Geophysical Research Abstracts
Vol. 16, EGU2014-9876, 2014
EGU General Assembly 2014

Simultaneous granitoids in common terranes: explanation of their geochemical diversity (the southern Siberia as example)

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It is generally assumed that the geochemical diversity of granitoids is directly related to the different geodynamic settings of their origin. However, sometimes simultaneous granitoids having different of geochemical affinities occur in common tectonic units and were formed under similar geodynamic setting. Particular, such cases could be demonstrated in the southern Siberian craton (SC) and adjacent area of the Central Asian Orogenic Belt (CAOB), where they were studied in details.

1) The Palaeoproterozoic (ca. 2.02 Ga) Chuya and Kutima granitoids are located in Baikal unit of the SC. Both granitoid complexes belong to the Akitkan orogenic belt and were formed in thickened continental crust within an accretionary orogen above a subduction zone. The I-type Chuya granitoids are similar to the tonalite-trondhjemite-granodiorite series. The Kutima granites are similar in contents of major oxides to oxidized A-type granites. Both granitoids show similar positive eNd(t) values. We assume, that the Chuya granitoids might have been formed through the melting of a metabasitic source, whereas the Kutima granites, through the melting of a crustal source of quartz-feldspathic composition.

2) The late Palaeoproterozoic (1.87 - 1.86 Ga) granitoids of the Birusa unit of the SC together with numerous simultaneous granitoids of other units of the SC mark post-collisional extension of thickened crust after the craton assembly. The majority of such granitoids belong to A-type granites. However, wide spectra of geochemical features were discovered among granitoids of the Birusa unit. The Birusa granitoids include I-type tonalites and diorites, S-type two-mica granites, as well as oxidized A-type granites. There are both magnesian and ferroan. All these granitoids are characterized by negative eNd(t). A crustal and mixed (crust-mantle) sources have been considered to explain geochemical diversity of the Birusa granitoids.

3) The early Palaeozoic (ca. 490 Ma) synmetamorphic granitoids of the Tutai and South Olkhon massifs are situated in the Olkhon terrane (CAOB). Both massifs were formed within accretion-thickened crust. The Tutai massif consists of moderately potassic granites, whereas the South Olkhon massif contains quartz syenites and granites. The granites from both massifs are alkali-calcic and weakly peraluminous. The Tutai and South Olkhon granites belong to the transitional I-S-type. The South Olkhon quartz syenites are metaluminous as well as alkaline and alkali-calcic rocks. Despite increased alkali contents, the South Olkhon quartz syenites are close to I- rather than A-type granites in the contents of trace and rare-earth elements. The Tutai and South Olkhon granites were derived from quartz-feldspar crustal rocks, whereas the South Olkhon quartz syenites might have originated from a mixed (crust-mantle) source.

We suggest the following factors as mainly responsible for the forming of simultaneous granitoids with different geochemical affinities in the common tectonic units: 1) heterogeneity of crustal protoliths; 2) melting in thickened continental crust; 3) underplating of mafic melts.