Mesozoic flysch on the Big Lyakhov Island (New Siberian Islands): age, provenance and tectonic setting

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Introduction

The Big Lyakhov Island is located on the southern margin of the New Siberian Platform. The Palaeozoic carbonate cover of this platform outcrops further north on the Kotel'ny and Bel'kov islands. The Late Jurassic volcanics and greywackes related to the Anjui - Svyatoi Nos Island Arc are exposed south of the Lyakhov Island. The South-Anjui suture separates the Anjui - Svaytoi Nos terraine from the New Siberian Platform (Fig. 1). This suture goes through the southeastern part of the Big Lyakhov Island, where it is marked by exotic tectonic slivers and blocks of the oceanic basalt, serpentinite and amphibolite (Fig. 1).

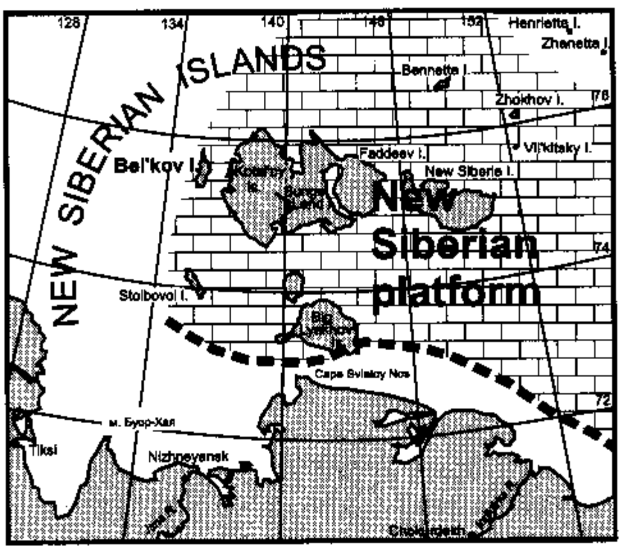

Fig. 1. Location of the Mesozoic flysch sequences on the New Siberian Islands. The studied area is shown by a rectangle.

The Burustas flysch occurs over most of the Big Lyakhov Island. In the studied area this flysch is dislocated, cleaved and intruded by the Aptian - Albian (Vol'nov et al. 1999; Layer et at. 2001) granodiorite. The first researchers have described the Big Lyakhov terrigenious rocks as Mesozoic. Later, a part of the flysch was dated as Late Proterozoic based on microfossil determinations (Vol'nov et al. 1970). However, Permian miospores were reported from the Burustas flysch by Vinogradov et al. (1974) and, according to Vol'nov et al. (1999), the age of the flysch is considered to be Permian – Triassic.

Description of the Burustas flysch

We studied the southeastern part of the island (Fig. 1). The Burustas flysch consists of interstratified sandstone, siltstone and mudstone, forming rhythms ranging from several centimeters to several meters. There also occur packages, up to fifty meters thick, predominantly composed of sandstone or mudstone. Gritstone and conglomerate are absent, implying that sedimentation took place far from the source area. The massive sandstones show an erosive base and graded bedding. Occasionally asymmetric current ripples have been observed. Packages of poorly-sorted fine-grained sandstone with hummocky cross-stratification were described at different levels in the sequence near Burustas Cape. In some sections, the turbidite features are not well expressed and pinch-outs of the sandstone layers are common.

Two aspects of the lithology and texture are critical for defining the environment; neither cross-bedded sandstone, conglomerate and gritstone or evidence of deep-marine turbidite deposition were observed. The depth of the palaeobasin didn't exceed the depth of storm oscillations. According to Mutti et al. (2003), the combination of turbidites and layers with hummocky cross-stratification is typical for flood-dominated submarine deltaic systems. These facies are described as typical to the external part of foreland basins adjacent to orogens. Uniform composition and poor exposure of the Burustas flysch didn't permit recognition of zoning and/or evolutionary stages of a foreland basin.

Composition and provenance

The Burustas sandstone is a typical greywacke. It is composed of volcanic and metamorphic quartz, plagioclase and rock fragments. The scales of the detrital chlorite and muscovite are present. The rock fragments are identified as modified felsite, chlorite-sericite schist, occasional metabasite and serpentinite. The heavy-mineral fraction contains ilmenite, zircon, rutile, apatite, chromite, garnet, epidote, amphibole and others. Zircon is represented by crystals showing different color, shape and degree of roundness. Some apatite grains are corroded in specific ways and resemble the apatite from the amphibolite nappe. The unrounded grains of the ilmenite, garnet and rutile are probably also related to this amphibolite. The chromite and serpentinite are products of the erosion of the ophiolite. The presence of serpentinite in the sandstones indicates that the source was close to sedimentation area.

The composition of detritus gives the evidence that two main sources shed material into the basin. These were the platform sequence and the island-arc volcanics. The colorless euhedral zircon crystals are interpreted as first-cycle sedimentation debris, probably derived from a volcanic arc. A third additional source was the exotic tectonic blocks of ophiolite and amphibolite. The mixed composition of the sandstone indicates that the Burustas flysch accumulated during collision of the Late Jurassic Anjui - Svaytoi Nos Island Arc with the New Siberian platform. According to the age of the post-collisional granodiorite, the collision occurred before the Aptian. Thus, the Burustas flysch should be younger than Jurassic and older then Aptian. The age of the syncollisional strata associated with South-Anjui suture on Western Chukotka was determined as latest Jurassic - Neocomian (Bondarenko et al. 2003). These strata have a tectonic position and mixed sandstone composition similar to the Burustas flysch. This evidence suggests that the previously established Permian - Triassic age of the Burustas Unit is not correct. We used fission-track dating of detrital zircon from the Burustas sandstone to further investigate the age of deposition.

Age of the Burustas flysch

The detrital zircon fission-track (ZFT) thermochronology allows determination of the age of the youngest fraction of zircon grains and thus gives a maximum age for deposition of the host strata. We collected one sample of sandstone from the Burustas Cape section and another from about 10 km eastward from Cape. The short etch time and broad range of grain ages indicate that the zircon FT ages are not reset and thus preserve information about cooling events in the source regions. The ages of the young zircon population from these samples are 163.7±9.2 Ma and 119.6±14.5 Ma. We believe that ZFT minimum age can be used as a proxy for the age of deposition. However, these data contradict the previously inferred Permian - Triassic age of the Burustas flysch and we suppose that the fossils of this age were redepositied. According to our data the Burustas flysch was accumulated from end of the Jurassic to beginning of the Cretaceous. However, we don't exclude the possibility of Triassic shales in tectonic slivers in the southeastern part of the island.

Conclusions

1. Burustas sediments were deposited in a submarine, flood-dominated, deltaic system. This system was probably located in an external part of a foreland basin on the southern margin of the New Siberian Platform.
2. Three sources produced debris to Burustas sandstone: platform cover, island-arc volcanics and exotic blocks of ophiolite, amphibolite. So, the Burustas flysch was deposited during collision of the Anjui - Svaytoi Nos island-arc with the New Siberian platform. We argue that the age of these syn-collisional strata is Late Jurassic - Early Neocomian.
3. Deposits correlated with the Burustas flysch are known on Stolbovoi Island, the Lesser Lyakhov Island and in Western Chukotka. All of them represent a single syncollisional foreland basin.

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