

The Age of Spitsbergen Basement Consolidation: U–Pb Dating of Detrital Zircons from the Upper Precambrian and Lower Carboniferous Clastic Rocks of the Northwestern Part of Nordenskiöld Land

A. N. Sirotkin^{a,*}, Corresponding Member of the RAS Yu. B. Marin^b, N. B. Kuznetsov^{c,d},
G. A. Korobova^b, and T. V. Romanyuk^{e,f,**}

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Abstract—The age distribution of detrital zircons from Upper Riphean and Early Carboniferous sandstones of the northwest part of Nordenskiöld Land (Spitsbergen Island) was studied. The results obtained supplement the previously known data on the rocks of Precambrian and Paleozoic masses of West Spitsbergen. Integrated consideration of these data showed that the time interval from the Middle Riphean to the Early Carboniferous inclusive might be subdivided into at least five stages characterized by quite different provinces supplying detritus to sedimentary basins. (The relics of these latter are represented in the present structure of western Svalbard.) The most ancient distinguished event of alteration of the sources of sedimentary matter (at the boundary of the Middle and Late Riphean) corresponds to the consolidation time of the ancient basement of Svalbard.

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The times of basement consolidation in different areas of the western Arctic are still debatable, along with the supplying provinces, ages, and paleogeographic conditions of the formation of Paleo- and Mesozoic sedimentary basins upon this basement. To solve these problems, we used the dating of detrital zircon grains (*dZr*) from sandstones and metamorphosed sandstones constituting Upper Precambrian and Paleozoic masses in the northwestern part of Nordenskiöld Land on Spitsbergen Island (Fig. 1, the inset).

Spitsbergen Island is characterized by variously developed metamorphosed Proterozoic formations along with masses of various Phanerozoic levels [3]. In the northwestern part of Nordenskiöld Land, the mass of dislocated and green-schist-metamorphosed car-

bonate and terrigenous rocks of the Sofiebogen Upper Riphean series is situated in the visible basement of the section (Fig. 1). Diamicrites of the Kapp-Linné Vendian system are found above. A thick sedimentary mass (6–7 km) occurs upon Proterozoic formations of pronounced structural unconformity and includes a considerable part of the Carboniferous system section, Permian, Triassic, Jurassic, Lower Cretaceous, and unconformity occurring Paleogene. The Mesozoic part of this sequence is known as the GEOTOP (or the Festningen [10]) section and represents a typical Mesozoic section of the western part of Svalbard.

The ages of formerly dated *dZr* from the sandstones of several Triassic levels [1], the matrix of Jurassic conglomerates [6], the Lower-Cretaceous sandstones, and the matrix of Paleogene conglomerates [1], show that the younger the rocks, the more significant the role of ancient ages within the *dZr*. Thus, the *dZr* with ages of 430–320 Ma the erosion products of Caledonian formations prevail most likely in Triassic rocks. Erosion products of the Proto-Uralian–Timanian orogen—the *dZr* of 726–634 Ma in age—are characteristic for the Jurassic period. The *dZr* from Grenvillian and Karelian provenance areas dominated in the Cretaceous. In the Lower Paleogene the Karelian and Late Archean *dZr* played the main role.

To study the Upper Riphean–Carboniferous formations underlying the GEOTOP section, we collected samples of Upper Riphean (C-163-1, muscovitic quartzite of the Sofiebogen series), Vendian

^a Polar Marine Geosurvey Expedition, St. Petersburg, 198412 Russia

^b St. Petersburg Mining University, St. Petersburg, 199106 Russia

^c Geological Institute, Russian Academy of Sciences, Moscow, 119017 Russia

^d Kazan (Volga Region) Federal University, Kazan, 420008 Russia

^e Schmidt Joint Institute of Physics of the Earth, Moscow, 123242 Russia

^f Gubkin Russian State University of Oil and Gas, Moscow, 119991 Russia

*e-mail: pechenga-67@yandex.ru

**e-mail: t.romanyuk@mail.ru