Shield massif anorthosites - indicators of ancient collison zones

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Massif anorthosites (MA) are typical of all Precambrian Shields. They are subdivided in two groups, each of which has distinctive compositions, character of association, geological setting and age (Markov and Bogatikov 1984). Sub-platform MA of Proterozoic age are a component of anorthosite-granite (rapakivi) formations. MA of the early stages of the Earth evolution are represented by mangerite-anorthosite and gabbro-anorthosite formations (Sharkov 1990). The first form large bodies occupying several thousands of square kilometres and are typical of folded zones marginal to shields (e.g., anorthosite associations of Kalar and Djugdjur massifs in the Stanovol Zone of these (Aldan Shield). The second group are much smaller in size and are composed of lens-like bodies of layered leuco-gabbro with subdominant gabbro and anorthosite components. They are located within the shields.

The MA of the Anabar Shield can be considered as an intermediate type. They belong to the mangerite-anorthosite formation according to composition, but their geological settings have some similarity to the gabbro-anorthosite formation, as they occur in linear zones crossing granulites. The Kotuikan-Monhkolin Zone of "deep-seated sliding and diaphthoresis" (Rozen *et al.* 1986) has been studied in most detail. According our recent data this zone consists of tectonically combined heterogeneous components. Progressively metamorphosed amphibolite-facies rocks, together with lens-like bodies of roughly layered anorthosite and rehydrated granulite among them, are widely present. The former differ from granulites both in composition and style of folding.

MA of the gabbro-anorthosite formation are closely associated with most metamorphic complexes and localized in thrust zones. Similar formations occur in uplifted block types of Kapuskasing (Canada), or Limpopo (South Africa). They are both found on the boundary of granite-greenstones areas. The former is considered to be an exposure of the lower crust in the thrust zone (Percival *et al.* 1989). For the latter, a more complex model is assumed; according to Van Reenen *et al.* (1989), the Limpopo Belt formed during continental collision.

Gabbro-anorthosite of Enisey Ridge is localized among high-pressure granulites. There are gabbro (f=20) and leucocratic gabbro (f=25) dominantly in this complex; anorthosites (f=40) are composed of plagioclase (An_{84-90}) with admixture of high-Al (up to 5-6% Al_2O_3) ortho- (f=20-22) and clinopyroxenes (f=12-15 mol.%). Their characteristic feature is close association with drusite and eclogite-like rocks. This makes the complex similar to the analog complexes from the Belomorsky Belt, that "trace zones of contacts between different geological history Earth's crust segments" (Markov and Bogartikov 1984).

MA were not known reliably in the Aldan Shield except on its southern margin. There are lens-like bodies (up to 0.5-1.0x6 km) of layered anorthosites - gabbro-anorthosites in the Sunnagin Block (NE part), considered to be the most stable in a tectonic sense. They are situated among banded hypersthene gneisses and associated with exotic garnet-clinopyroxene-orthoclase gneisses (possibly analog of mangerites) and small lens-like interlayers of garnet-amphibole and Ti-magnetite rocks. Anorthosites (f=50) are composed of dominant plagioclase (An_{49-57}) with admixture of inverted pigeonite (f=46-53) and clinopyroxene (f=35-43 mol.%). They are commonly amphibolized and converted to schist. Where these processes are intensively developed, anorthosite loses its typical appearance and, therefore, could be missed during field work.

Uniform metamorphism with surrounding rocks and intensive folding (i.e., pre- or synmetamorphic origin) are a general feature of MA of gabbro-anorthosites complexes. The most reasonable genetic theory is one that considers MA as a product of slow, magmatic crystallization of high-Al basaltic or andesitic melts at granulite facies pressures (about 8kb) and very high temperatures (about 1100^0C) (Markov and Bogatikov 1984). The origin of such melts and their evolution took place in ancient collision zones such as the Limpopo or Kapuskasing belts between granite-greenstone cratons and, like the MA of Enisey Ridge, Sunnagin Block or Anabar Shield, among granulite-gneiss areas.

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