Supplementary Material

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

**the basal Cambrian on Baltica**

Jan Ove R. Ebbestad1, Frida Hybertsen2,3, Anette E.S. Högström4, Sören Jensen5, Teodoro Palacios5, Wendy L. Taylor6, Heda Agić7, Magne Høyberget8 and Guido Meinhold9, 10

1Museum of Evolution, Uppsala University, Norbyvägen 16, 752 36 Uppsala, Sweden; 2Department of Earth Sciences, Uppsala University, 752 36 Uppsala, Sweden; 3Department of Palaeobiology, Swedish Museum of Natural History, Box 500 07, 104 05 Stockholm, Sweden; 4Arctic University Museum of Norway, UiT the Arctic University of Norway, 9037 Tromsø, Norway; 5Área de Paleontología, Facultad de Ciencias, Universidad de Extremadura, Avenida de Física s/n, 06006 Badajoz, Spain; 6Department of Geological Sciences, University of Cape Town, Private Bag X3, Rondebosch 7701, South Africa; 7Department of Earth Science, University of California at Santa Barbara, Santa Barbara, CA 93106, USA; 8Magne Høyberget, Rennesveien 14, 4513 Mandal, Norway; 9Department of Sedimentology & Environmental Geology, Geoscience Centre, University of Göttingen, Goldschmidtstraße 3, 37077 Göttingen, Germany and 10School of Geography, Geology and the Environment, Keele University, Keele, Staffordshire, ST5 5BG, UK

**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).

**References**

**Abramenko VI, Zinovenko GV and Piskun JV** (1994) Cambrian western deposits of the Eastern European Platform and the problems of their correlation. *Lithosphere* **1994(1)**, 42–55 (in Russian).

**Aksenov EM** (1985) Vendian of the East European Platform. In *The Vendian System, Vol. 2, Stratigraphy and geological processes* (eds BS Sokolov and MA Fedonkin), pp. 3–34. Russian Academy of Sciences, Department of Geology, Geophysics and Geochemistry, Moscow (in Russian).

**Aksenov EM** (1990) Vendian of the East European Platform. In *The Vendian System, Vol. 2, Stratigraphy and geological processes* (eds BS Sokolov and MA Fedonkin), pp. 1–37. Springer, Berlin.

**Alekseev AS, Grazhdankin DV, Reimers AN, Minchenko GV, Krayushkin AV, Larchenko VA, Ushakov VN and Stepanov VP** (2005) New data on the upper limit of the age of the ore-hosting strata Arkhangelsk diamondiferous province. In *Geology of Diamonds – Present and Future (of 50-th Anniversary of Mirnyi and Diamond Mining Industry in Russia* (ed. NN Zinchuked), pp. 235–41. Voronezh, Voronezh State University (in Russian).

**Areń B and Lendzion K** (1974) Organic Remains at the Vendian–Cambrian Boundary in the Platform Sediments in Poland. *Bulletin de l'Académie Polonaise des Sciences Série des Sciences* *de la Terre* **22**, 49–53.

**Areń B and Lendzion K** (1978) Stratigraphic and lithological characteristics of the Vendian and Lower Cambrian. *Prace Instytutu Geologicznego* **90**, 7–49.

**Astashkin VA, Pegel TV, Shabanov YuYa, Sukhov SS, Sundukov VM, Repina LN, Rozanov AYu and Zhuravlev AYu** (1991) The Cambrian System on the Siberian Platform. Correlation Chart and Explanatory notes. *International Union of Geological Sciences Publication* **27**, 1–133.

**Bartley JK, Pope M, Knoll AH, Semikhatov MA and Petrov PYu** (1998) A Vendian–Cambrian boundary succession from the northwestern margin of the Siberian Platform: stratigraphy, palaeontology, chemostratigraphy and correlation. *Geological Magazine* **135**, 473–94.

**Birkis AP, Brangulis AP, Volkova NA, Rozanov AYu** (1972) New information on the Cambrian stratigraphy of eastern Latvia. *Proceedings of the Academy of Science of SSSR* **204**, 163–166. (in Russian).

**Brangulis AP** (1985) *Vendian and Cambrian of Latvia*. Riga: Zinathe, 134 pp (in Russian).

**Brangulis AP** (ed) (1989) *Stratigraphical and reference sections of the Vendian, Cambrian and Ordovician of Latvia*. Zinatne: Riga. (in Russian).

**Brasier M, Cowie J and Taylor M** (1994) Decision on the Precambrian–Cambrian boundary stratotype. *Episodes* **17**, 3–9.

**Bromley RG** (2002) Field meeting: Bornholm, Denmark, 28 August to 4 September, 2000. *Proceedings of the Geologists' Association* **113**, 77–88.

**Butakov EP, Vicks EG and Skorobogatykh PP** (1978) Yudomiy of the South-West of the Siberian Platform. In *New in Late Precambrian stratigraphy and paleontology of the Siberian Platform* (ed. VV Khomentovsky), pp. 84–104. Russian Academy of Sciences, Institute of Geology and Geophysics, Siberian Branch, Novosibirsk (in Russian).

**Chumakov NM, Semikhatov MA and Sergeev VN** (2013) Vendian reference section of southern middle Siberia. *Stratigraphy and Geological Correlation* **21**, 359–82*.*

**Contreras Sánches MM, Jensen S and Palacios T** (2006) Sabelidítidos y vendoténidos del Anticlinal de Ibor (Zona Centroibérica). In *Resúmenes*, *Libro de resúmenes - XXII Jornadas de Paleontología XXII Jornadas de la Sociedad Española de Paleontología* (ed. E. Fernández-Martínez)pp. 101–3. Universidad de León, León.

**Dmitrovskaya YuE, Rozanov AYu, Kagramanyan NA and Esipko OA** (1995) Local stratigraphic subdivision of the Cambrian in the Moscow Syneclise. *Otechestvennaja Geologija* **11**, 28–38 (in Russian).

**Dong L, Xiao S, Shen B, Yuan X, Yan X and Peng Y** (2008) Restudy of the worm-like carbonaceous compression fossils *Protoarenicola*, *Pararenicola*, and *Sinosabellidites* from early Neoproterozoic successions in North China. *Palaeogeography, Palaeoclimatology, Palaeoecology* **258**, 138–61.

**Dronov A, Tolmacheva T, Raevskaya E and Nestell M** (2005) *Cambrian and Ordovician of St. Petersburg Region. Guidebook of the pre-conference field trip. 6th Baltic stratigraphical Conference. IGCP 503 Meeting August 23*–*25, 2005*. Baltic Stratigraphical Association. St. Petersburg State University. A.P. Karpinsky All-Russian Research Geological Institute, 63 pp.

**Felitsyn SB, Vidal G and Moczydłowska M** (1998) Trace elements and Sr and C isotopic signatures in late Neoproterozoic and earliest Cambrian sedimentary organic matter from siliciclastic successions in the East European Platform. *Geological Magazine* **135**, 537–51.

**Føyn S** (1967) Dividal-gruppen (‘Hyolithus-sonen’) i Finnmark og dens forhold til de eokambriske-kambriske formasjoner. *Norges Geologiske Undersøkelse Bulletin* **249**, 1–84.

**Føyn S and Glaessner MF** (1979) *Platysolenites*, other animal fossils and the late Precambrian–Cambrian transition in Norway. *Norsk Geologisk Tidsskrift* **59**, 25–46.

**Gailīte LI, Kuršs V, Lukševiča L, Lukševičs E, Pomeranceva R, Savaitova L, Stinkulis Ģ and Zabele A** (2000) *Legends for geological maps of Latvian bedrock.* Riga: State Geological Survey, 101 pp.

**Gnilovskaya MB** (1971) The oldest Vendian aquatic plants on the Russian platform. *Paleontological Journal* **1971(3)**, 101–7 (in Russian).

**Grabau AW** (1900) Palaeontology of the Cambrian terranes of the Boston Basin. *Occasional Papers of the Boston Society of Natural History* **4**, 601–94.

**Grausman** **VV, Rudavskaya VA and Vasilieva NI** (1996) Upper Precambrian and Lower Cambrian stratigraphy of the Olenek Uplift. *Otechestvennaya Geologiya*. **8**, 30–35 (in Russian).

**Gravestock DI and Shergold JH** (2001) Australian Early and Middle Cambrian Sequence Biostratigraphy with Implications for Species Diversity and Correlation. In *The Ecology of the Cambrian Radiation* (eds Zhuravlev, AYu and Riding R), pp. 107–136. New York: Columbia University Press.

**Grazhdankin DV** (2003) Structure and depositional environment of the Vendian Complex in the southeastern White Sea Area. *Stratigraphy and Geological Correlation* **11**, 313–31.

**Grazhdankin DV and Krayushkin AV** (2007) Trace fossils and the upper Vendian boundary in the southeastern White Sea Region. *Reports of the Academy of Sciences* **416**, 1027–31.

**Gureev YuA** (1988) Vendian Non-Skeletal Fauna. In *Biostratigraphy and Paleogeographic Reconstructions of the Precambrian of the Ukraine* (ed. VA Ryabenko), pp. 65–81. Kiev: Naukova Dumka.

**Hamar G** (1967) *Platysolenites antiquissimus* Eichwald (Vermes) from the Lower Cambrian of northern Norway. *Norges Geologiske Undersøkelse* **249**, 89–95.

**Hu SX** (2005) Taphonomy and Palaeoecology of the Early Cambrian Chengjiang biota from Eastern Yunnan, China. *Berliner Paläontologische Abhandlungen* **7**, 1–197.

**Igolkina NS** (1956) On the age of sandy-clayey rocks of the "Winter Coast" of the White Sea. In *Materials on geology of the European territory of the USSR* (ed. MM Tolstikhina), pp. 169–73. All-Russian Research Geological Institute, New Series vol. 14 (in Russian).

**Isakar M and Peel JS** (2007) Lower Cambrian helcionelloid molluscs from Estonia. *GFF* **129**, 255–62.

**Jachowicz-Zdanowska M** (2013) Cambrian phytoplankton of the Brunovistulicum–taxonomy and biostratigraphy. *Polish Geological Institute Special Papers* **28**, 1–150.

**Jago JB, Gehling JG, Betts MJ, Brock GA, Dalgarno CR, García-Bellido DC, Haslett PG, Jacquet SM, Kruse PD, Langsford NR, Mount TJ and Paterson JR** (2020) The Cambrian System in the Arrowie Basin, Flinders Ranges, South Australia. *Australian Journal of Earth Sciences* **67**, 923–48.

**Jankauskas T and Laškova L** (2004) Cambrian. In *Evolution of Earth Crust and its resources in Lithuania* (ed. V Baltrūnas), pp. 50–6. Vilnius: Litosfera.

**Jensen S and Grant SWF** (1998) Trace fossils from the Dividalen Group, northern Sweden: implications for Early Cambrian biostratigraphy of Baltica. *Norsk Geologisk Tidsskrift* **78**, 305–17.

**Jensen S and Mens K** (2001) Trace fossils *Didymaulichnus* cf. *tirasensis* and *Monomorphichnus* isp. from the Estonian lower Cambrian, with a discussion on the early Cambrian Ichnocoenoses of Baltica. *Proceedings of the Estonian Academy of Sciences,* *Geology* **50**, 75–85.

**Jensen S, Gehling JG and Droser ML** (1998) Ediacara-type fossils in Cambrian sediments. *Nature* **393**, 567–9.

**Kaufman AJ, Knoll AH, Semikhatov MA, Grotzinger JP, Jacobsen SB and Adams W** (1996) Integrated chronostratigraphy of Proterozoic–Cambrian boundary beds in the western Anabar region, northern Siberia. *Geological Magazine* **133**, 509–33.

**Khomentovsky VV** (1985) Vendian of the Siberian Platform. In *The Vendian System, Vol. 2, Stratigraphy and geological processes* (eds BS Sokolov and MA Fedonkin), pp. 83–161. Moscow: Russian Academy of Sciences, Department of Geology, Geophysics and Geochemistry (in Russian).

**Khomentovsky VV** (1990) Vendian of the East European Platform. In *The Vendian System, Vol. 2, Stratigraphy and geological processes* (eds BS Sokolov and MA Fedonkin), pp. 102–83. Berlin: Springer.

**Khomentovsky VV** (2008) The Yudomian of Siberia, Vendian and Ediacaran Systems of the International Stratigraphic Scale. *Stratigraphy and Geological Correlation* **16**, 581–98 (in Russian).

**Khomentovsky VV and Trofimov VR** (1980) Vendian of western Anabar. In *New data on late Precambrian stratigraphy West Siberian Platform and its folding framework* (ed. VV Khomentovsky), pp. 3–30. Novosibirsk: Russian Academy of Sciences, Institute of Geology and Geophysics, Siberian Branch (in Russian).

**Kir’yanov VV** (1968) Palaeontological remains and stratigraphy of the Baltic Group deposits in Volhynia-Podolia. In *Paleontology and stratigraphy of the Lower Paleozoic in Volyn-Podolia* (eds TA Ishchenko, VV Kiriakov and VS Krandievsky), pp. 5–25. Kiev: National Academy of Sciences of Ukraine (in Russian).

**Kir’yanov VV** (1969) Scheme of the stratigraphy of the Cambrian deposits of Volyn. *Geological Journal* **29**, 48–62 (in Ukrainian).

**Kir’yanov VV** (1985) New stratigraphic subdivisions of the Precambrian boundary deposits of the Cambrian of the Podolsk ridge of the Ukrainian Shield. In *New data on the Vendian and Lower Paleozoic stratigraphy of the Volyno-Podolia*, pp. 41–9. Kiev: Ukrainian Academy of Sciences, Institute of Geological Sciences (in Ukrainian).

**Kir’yanov VV** (2006) Stratigraphy of the oldest Cambrian sediments of the East European and Siberian platforms. *Geological Journal* **2006 (2–3)**, 115–22.

**Kirikov VP** (2011) *State geological map of the Russian Federation. Scale 1:1,000,000 (third generation). Central European Series. Sheet N- (34) - Kaliningrad. Explanatory letter*, 226 pp. Ministry of Internal Affairs of the Russian Federation, FSUE VSEGEI (in Russian).

**Kirikov VP** (2016) *State geological map of the Russian Federation. Scale 1:1,000,000 (third generation). Central European Series. Sheet O-37 (Yaroslavl). Explanatory note*, Ministry of Internal Affairs of the Russian Federation, FSUE VSEGEI, 356 pp. (in Russian).

**Kirsanov VV** (1974) On the question of stratigraphy on the border layers of the Vendian and Cambrian in the central areas of the East European Platform. In *Biostratigraphy and paleontology of Lower Cambrian in Europe and North Asia* (eds IT Zuravleva and AYu Rozanov), pp. 5–21. Moscow: Russian Academy of Sciences, Institute of Geology and Geophysics, Siberian Branch (in Russian).

**Knoll AH, Grotzinger JP, Kaufman AJ and Kolosov P** (1995) Integrated approaches to terminal Proterozoic stratigraphy: An example from the Olenek Uplift, northeastern Siberia. *Precambrian Research* **73**, 251–70.

**Konstantinenko LI and Kir'yanov VV** (2013) The Cambrian System. In *Stratigraphy of Upper Proterozoic and Phanerozoic of Ukraine. Volume 1, Stratigraphy of Upper Proterozoic, Paleozoic and Mesozoic of Ukraine* (ed. PF Gozhyk), pp. 155–66. Kiev: National Academy of Sciences of Ukraine, Institute of Geological Sciences, (in Ukrainian).

**Kouchinsky A, Bengtson S, Landing E, Steiner M, Vendrasco M and Ziegler K** (2017) Terreneuvian stratigraphy and faunas from the Anabar Uplift, Siberia. *Acta Palaeontologica Polonica* **62**, 311‒440.

**Kowalski WR** (1983) Stratigraphy of the Upper Precambrian and lowest Cambrian strata in southern Poland. *Acta Geologica Polonica* **33**, 183–218.

**Kulling O** (1964) Översikt över norra Norrbottensfjällens Kaledonberggrund. *Sveriges Geologiska Undersökning* **Ba19**, 1–166

**Kushim EA, Golubkova EYu and Plotkina YuV** (2016) Biostratigraphic characteristics of the Vendian–Cambrian deposits of the South Ladoga. *Bulletin of the Voronezh State University, Geology Series* **2016(4)**, 18–22.

**Kuzmenko YuT and Burzin MB** (1996) *Stratigraphic scheme of the Vendian deposits of the Moscow syneclise. Explanatory note*. Moscow: Regional Interdepartmental Stratigraphic Commission, 46 pp. (in Russian).

**Kuznetsov NB, Belousova EA, Alekseev AS and Romanyuk TV** (2014) New data on detrital zircons from the sandstones of the lower Cambrian Brusov Formation (White Sea region, East-European Craton): unravelling the timing of the onset of the Arctida–Baltica collision. *International Geology Review* **56**, 1945–63.

**Landing E** (1994) Precambrian*–*Cambrian boundary global stratotype ratified and a new perspective of Cambrian time. *Geology* **22**, 179–82.

**Landing E, Geyer G, Brasier MD and Bowring, SA** (2013) Cambrian evolutionary radiation: Context, correlation, and chronostratigraphy—overcoming deficiencies of the first appearance datum (FAD) concept. *Earth‐Science Reviews* **123**, 133–72.

**Landing E, Myrow PM, Benus AP and Narbonne GM** (1989) The Placentian series: Appearance of the oldest skeletalized faunas in southeastern Newfoundland. *Journal of Paleontology* **63**, 739–69.

**Landing E, Narbonne GM, Myrow P, Benus AP and Anderson MM** (1988) Faunas and depositional environments of the upper Precambrian through lower Cambrian, southeastern Newfoundland. *New York State Museum Bulletin* **463**, 18–52.

**Landing E, Peng S, Babcock, LE, Geyer G and Moczydłowska-Vidal M** (2007) Global standard names for the lowermost Cambrian series and stage. *Episodes* **30**, 287.

**Lendzion K** (1986) Sedimentation of the Vendian–Cambrian marine sequence, Poland. *Geological Magazine* **123**, 361–65.

**Lieldiena EK & Fridrichsone AI** (1968) On the Cambrian stratigraphy of western Latvia. In *Stratigraphy of the lower Palaeozoic of the Baltic region and its correlation to other regions* (A Grigelis et al. eds), pp. 33–57. Vilnius: Mintis. (in Russian).

**Luo H and Zhang S** (1986) Early Cambrian Vermes and trace fossils from Jinning-Anning region, Yunnan. *Acta Palaeontologica Sinica* **25**, 307–11 (in Chinese).

**Luo H, Hu S, Han J, Zhang S, Zhan D, Lu Y and Yao X** (2014) Restudy of Palaeoscolecidians from the Meishucun Section, Jinning, Yunnan, China. *Journal of Northwest University (Natural Science Edition)* **44**, 947–53 (in Chinese).

**Lyashenko AN and Aseeva EA** (1979) Some supporting sections of the Upper Proterozoic and Lower Cambrian sediments in the Kitaigrod village Region, (the Dniester area). *Geological Journal* **39**, 41–53 (in Russian).

**Maknach AS, Zinovenko GV, Abramenko VI and Piskun LV** (2010) Stratigraphic scheme of the Cambrian sediments. In *Stratigraphic charts of Precambrian and Phanerozoic deposits of Belarus* (ed. SA Kruchek), pp. 11, 12. Minsk: Belarusian Research Geological Exploration Institute (in Russian).

**Maslov AV, Grazhdankin DV, Podkovyrov VN, Isherskaya MV, Krupenin MT, Petrov GA, Ronkin YL, Gareev EZ and Lepikhina OP** (2009) Provenance composition and features of geological evolution of the Late Vendian foreland basin of the Timan orogen. *Geochemistry International* **47**, 1212–33.

**Maslov AV, Grazhdankin DV, Podkovyrov VN, Ronkin YL, and Lepikhina OP** (2008) Composition of sediment provenances and patterns in geological history of the Late Vendian Mezen basin. *Lithology and Mineral Resources* **43**, 260–80.

**McIlroy D and Brasier MD** (2017) Ichnological evidence for the Cambrian explosion in the Ediacaran to Cambrian succession of Tanafjord, Finnmark, northern Norway. In *Earth System Evolution and Early Life: a Celebration of the Work of Martin Brasier* (eds AT Brasier, D McIlroy and N McLoughlin), pp. 351–68. Geological Society of London, Special Publication no. 488.

**McIlroy D, Green OR and Brasier MD** (2001) Palaeobiology and evolution of the earliest agglutinated Foraminifera: *Platysolenites, Spirosolenites* and related forms. *Lethaia* **34**, 13–29.

**Meidla T** (2017) Ediacaran and Cambrian stratigraphy in Estonia: an updated review. *Estonian Journal of Earth Sciences* **66**, 152–60

**Mens K** (1980) Introduction. In *Palaeogeography and lithology of Vendian and Cambrian of the western part of the East-European Platform. Contribution of the Soviet-Polish working group on the Precambrian–Cambrian boundary problem* (eds BM Keller and AYu Rozanov), pp. 5–8. Moscow: Russian Academy of Sciences (in Russian).

**Mens K** (1987) Introduction. In *Palaeogeography and lithology of Vendian and Cambrian of the western part of the East-European Platform. Contribution of the Soviet-Polish working group on the Precambrian–Cambrian boundary problem* (eds AYu Rozanov and K. Łydka), pp. 9–12. Warsaw: Institute of Geological Sciences of the Polish Academy of Sciences, and Moscow: Russian Academy of Sciences.

**Mens K** (2003) Early Cambrian tubular fossils of the genus *Onuphionella* from Estonia. *Proceedings of the Estonian Academy of Sciences,* *Geology* **52**, 87–97.

**Mens K and Isakar M** (1999) facies distribution of Early Cambrian molluscs in Estonia. *Proceedings of the Estonian Academy of Sciences,* *Geology* **48**, 110–15.

**Mens K and Pirrus E** (1977) *Stratotype Sections of the Cambrian of Estonia.* Tallin: Valgus,68 pp. (in Russian).

**Mens K and Pirrus E** (1997) Cambrian. In *Geology and Mineral Resources of Estonia* (eds A Raukas and A Teedumäe), pp. 39–51. Tallinn: Estonian Academy Publishers.

**Mens K and Posti E** (1984) Distribution and correlation significance of organic remains in the Baltic Series of Estonia. In *Stratigraphy of ancient Paleozoic deposits of the Baltic* (eds R Männil, and K Mens), pp. 5–17. Tallinn: Estonian Academy of Sciences, Insitute of Geology (in Russian).

**Mens K, Bergström J and Lendzion K** (1987) *The Cambrian System on the East European Platform* (*Correlation chart and explanatory notes*). Tallinn: Valgus, 119 pp. (in Russian).

**Mens K, Bergström J and Lendzion K** (1990) The Cambrian System on the East European Platform; correlation chart and explanatory notes. *International Union of Geological. Sciences Publication* **25**, 1–73.

**Mikołajczak M, Mazur S and Gągała Ł** (2019) Depth-to-basement for the East European Craton and Teisseyre–Tornquist Zone in Poland based on potential field data. *International Journal of Earth Sciences* **108**, 547–67.

**Missarzhevsky VV** (1989) The oldest fossils and stratigraphy of Precambrian/Cambrian boundary sequences. Transactions *of the Institute of* Geology *and* *Geophysics, Russian Academy of Sciences* **443**, 1–235.

**Moberg JC** (1908) Bidrag till kännedomen om de kambriska lagren vid Torneträsk. *Sveriges Geologiska Undersökning* **C212**, 1–30.

**Moczydłowska M** (1991) Acritarch biostratigraphy of the Lower Cambrian and the Precambrian–Cambrian Boundary in Southeastern Poland. *Fossils and Strata* **29**, 1–127.

**Moczydłowska M** (1998) Lower Cambrian acritarch biochronology in Baltoscandia. In *Guide to excursions in Scania and Västergötland, southern Sweden. IV field conference of the Cambrian Stage subdivision working group. International subcommission on Cambrian stratigraphy. Sweden, 24-31 August 1998* (ed. P Ahlberg), 9–16. Lund Publications in Geology vol. 141.

**Moczydłowska M** (2008) New records of late Ediacaran microbiota from Poland. *Precambrian Research* **167**, 71–92.

**Moczydłowska M** **and Vidal G** (1986) Lower Cambrian acritarch zonation in southern Scandinavia and southeastern Poland. *Geologiska Föreningen i Stockholms Förhandlingar* **105**, 201–23.

**Moczydłowska M, Westall F and Foucher F** (2014) Microstructure and biogeochemistry of the organically preserved Ediacaran metazoan *Sabellidites*. *Journal of Paleontology* **88**, 224–39.

**Moczydłowska M, Budd GE and Agić H** (2015) Ecdysozoan-like sclerites among Ediacaran microfossils. *Geological Magazine* **152**, 1145–8.

**Mount JF** (1993) Uratanna Formation and the base of the Cambrian, Angepena Syncline. In Field Guide to the Adelaide Geosyncline and Amadeus Basin (eds RJF Jenkins, JF Lindsay and MR Walter), pp. 85–90. Australian Geological Survey Organisation Record 1993/35.

**Nagovitsin KE, Rogov VI, Marusin VV, Karlova GA, Kolesnikov AV, Bykova NV and Grazhdankin DV** (2015) Revised Neoproterozoic and Terreneuvian stratigraphy of the Lena-Anabar Basin and north-western slope of the Olenek Uplift, Siberian Platform. *Precambrian Research* **270**, 226–45.

**Narbonne GM, Myrow P, Landing E and Anderson MM** (1987) A candidate stratotype for the Precambrian–Cambrian boundary, Fortune Head, Burin Peninsula, southeastern Newfoundland. *Canadian Journal of Earth Sciences* **24**, 1277–93.

**Nesterovsky VA, Martyshyn AI and Chupryna AM** (2018) New biocenosis model of Vendian (Ediacaran) sedimentation basin of Podilia (Ukraine). *Journal of Geology, Geography and Geoecology* **27**, 95–107.

**Nielsen AT and Schovsbo NH** (2007) Cambrian to basal Ordovician lithostratigraphy in southern Scandinavia. *Bulletin of the Geological Society of Denmark* **53**, 47–92.

**Nielsen AT and Schovsbo NH** (2011) The Lower Cambrian of Scandinavia: Depositional environment, sequence stratigraphy and palaeogeography. *Earth Science Reviews* **107**, 207–310.

**Orłowski S** (1987) Stratigraphy of the Lower Cambrian in the Holy Cross Mountains, Central Poland. *Bulletin of the Polish Academy of Sciences, Earth Sciences* **35**, 91–6.

**Pacześna J** (2008) Borehole Łopiennik IG 1. *Profile Głębokich Otworów Wiertniczych Państwowego Instytutu Geologicznego* **123**, 1–268.

**Pacześna J** (2011) Borehole Parczew IG 10. *Profile Głębokich Otworów Wiertniczych Państwowego Instytutu Geologicznego* **130**, 1–334.

**Pacześna J** (2014) Lithostratigraphy of Ediacaran deposits in the Lubelskie-Podlasie sedimentary basin (eastern and south-eastern Poland). *Biuletyn Państwowego Instytutu Geologicznego* **460**, 1–24.

**Palacios T, Jensen S, Barr SM, White CE and Myrow PM** (2018) Organic walled microfossils from the Ediacaran–Cambrian boundary stratotype section, Chapel Island and Random formations, Burin Peninsula, Newfoundland, Canada: global correlation and significance for the evolution of early complex ecosystems. *Geological Journal* **53**, 1728–42.

**Palij VM** (1976) Remains of soft-bodied animals and trace fossils from the Upper Precambrian and Lower Cambrian of Podolia. In *Paleontology and Stratigraphy of Upper Precambrian and Lower Paleozoic of the South-West of Eastern-European Platform* (ed. VA Ryabenko), pp. 63–76. Kiev: Naukova Dumka (in Russian).

**Palij VM, Posti E and Fedonkin MA** (1979) Soft-bodied Metazoa and animal trace fossils in the Vendian and early Cambrian. In *Upper Precambrian and Cambrian palaeontology of the East-European Platform. Contribution of the Soviet-Polish working group on the Precambrian-Cambrian boundary problem* (eds BM Keller and AYu Rozanov), pp. 49–63. Warsaw: Institute of Geological Sciences of the Polish Academy of Sciences and Moscow: Geological Institute of the Russian Academy of Sciences (in Russian).

**Palij VM, Posti E and Fedonkin MA** (1983) Soft-bodied Metazoa and animal trace fossils in the Vendian and Early Cambrian. In *Upper Precambrian and Cambrian palaeontology of the East-European Platform. Contribution of the Soviet-Polish working group on the Precambrian-Cambrian boundary problem* (eds A Urbanek and AYu Rozanov), pp. 56–74. Warsaw: Institute of Geological Sciences of the Polish Academy of Sciences and Moscow: Geological Institute of the Russian Academy of Sciences.

**Parkhaev PY, Karlova GA and Rozanov AY** (2011) Taxonomy, stratigraphy and biogeography of *Aldanella attleborensis*—a possible candidate for defining the base of Cambrian Stage 2. *Museum of Northern Arizona Bulletin* **67**, 298–300*.*

**Paškevičenė LT** (1980) *Acritarchs of the Vendian and Cambrian boundary deposits of the west of the East European Platform.* Moscow: Nauka, 75 pp.

**Pirrus E** (2004) Possibilities of stratigraphical interpretation of the Dividal Group in the Kilpisjarvi area (Finnish Lapland), based on lithogenetic characteristics. *Proceedings of the Estonian Academy of Sciences,* *Geology* **53**, 28–41.

**Patrulis D & Iordan M** (1974) Asupra prezenţei pogonoforului *Sabellidites cambriensis* Ian. şi a “algei” *Vendotaenia antiqua* Gnil. în depozitele presiluriene din Podişul Moldovenesc. *Dări de Seamă ale* ş*edentilor* **60**, 1–18.

**Podkovyrov VN, Maslov AV, Kuznetsov AB and Ershova VB** (2017) Lithostratigraphy and geochemistry of Upper Vendian‒Lower Cambrian Deposits in the Northeastern Baltic Monocline. *Stratigraphy and Geological Correlation* **25**, 1–20.

**Raevskaya E** (2005) Diversity and distribution of Cambrian acritarchs from the Siberian and East Europe and Platforms–a generalized scheme. *Carnets de Géologie Memoire* **2005(2)**, 39–44.

**Rogov VI, Karlova GA, Marusin VV, Kochnev BB, Nagovitsin KE and Grazhdankin DV** (2015) Duration of the first biozone in the Siberian hypostratotype of the Vendian. *Russian Geology and Geophysics* **56**, 573–83.

**Shaler NS and Foerste AF** (1888) Preliminary description of North Attleborough fossils. *Bulletin of the Museum of Comparative Zoology* **16**, 27–41.

**Slater BJ, Harvey THP and Butterfield NJ** (2018) Small Carbonaceous Fossils (SCFs) from the Terreneuvian (lower Cambrian) of Baltica. *Palaeontology* **61**, 417–39.

**Sokolov BS** (1952) On the age of the old sedimentary cover of the Russian Platform. *Bulletin of the Russian Academy of Sciences, Geological Series* **5**, 21–31 (in Russian).

**Sokolov BS** (1965) The oldest Early Cambrian deposits and sabelliditids. In *All-Union Symposium on the Paleontology of the Precambrian and Cambrian: Abstracts* (ed. BS Sokolov), pp. 78–91. Novosibirsk: Russian Academy of Sciences, Institute of Geology and Geophysics, Siberian Branch (in Russian).

**Sokolov BS** (1968) Vendian and Early Cambrian Sabelliditida (Pogonophora) of the USSR. Problems of Paleontology. International Geology Congress, 23rd Session. Reports of Soviet Geologists. Symposium International Paleontology Union. Moscow, pp. 73–9 (in Russian).

**Sokolov BS** (1972) Vendian and Early Cambrian Sabelliditida (Pogonophora) of the USSR. *Proceedings of the International Paleontological Union, 23rd International Geological Congress (Prague 1968)*, 79–84.

**Sokolov BS** (1975) Paleontological finds in the Pre-Usolian Deposits of the Irkutsk Amphitheater. In *Analogues of Vendian Complex in Siberia. Proceedings of the Conference on the Vendian Stratigraphy of the Siberian Platform* (eds BS Sokolov and VV Khomentovsky), pp. 112–17. Transactions of the Institute of Geology and Geophysics vol. 232 (in Russian).

**Sokolov BS** (1985) Vendian System. Historical-geological and paleontological background. In *The Vendian System, Vol. 2, Stratigraphy and geological processes* (eds BS Sokolov and MA Fedonkin), pp. 199–214. Moscow: Russian Academy of Sciences, Department of Geology, Geophysics and Geochemistry (in Russian).

**Sokolov BS** (1990) Vendian System. Historical-geological and paleontological basis. In *The Vendian System, Vol. 2, Stratigraphy and geological processes* (eds BS Sokolov and MA Fedonkin), pp. 226–242. Berlin: Springer.

**Sokolov BS** (1997) *Essays on the advent of the Vendian System*. Moscow: KMK Scientific Press, 142 pp. (in Russian).

**Stankovsky AF, Verichev EM and Dobeiko IP** (1985) Vendian of the South-Eastern White Sea. In *The Vendian System, Vol. 2, Stratigraphy and geological processes* (eds BS Sokolov and MA Fedonkin), pp. 67–76. Moscow: Russian Academy of Sciences, Department of Geology, Geophysics and Geochemistry (in Russian).

**Stankovsky AF, Verichev EM and Dobeiko IP** (1990) Vendian of the South-Eastern White Sea. In *The Vendian System, Vol. 2, Stratigraphy and geological processes* (eds BS Sokolov and MA Fedonkin), pp. 76–87. Berlin: Springer.

**Systra YJ and Jensen S** (2006) Trace fossils from the Dividalen Group of northern Finland with remarks on early Cambrian trace fossil provincialism. *GFF* **128**, 321–58.

**Szczepanik Z and Żylińska A** (2016) The oldest rocks of the Holy Cross Mountains, Poland–biostratigraphy of the Cambrian Czarna Shale Formation in the vicinity of Kotuszow. *Acta Geologica Polonica* **66**, 267–81.

**Trandofilova EF** (1968). On the first find of *Sabellidites cambriensis* Yan. from pre-Silurian deposits of Moldavia. *Proceedings of the Academy of Sciences of the SSSR* **178**, 919–920. (in Russian).

**Tynni R** (1980) Fossiileja Porojärven alueella kaledonialasien ylityöntölaatan alaisissa ala-kambrisissa sedimenteissä. *Geologi* **32**, 17–32.

**Urbanek A** (1979) Sabellidites. In *Upper Precambrian and Cambrian palaeontology of the East-European Platform. Contribution of the Soviet-Polish working group on the Precambrian-Cambrian boundary problem* (eds BM Keller and AYu Rozanov), pp. 88–92. Warsaw: Institute of Geological Sciences of the Polish Academy of Sciences and Moscow: Geological Institute of the Russian Academy of Sciences (in Russian).

**Urbanek A and Mierzejewska G** (1983) Soft-bodied Metazoa and animal trace fossils in the Vendian and Early Cambrian. In *Upper Precambrian and Cambrian palaeontology of the East-European Platform. Contribution of the Soviet-Polish working group on the Precambrian-Cambrian boundary problem* (eds A Urbanek and AYu Rozanov), pp. 100–11. Warsaw: Institute of Geological Sciences of the Polish Academy of Sciences and Moscow: Geological Institute of the Russian Academy of Sciences.

**Urbanek A and Rozanov AYu** (1979) *Upper Precambrian and Cambrian palaeontology of the East-European Platform. Contribution of the Soviet-Polish working group on the Precambrian*–*Cambrian boundary problem*. Warsaw: Institute of Geological Sciences of the Polish Academy of Sciences and Moscow: Geological Institute of the Russian Academy of Sciences, 158 pp (in Russian).

**Valkov AK** (1987) Biostratigraphy of the Lower Cambrian of the eastern Siberian platforms (Yudomo-Olenek region). Moscow: Russian Academy of Sciences, Siberian Branch. Irkutsk Institute of Geology 136 pp (in Russian).

**Velikanov VA** (1990) *Vendian of Podolia: Excursion guidebook for the 3rd International Symposium on the Cambrian system and the boundary of the Vendian and Cambrian.* Kiev: IGN AN USSR, 129 pp. (in Russian).

**Velikanov VA** (2009) Problematic issues Vendian stratigraphy of Ukraine. *Geologichnyy Zhurnal* **328**, 7–13 (in Ukrainian).

**Velikanov VA and Melnychuk VG** (2013) The Vendian System. Introduction. In *Stratigraphy of Upper Proterozoic and Phanerozoic of Ukraine. Volume 1, Stratigraphy of Upper Proterozoic, Paleozoic and Mesozoic of Ukraine* (ed. PF Gozhyk), pp. 49–51. Kiev: Institute of Geological Sciences, National Academy of Sciences of Ukraine (in Ukrainian).

**Vidal G** (1981) Micropaleontology and biostratigraphy of the Upper Proterozoic and Lower Cambrian sequence in east Finnmark, northern Norway. *Norges Geologiske Undersøkelse* **362**, 1–53.

**Vidal G, Palacios T, Gamez-Vintanedj Diez Baldau MA and Grant SWF** (1994) **N**eoproterozoic*–*early Cambrian geology and palaeontology of Iberia. *Geological Magazine* **131**, 729–65

**Vidal G, Palacios T, Moczydłowska M and Gubanov AP** (1999) Age constraints from small shelly fossils on the early Cambrian terminal Cadomian Phase in Iberia. *GFF* **121**, 137–43.

**Volkova NA** (1996) Cambrian acritarchs; from the Moscow Syneclise. *Bulletin of Moscow Society of Naturalists*, *Geological Series* **71**, 51–7 (in Russian).

**Yakobson KE** (2014) Problems of the Vendian of the Eastern European Platform. *Regional* *Geology and Metallogeny* **60**, 109–15 (in Russian).

**Yang R, Zhang C, Song G and Luo X** (2006) Vermicular fossils in the Early Cambrian Xidashan Formation in the Quruqtagh region of Xinjiang, China. *Progress in Natural Science* **16**, 559–62.

**Yanovsky AS** (2012) Cambrian System. In *State geological map of the Russian Federation. Scale 1:1,000,000 (third generation). Central European Series. Sheet O-37 (Yaroslavl). Explanatory note* (ed. VP Kirikov), pp. 38–49. Ministry of Internal Affairs of the Russian Federation, FSUE VSEGEI (in Russian).

**Zang W, Moczydłowska M and Jago JB** (2007) Early Cambrian acritarch assemblage zones in South Australia and global correlation. *Memoirs of the Association of Australasian Palaeontologists* **33**, 141–77.

**Zinovenko GV** (2009) *Podlasko-Brest depression. Structure, history of development and minerals*. Minsk: Academy of Sciences Of Belarus, 142 pp. (in Russian).

**Zoricheva AI** (1963) Upper Proterozoic and Lower Paleozoic formations. North of the Russian Platform. In *Geology of the USSR. Vol. 2. Arkhangelsk, Vologda regions Part 1. Geological description* (eds AI Zoricheva and SI Volkov), pp. 79–99. Moscow: Russian State Geological Committee (in Russian).