Granulites of the Olekma granite-greenstone terrain Aldan Shield, USSR

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The Olekma granite-greenstone terrain is located in the western part of the Aldan Shield. It consists of: Proterozoic greenschist-facies metasedimentary rocks united by the Udokan supergroup; Archaean low-grade amphibolite-facies greenstone rocks (the Subgan supergroup); low- and high-grade amphibolite-facies tonalite-trondhjemite gneisses (the Olekma complex); and tectonic blocks of granulite-facies orthogneisses and paragneisses (the Kurulta supergroup). Tectonic blocks of the Kurulta supergroup are made up of orthogneisses (80-85%); enderbites, charnockites, granite gneisses, and paragneisses (15-20%); garnet-biotite and garnet-cordierite gneisses; and two-pyroxene-amphibole plagiogneisses with calc-silicate interlayers. There are two groups of granulite blocks with different orientations, namely, submeridionally striking and latitudinally striking. There are also relict eclogite and granulite assemblages in the metabasites among the Olekma complex rocks. The geology, structure and metamorphism of the granulite-facies rocks of the Kurulta and Olomokit blocks have been well studied.

Orthogneisses of the latitudinally striking Kurulta block are represented mainly by enderbites and charnockites; granite gneisses also occur among the submeridionally striking Olomokit block. There are a few geochronological ages for the rocks of Olomokit block, where basic rocks have ages of approximately 3.2 Ga. Ages of basic rocks of the Kurulta block vary from 3.3. to 2.0 Ga.

P-T- conditions of granulite-facies metamorphism of these blocks have, on the average, $T = 700\text{-}800^{\circ}C$ and $P = 6\text{-}7$ kb (Cor-Grt geothermobarometers, Bi-Grt and two-pyroxene geothermometers). Some areas show an increase in pressure, e.g., $T = 700\text{-}900^{\circ}C$, $P = 7\text{-}10$ kb (Grt-Cpx, Grt-Opx-Pl-Qtz geothermobarometers), that is confirmed by the formation of 'pencil' granulites, the appearance of garnet-clinopyroxene assemblages in

the basic rocks and the disappearance of assemblages of cordierite in garnet metapelites. These areas sometimes lie on the continuation of blastomylonite zones within the Olekma complex. The grade and volume of retrogressive changes of rocks differ in those blocks. The rocks of the Olomokit block were retrogressively metamorphosed under the high-grade and low-grade amphibolite facies P-T conditions, but only a small part of the Kurulta block rocks have been retrogressively metamorphosed under high-grade amphibolite facies P-T conditions.

Bodies of basic rocks containing relict eclogite and granulite assemblages are found particularly among tonalite-trondhjemite gneisses near the boundary of the Olekma granite-greenstone terrain area and the Aldan granulite-gneiss area. The ages of those rocks are 2.4-2.0 b.y. (Sm-Nd method); the ages of the later metamorphic changes in them are 2.0 - 1.8 b.y. The central parts of thicker (3-7 m) basic boudins contain relicts of garnet and clinopyroxene with symplectic intergrowths of plagioclase. Garnet grains are surrounded by kelyphitic rims of plagioclase and hornblende, and clinopyroxenes are partially replaced by hornblende. Garnet and clinopyroxene are absent from the margins of the boudins (which have bulk compositions similar to the central parts) and the mineral assemblage there is hornblende and plagioclase, i.e., an amphibolite-facies paragenesis. Petrographic observations, along with mineral chemistry, suggest that during the early stages of metamorphism the (anhydrous) basic rocks had garnet + jadeite-rich clinopyroxene assemblages. Subsequently, during decompression and continuing deformation, sodic plagioclase exsolved from the clinopyroxene and the garnet and clinopyroxene were variably recrystallised to give hornblende + plagioclase amphibolite-facies assemblages.

The difference in the P-T conditions in the granulite-facies metamorphism, in the retrograde alterations and in the formation, composition and geologic setting of the blocks, lead to the suggestion that repeated episodes of granulite-facies metamorphism took place with different time periods and various geotectonics settings.