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Early Proterozoic granitoids of the Olenek complex (*northern Siberian craton*): petrogenesis and geodynamic setting

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Abstract

The paper deals with geological and geochemical studies of granitoids of the Olenek complex in the Olenek uplift of the basement of the northern Siberian craton. The age of these granitoids was earlier estimated at 2036 ± 11 Ma. The granitoids of the Olenek complex correspond in composition to high-alumina quartz diorites, granites, and leucogranites of the normal petrochemical series. According to geochemical and mineralogical characteristics, the quartz diorites can be assigned to granites of the transitional *I–S* type, and the granites and leucogranites, to *S*-type granites. The $\varepsilon_{Nd}(T)$ values in the granites of the Olenek complex vary from –0.2 to +1.4, and the Nd model age is 2.4–2.5 Ga. The quartz diorite is characterized by $\varepsilon_{Nd}(T) = +3.0$ and a Nd model age $T(DM) = 2.2$ Ga. The geochemical characteristics of the granites and leucogranites indicate their formation through the melting of a source of graywacke composition, whereas the quartz diorites resulted, most likely, from the mixing of granitic and basaltic melts. The fact that the granitoids of the Olenek complex intruded the folded rocks of the Eekit Formation but stay virtually undeformed massive bodies suggests that they formed at the postdeformation stage of the regional evolution after the completion of the Paleoproterozoic orogenic events. The intrusion of granitoids marks the completion of the formation of the Early Proterozoic Eekit fold belt on the western (in the recent coordinates) margin of the Birekta terrane of the Olenek superterraine and the final formation of the superterrane structure. At the next stage of magmatism (1.98–1.96 Ga), best pronounced in the uplifts of the basement of the northern Siberian craton, all terranes forming the Anabar and Olenek superterranes assembled into a single structure.

Keywords: granitoids; geochemistry; Early Proterozoic; Olenek uplift; Siberian craton

Introduction

Early Proterozoic granitoids are widespread within the Siberian craton; most of them are confined to the uplifts of the basement of its southern part, whereas in its northern part they are scarcer and occur in the Anabar Shield and in the Olenek uplift (Fig. 1). Early Proterozoic granitoids of the Anabar Shield are localized mostly in the Early Proterozoic Kotuikan and Billyakh collision zones separating the Magan and Daldyn and the Daldyn and Khapchan terranes, respectively (Fig. 2) (Molchanov et al., 2011; Rosen, 2003; Rozen et al., 2000). The granitoids form small massifs and vein bodies. The U–Pb zircon age of most granitoids of collision zones is 1.98–1.96 Ga (Gusev et al., 2013; Molchanov et al., 2011; Smelov et al., 2012). Some granite-gneiss and granite bodies of small vein blocks in the Kotuikan collision zone are younger, 1.92–1.82 Ga (Gusev et al., 2013; Molchanov et al., 2011). Collisional granitoids in the Billyakh and Kotuikan zones, dated at 1.98–1.96 Ga, have signs of structural and metamorphic transformations. The granitoids include monzodiorites, diorites, granodiorites, granosyenites, granites, and leucogranites, which chemically correspond to medium-alkali rocks and have high Fe contents (Gusev et al., 2013; Smelov et al., 2012). A distinctive feature of the granitoids of both zones is varying contents of trace and rare-earth elements. Therefore, they cannot be assigned to a single type according to the "alphabet" classification (Gusev et al., 2013; Smelov et al., 2012). Rocks of continental crust were, most likely, sources of parental melts for these granitoids (Gusev et al., 2013; Molchanov et al., 2011; Smelov et al., 2012).

Early Proterozoic granitoids of the Olenek uplift form several massifs (Fig. 2). Their U–Pb zircon age is estimated at 2036 ± 11 Ma (Wingate at al., 2009), but their geochemical composition has not been determined yet in contrast to the granitoids of the Kotuikan and Billyakh collision zones of the Anabar Shield (Gusev et al., 2013; Smelov et al., 2012).

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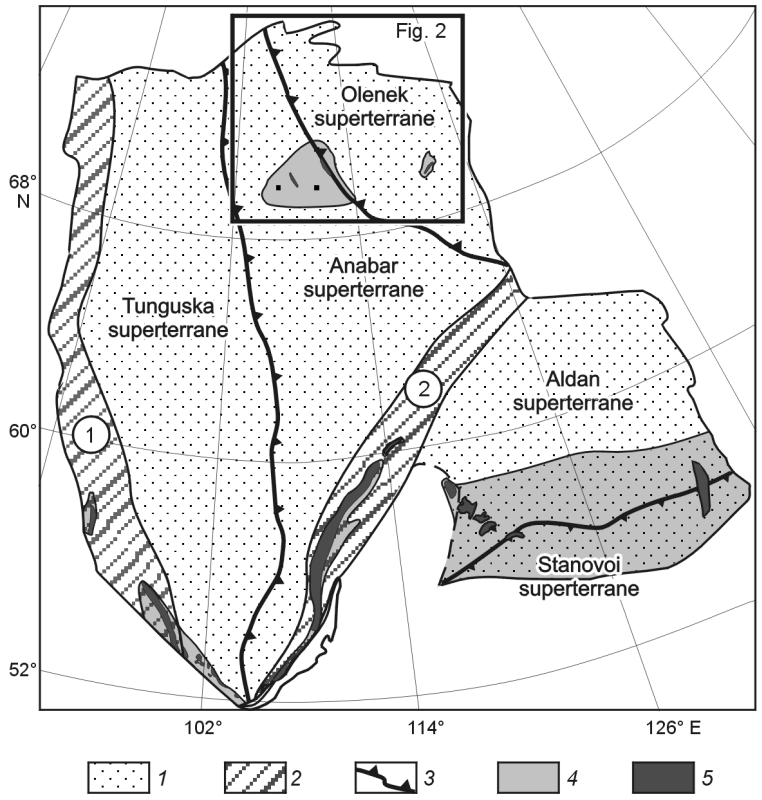

Fig. 1. Schematic map of major tectonic elements of the Siberian craton and outcrops of Early Proterozoic granitoids (modified after Gladkochub et al. (2006) and Rosen (2003)). *1*, major superterranes (provinces); *2*, Early Proterozoic fold belts; *3*, suture zones; *4*, basement uplifts; *5*, Early Proterozoic granitoids. Encircled numerals: 1, Angara fold belt; 2, Akitkan fold belt.

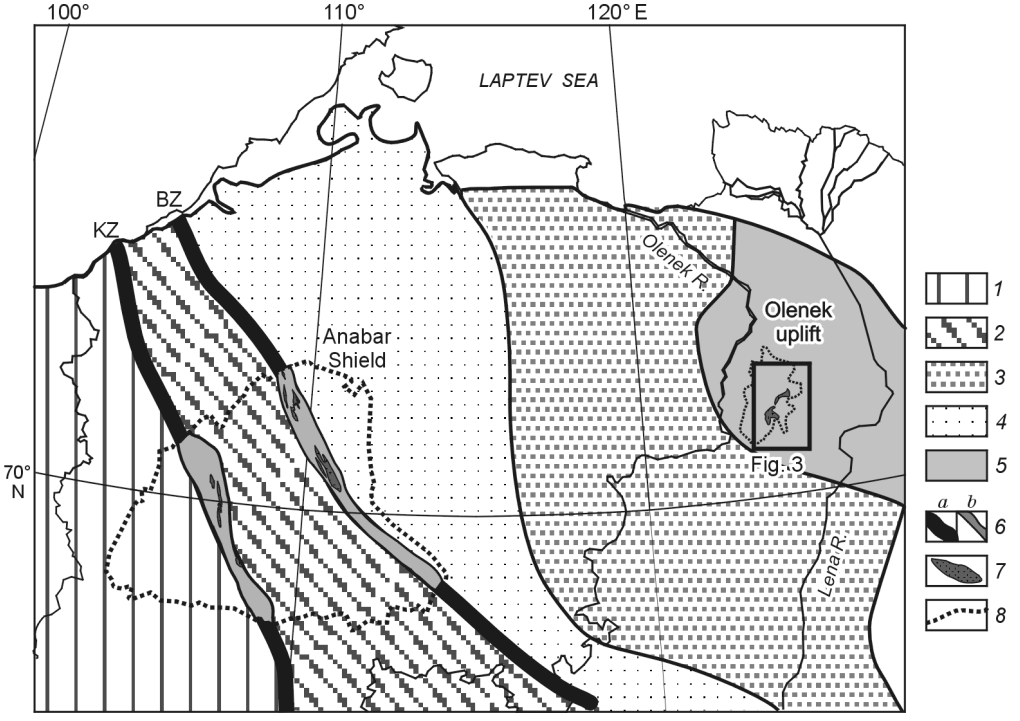

Fig. 2. Schematic map of the northern Siberian craton (modified after Gladkochub et al. (2006) and Rozen et al. (2000)). *1,* Archean Magan terrane; *2*, Archean Daldyn terrane; *3*, Early Proterozoic Birekta terrane; *4*, Early Proterozoic Khapchan fold belt; *5*, Early Proterozoic Eekit fold belt; *6*, Early Proterozoic collision zones: *a*, overlain by the platform cover rocks; *b*, exposed; *7*, Early Proterozoic granitoids; *8*, basement uplifts. KZ, Kotuikan collision zone; BZ, Billyakh collision zone.