with the lowest *P.* *antiquissimus* occurring 72.2 m above the top of the formation (at 1521.5 m). The stratigraphically lowest occurrence of *Sabellidites* is located at 1613.8 m, 20.1 m below the top of the Włodawa Formation. Acritarchs of the *Asteridum*–*Comasphaeridium* Zone ranges through the entire Mazowsze Formation (1593.9–1464.3 m); Areń & Lendzion (1974) list a lower occurrence of *Sabellidites* at 1625.4 m.

In the Parczew IG-10 core (Moczydłowska, 1991; Pacześna, 2011) (Fig. 9b, locality 10d), the lowest occurrences of *P. antiquissimus* is at 2106.5–2121.5 m, 57–42 m above the top of the Włodawa Formation. *Sabellidites* sp. is noted a few metres below *Platysolenites* at 2133.5–2148.5 m, 30–15 m above the top of the Włodawa Formation. The *A. tornatum*–*C. velvetum* Zone ranges through nearly the entire Mazowsze Formation (2065.0–2181.0 m).

S*abellidites* *cambriensis* and *Platysolenites antiquissimus* are identified in the upper part of the Czarna Formation in the Holy Cross Mountains of southern Poland, but they do not overlap stratigraphically (Kowalski, 1983; Orłowski, 1987). The area is situated to the west of the Teisseyre–Tornquist Zone (Fig. 9b, locality 10e), and is part of the Trans-European Suture Zone. The various tectonic blocks constituting the area may have been adjacent to Baltica already in the Ediacaran and onwards (Mikołajczak *et al.* 2019). Kowalski (1983) reported *Skiagia ornata* (as *Baltisphaeridium ornatum*) occurring in the *Sabellidites* Zone in the Korytnica 2 drill core, but this has not been reconfirmed. Szczepanik & Żylińska (2016) identified two local acritarch zones in this part of the Czarna Formation spanning the *Skiagia –Fimbriaglomerella* Assemblage Zone. These authors emphasized the need for a revision of the lower Cambrian in the Holy Cross Mountains. Their assemblages were compared to the BAMA III *Ichnosphaera flexuosa–Comasphaeridium molliculum* Assemblage Zone of Jachowicz-Zdanowska (2013). Nine regional zones (BAMA I to BAMA IX) were defined for the Cambrian on the Brunovistulicum block in southern Poland and northeastern Czech Republic (west of the Teisseyre–Tornquist Zone) by Jachowicz-Zdanowska (2013). The oldest (BAMA I) *Pulvinosphaeridium antiquum*–*Pseudotasmanites* Assemblage Zone consists mostly of simple leiospherids but tiny *Granomarginata* were also identified, while BAMA II encompasses the *Asteridium–Comasphaeridium* Assemblage Zone of Moczydłowska (1991). Jachowicz-Zdanowska (2013) attributed BAMA I to the upper Ediacaran and correlated it with the traditional *Sabellidites* Zone, while Szczepanik & Żylińska (2016) placed both BAMA I and BAMA II in the Fortunian of the oldest Cambrian.

The stratigraphic development of the lowermost Cambrian in western Belarus is very similar to that of the Polish sections on the East European Platform (Abramenko *et al.* 1994; Zinovenko, 2009). In the Skweriki-1 and Stradech–17 drill cores (Fig. 9b, locality 10f), the lowermost Cambrian Rytska Formation is 10–30 m thick (= the Rudamina Formation in NW Belarus) and contains *Sabellidites* and the carbonaceous fossil *Cochleatina*. Both units are considered to be of Rovnian age (Macknach *et al.* 2010). The boundary to the overlying Stradech Formation (about 120 m thick) is unconformable. *Granomarginata* is recorded throughout this unit, along with *Platysolenites* ranging from near the base of the formation to the top (Paškevičenė, 1980; Abramenko *et al.* 1994; Zinovenko, 2009).

*1.f. Ukraine, Romania and Moldova*

Cambrian deposits of Ukraine are found in several structural blocks with variable nomenclature of the sedimentary rocks across these blocks (Velikanov, 1990; Kir’yanov, 2006; Konstantinenko & Kir'yanov, 2013, table 3.1). Kir’yanov (1968, 1969) established the Rovno Regional Stage (coinciding in extent, both spatially and temporally, to the Rovno Formation in his terminology) in the drill core section at Klevan (Fig. 9b, locality 11a), and also gave a detailed description of the Bolshoi Obzyr drill core section slightly to the north-west (Fig. 9b, locality 11b). A reference section for Rovno strata in the Podilliya (or Podolia) area is the outcrop near the village of Kitaygorod, Khmelnytsky region, Ukraine (Fig. 9b, locality 11c) (Lyashenko & Aseeva, 1979; Kir’yanov, 1985; Velikanov, 1990; Konstantinenko & Kir'yanov, 2013). The succession here was proposed as a hypostratotype for the Ediacaran–Cambrian boundary by Kir’yanov (2006).

The transition from the Vendian Kanilovka beds in the Bolshoi Obzyr core is gradual and the lower Cambrian is divided into the Rovno (287.7–247.55 m) and Stokhod formations (247.55–138.3 m) (Fig. 9). The Rovno Formation varies in thickness between 29.0–53.0 m whereas the Stokhod Formation varies in thickness between 71.2 and 109.3 m (Konstantinenko & Kir'yanov, 2013). *Sabellidites* occurs in a short interval between 265.0–247.55 m in the core while *Platysolenites* is found in the Stokhod Formation. Kir'yanov (1968) indicated that rare fragments of sabelliditids (including *Sokoloviina*) are found in the lower 2–3 m of the Stokhod Formation and a single or a few specimens of *Serpulites petropolitanus* (= *Platysolenites antiquissimus*) were found by him in the underlying Rovno Formation.

The latest Kotlinian Stage of the Vendian in the Podilliya area of SW Ukraine is represented by the *c.* 80 m thick Studenitsa Formation. Among other fossils, this stage contains leiosphaerid acritarchs and the Ediacaran problematica *Harlaniella* and *Palaeopascichnus* (Palij, 1976; Konstantinenko & Kir'yanov, 2013). The transition to the overlying Rovno Regional Stage Okunets Formation (10–16.8 m thick) is gradual (Konstantinenko & Kir'yanov, 2013; Nesterovsky *et al.* 2018). This unit contains leiosphaerid acritarchs, fragments of *Sabellidites*, and an association of simple trace fossils (Konstantinenko & Kir'yanov, 2013; Gureev, 1988). In their section 3 at the village of Kitaygorod, Lyasheno & Aseeva (1979) indicate *Sabellidites cambriensis* about 4.8 m above what was considered at that time the boundary to the Kanilov Formation prior to the definition of the Okunets Formation by Kir’yanov (1985) (see also Velikanov, 1990). In the section drawn by Kir’yanov (1985) and reproduced in Velikanov (1990), ‘Sabelliditidae’ are shown about 3 and 6 m above the base of the Okunets Formation; the former occurrence is attributed to the sabelliditid *Sokoloviina* and the upper to *Sabellidites*. Abundant vendotaenids are reported throughout the Okunets Formation and *Parasabellidites* is recognized (Velikanov, 1990)*.* A more diverse trace fossil association, including *Treptichnus pedum*, *T. triplex*, and *Gyrolithes polonicus* occurs in the overlying Khmelnitsky Formation (about 60 m thick) where *Sabellidites* is common. Kir’yanov (2006) placed the base of the *Treptichnus pedum* Ichnozone at the base of the Okunets Formation, although this is still debated (Velikanov, 2009; Velikanov & Melnychuk, 2013). The upper unit is the Zbrutska Formation (13–44 m thick), which has yielded Lontovan acritarch assemblage but fossils are sparse (Konstantinenko & Kir'yanov, 2013).

In the general stratigraphical chart (Kir'yanov, 2006; Konstantinenko & Kir'yanov, 2013), the lower range of *Sabellidites* coincides with simple leiosphaerid acritarchs while the subsequent level indicates *Sabellidites*, *Platysolenites* and *Granomarginata*.

*Sabellidites cambriensis* were recovered in drill-cores from the southerly continuation of the Volyn-Podillya basin of Romania and Moldova. Several well-preserve specimens were illustrated by Patrulius & Iordan (1974) from the Bătrȋneşti drill core in Romania (Fig. 9b, locality 11d). The taxon is present between 607 and 649 m in the core, being numerous and well preserved at 627–634 m. Associated fossils were not reported, but the level was attributed to the *Platysolenites* Zone and compared to the Ebrit Formation in the adjacent strata in Moldova. In this territory, Trandafilova (1968) showed the presence of *Sabellidites* in a 200 m section of a well south of Leova (Fig. 9b, locality 11e), comparing the strata with those east Baltica. Associated fossils were not reported.

*1.g.* Sabellidites cambriensis *in other regions*

*Sabellidites* *cambriensis* is reported from the Anabar and Olenek uplifts in the north-central and north-eastern part of the Siberian platform respectively, often in large accumulations (Valkov, 1987; Missarzhevsky, 1989; Sokolov, 1985, 1990, 1997), co-occuring with *Granomarginata prima*/*squamacea* and *Asteridium tornatum* (Khomentovsky, 1985, 1990; Knoll *et al.* 1995) as well as a skeletal fauna (Rogov *et al.* 2015; Kouchinsky *et al.* 2017).

In the Anabar uplift, *S.* *cambriensis* is found in the Manykay Formation (about 95 m thick) at the Kotuikan River (Khomentovsky & Trofimov, 1980; Khomentovsky, 1985, 1990). The succession was also illustrated by Kaufman *et al.* (1996) and Kouchinsky *et al.* (2017), where the latter authors referred the beds to the Nemakit-Daldyn Formation. Khomentovsky & Trofimov (1980) recorded sabelliditids in the matrix of the basal 0.6 m conglomerate (layer 1), *Sabellidites* sp. in the lower part of layer 3 (*c.* 22–27 m from the base) where it occurs with *Anabarites trisulcatus*, and *Sabellidites* cf. *cambriensis* in layer 5 (*c.* 35–40 m from the base) along with a shelly fauna. Kouchinsky *et al.* (2017) found *Platysolenites antiquissimus* in the lower part of layer 3, some distance from its base along with *Anabarites trisulcatus*. The boundary between the *Anabarites trisulcatus* and *Purella antiqua* Assemblage zones is placed in layer 8, and *P. antiquissimus* ranges throughout the Nemakit-Daldyn, Medvezhya, and the lower Emyaksin formations. *Aldanella attleborensis* is found in the Medvezhya and the lower Emyaksin formations (uppermost Fortunian Stage and lower part of Cambrian Stage 2). The Ediacaran–Cambrian boundary in the Anabar uplift area was placed in the upper part of the underlying Staraya Rechka Formation by Kouchinsky *et al.* (2017).

In the Olenek uplift, *S.* *cambriensis* occurs in the uppermost part of the 27 m thick Syhargalakk Formation (lower part of the now redefined Kessyusa Formation, see Nagovitsin *et al.* 2015), with *Treptichnus pedum* (Rogov *et al.* 2015). *Sabellidites* *cambriensis* and *Paleolina* were found in the lower part of the Kessyusa Formation already in the 1960s (Sokolov, 1997 and references therein). A low‐diversity assemblage of organic‐walled microfossils, including *Granomarginata*, is known from this interval (e.g. Kir’yanov, 2006), although this interpretation may be modified if data presented by Grausman *et al*. (1996) are confirmed (see Nagovitsin *et al*. 2015).

In northern Siberia, there is also is a rich shelly fauna in the lowermost Cambrian, encompassing the *Anabarites trisulcatus* and *Purella antiqua* assemblage zones (Kouchinsky *et al.* 2017). Rogov *et al.* (2015) placed the boundary between the *Anabarites trisulcatus* and *Purella antiqua* assemblage zones at the *T.* *pedum* zone boundary with a maximum radiometric age of 543.9 ± 0.24 Ma, suggesting that the former zone was of late Ediacaran age. Both the correlation and age determination were disputed by Kouchinsky *et al.* (2017) who correlated both zones with the Fortunian.

Specimens from the Turukhansk Uplift on the western edge of the Siberian platform were identified as *Sabellidites* ex. gr. *cambriensis* by Sokolov (1965). These, as well as sabelliditids from the Yudoma-Maya region in the southeastern part of the platform and the Ura Uplift in southern Bailkal, southeastern margin of the Siberian platform (Astashkin *et al.* 1991; Khomentovsky, 2008; Chumakov *et al.* 2013), are now identified as the sabelliditid *Paleolina* (Sokolov, 1968, 1972, 1975; Butakov *et al.* 1978; Bartley *et al.* 1998).

*Sabellidites* is described or noted from several places in China, although several of the records may be contested. Luo *et al.* (2014) transferred *Sabellidites* *yunnanensis* Luo & Zhang, 1986, and *Sabellidites badaowanensis* Luo & Zhang, 1986, from the Yunnan province in South China to the palaeoscolecid taxon *Mafangscolex* Hu, 2005. Dong *et al.* (2008) provide an extensive list of reported occurrences of *Sabellidites cambriensis* or *S*. sp. from the southern Liaoning Province of North China, showing that the identifications were based on incomplete specimens or could be synonymised with other taxa. Yang *et al.* (2006) illustrated *S. cambriensis* from the Xidashan Formation in the Northern Xinjiang region in northwestern China. These fossils are very abundant and well-preserved, but apart from sponge fossils, other associated taxa are missing. The occurrence is considered to be high in the lower Cambrian.

*Sabellidites cambriensis* and *Saarina* sp. were reported from the Ibor Anticline in central Spain by Contreras Sánches *et al.* (2006) with earlier reports from this area also given by Vidal *et al.* (1994, 1999). The Spanish occurrences of *Sabellidites* overlies the highest occurrences of *Cloudina* but antedate occurrences of Cambrian-type trace fossils.

In Australia, *Sabellidites* cf. *cambriensis* is reported from the Uratanna Formation in the Arrowie Basin, South Australia (Mount, 1993; Gravestock & Shergold, 2001). This unit reaches a thickness of about 460 m, but is variably thick as it was deposited on a topographically uneven base (Jago *et al.* 2020). The unit encompass the *Redkinia*–*Cymatiosphaera* Zone, spanning the Ediacaran–Cambrian boundary (Zang *et al*. 2007). *Sabellidites* occurs in the middle of the formation with the trace fossil *T. coronatum* some 60 m above this and *T. pedum* even higher in the section (Mount, 1993; Jensen *et al.* 1998; Gravestock & Shergold, 2001; Zang *et al.* 2007).

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