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The Palaeozoic of the Eurasian high Arctic

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The Eurasian high Arctic margin is dominated by wide continental shelves composed of thick Mesozoic and Late Palaeozoic sedimentary successions underlain by older Palaeozoic and Proterozoic complexes. We aim to discuss data on the Severnaya Zemlya Archipelago, which is located in the Kara Sea north of the Taimyr Peninsula of central Siberia. Its position on the edge of the Eurasian margin and well-exposed Palaeozoic geology makes this domain important for reconstructing Arctic palaeogeography.

The Palaeozoic rock succession of Severnaya Zemlya starts with the Upper Proterozoic and continues up to the Permian.

A thick (c. 3.000 m) Riphean and Vendian turbidite succession is overlain, perhaps unconformably, by Early Cambrian siliciclastics. The thickness of the Cambrian succession is c. 2.500 m. A rich arthropod fauna of the Maratovskaya Formation indicates a broad marine influx at the end of Early Cambrian. The general marine transgressions reached Severnaya Zemlya at the beginning of the Middle Cambrian and Furongian followed by a short episode of folding, uplift and erosion in the latest Cambrian.

The Ordovician succession (c. 1.700 m) starts with a Tremadocian transgression. Combinations of sandstones, shales and volcanics are prominent. Shallow marine environments existed through the Early to Middle Ordovician with a benthic fauna of gastropods, brachiopods, ostracodes, crinoids and bryozoans dominating. The Middle Ordovician is marked by black shales and limestones with gypsum. Basal quartzitic sandstones in the Late Ordovician, perhaps marking a hiatus, are overlain by detrital limestones.

The Silurian is characterised by thick carbonate sequences (c. 2.500 m), abundant shelly fossils and coral-stromatoporate development. The occurrence of graptolite facies within the carbonate section on Severnaya Zemlya is in agreement with the early mid Telychian sea-level high stand recorded in the other basins, and a distribution of cephalopod limestone biofacies reflects episodes of upwelling along the marine shelves. In the Ludlow, marine sedimentation in the basin became restricted, and in the Pridoli a lagoonal facies gave the way to Devonian Old Red Sandstones; they are up to 2.000 m thick and yield vertebrates and plant remains.

Folding of the Palaeozoic succession occurred in the latest Devonian or earliest Carboniferous. Overlying sandstones (c. 100 m) range from Late Carboniferous to Permian.

Together with the northern part of the Taimyr Peninsula and the northern Kara Sea, Severnaya Zemlya represents the exposed part of the North Kara Terrane. In earlier publications, it has been interpreted as a part of Siberia, a part of Baltica, a small independent continental plate or a part of larger entity Arctida that was accreted to Siberia in Late Palaeozoic (see METELKIN *et al.* 2005 for references). Recently it has been inferred that Severnaya Zemlya has been a part of Baltica at least since the late Neoproterozoic Timanian Orogeny (GEE & PEASE 2004).

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Palaeomagnetic data from Severnaya Zemlya suggested that the North Kara Terrane occupied similar latitudes to Baltica and Siberia in the Silurian and Devonian, and was at different latitude in the Early Ordovician (METELKIN *et al.* 2005). However, recently published isotopic data from Severnaya Zemlya (LORENZ *et al.* 2008, and references therein) favour its affinity to Baltica. New geochronological studies of igneous rocks from northern Taimyr provide more evidence for the interpretation of North Kara as a northern continuation of Baltica's eastern passive margin in the Early Palaeozoic (PEASE & SCOTT 2009). Potential field anomalies provide essential information on the probable connection of the North Kara Terrane westwards into the eastern parts of the Barents Shelf and Novaya Zemlya (GEE *et al.* 2006). Interestingly, the above mentioned depositional break in the late Cambrian of Severnaya Zemlya resulted in an angular unconformity. Both palaeontological and isotope-age data precisely constrain its age from the *Peltura scarabaeoides* Zone of the Furongian to the early Tremadocian. A comparable unconformity in terms of timing and style of deformation has been described from the southern Novaya Zemlya (PEASE & SCOTT 2009), and reported in Vaigach, Pai-Khoi, and the Polar Urals (KUZNETSOV 2009). The similarity of these unconformities strengthen the argument that North Kara was part of Baltica, probably, being closely located to Novaya Zemlya. The apparent lack of the unconformity in northern Novaya Zemlya is enigmatic and needs further investigations.

So far faunal evidences do not provide decisive answer on stronger affinity with any of the above mentioned palaeocontinents. They suggest that Severnaya Zemlya has been in the proximity of both Baltica and Siberia, with no large separation between Severnaya Zemlya and the later. The Cambrian trilobites *Kujandaspis ketiensis* and *Maladiodella* aff. *abdita* indicate a connection between Severnaya Zemlya and Siberia, whereas, brachiopods are distinct from those of Siberia (BOGOLEPOVA *et al.* 2001). The trace fossil *Cruziana semiplicata* is known from Baltica and, recently, from Severnaya Zemlya (JENSEN *et al.* in press). A distribution analysis of the Ordovician fauna shows that they contain elements typical of Baltica (60% of common taxa), Siberia (30% of common taxa) and Laurentia (30% of common taxa) biotic provinces (BOGOLEPOVA *et al.* 2006). New data on the Silurian faunas of Severnaya Zemlya give some unique information on their similarities to those of Baltica and Laurentia. The evidence from the benthonic myodocope ostracode *Entomozoe* indicates connection between Severnaya Zemlya and eastern North Greenland (SIVETER & BOGOLEPOVA 2006). One more example of these affinities can be shown with regard to conodonts, which occur commonly in the Early Silurian successions of Severnaya Zemlya (MÄNNIK *et al.* 2009). Several taxa characteristic of the Telychian faunas of Baltica (*Apsidognathus* cf. *milleri*, *Distomodus* cf. *staurognathoides* and *Pterospathodus eopennatus*) were found in the region for the first time. Moreover, on Severnaya Zemlya, *Pterospathodus eopennatus* occurs together with *Aspelunda* aff. *expansa* and *Ozarcodina broenlundii*, known from Peary Land of eastern North Greenland.

The relationship between Baltica, including the North Kara Terrane, and Siberia remains controversial arising all the questions of how far there were apart, divided by a deep ocean or a shallow marine area, and, consequently, whether the Uralian Ocean, separating Baltica and Siberia extended into the modern days high Arctic areas or not; this is on-going research.

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