ARBANSKY MASSIF IN THE EASTERN SIBERIA- THE LARGEST IN RUSSIA BLOCK OF THE EARLY PRECAMBRIAN UPPER MANTLE AND LOWER CRUSTAL ROCKS

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The Arbansky massif (~70 km^2, thickness 1 km) is located in 150 km to northwest from Lake Baikal in the bordering Prisayanian uplift of the Siberian platform Precambrian basement. The uplift formed by 2 large structures: Sharyzhalgay block which formed by the early proterozoic (2.5-2.4 Ga) granulite complex, and Onotsky graben -fragment of the late archean granite-greenstone terrane (fig.1).

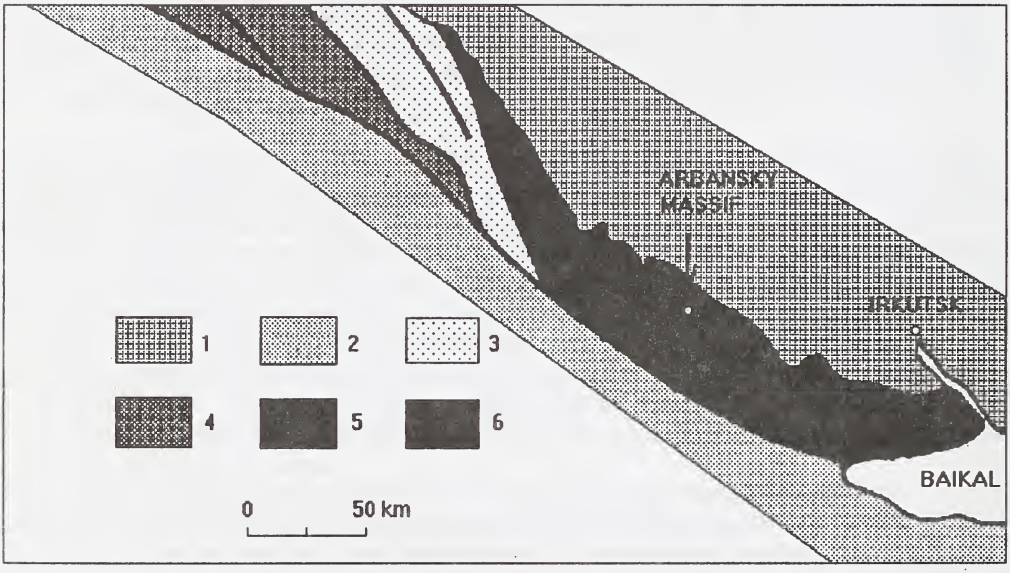

Fig.1. Prisayanian bordering uplift of the Siberian platform:
1- phanerozoic and late proterozoic platform sedimentary cover; 2-late proterozoic folded belt (baikalides); 3-early proterozoic rocks of Uriksko-Iiysky graben; 4-early archean rocks of Biryusa block; 5-late archean rocks in Onotsky graben; 6-early proterozoic granulites of Sharyazhalgay block

The massif situated within Onotsky greenstone belt. It consists of overthrusted nappes of tectonized upper mantle and lower crustal rocks, which were tectonically emplaced in the Early Proterozoic (2.2-2.0 Ga ago), when continent-continent collision

took place (Aftalion et al.,1991). The massif contains spinel harzburgites, which are samples of typical upper mantle, eclogites and garnet granulites with layers of garnet-kyanite schists (metapelites), which are samples of the upper mantle and lower crust (Fig.2).

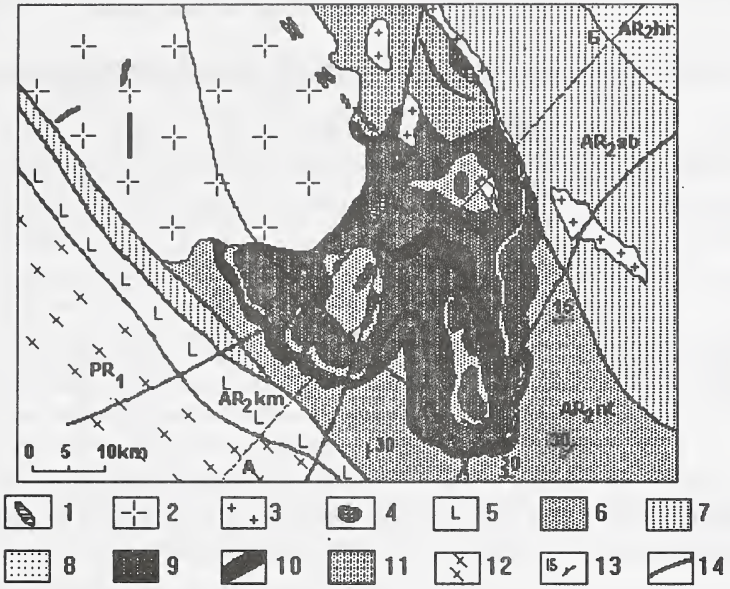

Fig.2. Arbansky massif: 1-the late proterozoic diabase dykes; 2-3 - the early proterozoic granites; 4-the early proterozoic basites and ultrabasites; 5-8 - the late archean rock of Onotsky greenstone belt: 5-Kamchadal'skaya suite, 6-Maloiretskaya suite, 7-Sosnovy Baets suite, 8-Kharantoi suite; 9-11 - Arbansky massif: 9-Gr granulites and eclogites of the lower part of the massif, 10-ultramafites, 11-Gr granulites of the upper part of the massif; 12-Py granulites of Sharyazhalgay complex;13-dipping;14-faults

Spinel, hornblende peridotites, and spinel and garnet websterites with relics of cumulative structures are deep-seated intrusive rock. All sequence looks like high-grade metamorphosed volcanic-sedimentary pile, which were soldered by intrusions of different ultramafic melts in high pressure conditions.

Petrography of the rocks. Garnet granulite is composed by two pyroxenes (hyperstene and ferrous augite), garnet, acid plagioclase (Table), and about 2-3% of ilmenite ; there are small amount of phlogopite among neoblasts. Special attention must be given on high Fe content of minerals which is not typical for basites. The bulk composition of the rock is unusual too (Table 1). Tectonized eclogite is formed by porphyroclasts of augite with 9-14.7% of jadeite and small amount of hyperstene Fs_{38}, and neoblasts of Cpx and garnet with subordinate quartz, ilmenite, phlogopite and Hbl. Composition of minerals is more magnesian than in Gr granulites. Garnet-kyanite schists formed by garnet and kyanite with subordinate irregular aggregates of quartz, rutile, and sometimes acid plagioclase. Feature of these rocks is oriented needle-like inclusions of kyanite in garnet. Spinel harzburgite has all features of the mantle samples both in structure and mineral composition. Cumulate phases in hornblende peridotites are Ol,

green-brown Sp, green magnesian hornblende and ortho- or clinopyroxene. Feature of Sp websterite is appearance of symplectitic coronas of spinel, olivine and plagioclase around spinel. Primary cumulate structure remains in the better way in Gr websterite, where Gr plays role of intercumulus phase in two-pyroxene cumulate. Feature of the rock is symplectitic coronas of spinel, orthopyroxene and plagioclase around garnet.

Table. Representative chemical analyses of rocks and minerals from the Arbansky massif.

	3780-5					3615		a14b	
Oxide	Rock	Pl	Cpx	Opx	Gt	Cpx	Gt	Rock	Gt
SiO_2	43.41	61.49	51.74	50.74	38.20	53.38	39.42	48.25	40.06
TiO_2	1.03	-	0.15	-	-	0.10	-	2.60	0.04
Al_2O_3	10.97	25.07	2.82	1.11	21.83	3.38	22.05	36.72	22.90
Fe_2O_3	3.38	-	-	-	-	-	-	1.66	23.20
FeO	21.51	-	11.81	29.49	27.58	9.16	24.34	5.31	-
MnO	0.27	-	-	0.10	0.38	0.06	1.02	0.05	0.64
MgO	8.85	-	11.52	17.60	4.72	12.01	6.98	4.01	11.37
CaO	8.00	6.39	20.55	0.49	7.71	19.82	6.11	0.89	3.11
Na_2O	0.34	7.46	0.80	-	-	2.15	-	0.15	-
K_2O	0.05	0.05	-	-	-	-	-	0.06	-
$H2O^-$	0.20	-	-	-	-	-	-	0.25	-
CO_2	0.22	-	-	-	-	-	-	0.12	-
LOI	1.13	-	-	-	-	-	-	0.10	-
Total	99.35	100.46	99.39	99.53	100.42	100.06	99.97	100.16	101.32

Note: 3780-5 - garnet granulite, 3615 - eclogite, a14b - garnet-kyanite rock.

Thermobarometry indicates that these rocks crystallized under the following conditions: spinel harzburgite,~10-12 kb; garnet websterite (with lamellae of garnet in clinopyroxene), 24-36 kb; eclogite, 26-34 kb; garnet granulite, 15-22 kb; spinel, hornblende peridotite, 7-10 kb; spinel, olivine websterite, 9-14 kb; spinel websterite, 5-6 kb. Garnet granulites were formed under conditions of the lowerest part of the crust or the top of upper mantle, and eclogites - the upper mantle one. Intrusions of spinel ultramafites crystallized in the lower crust under moderate parameters, and garnet websterites - in the mantle. It is not clear situation with Sp harzburgites - they are typical mantle rock, however, were formed under more moderate conditions then Gr granulites and eclogites; probably, they are slices of younger mantle diapir, tectonically emlpaced into the lower continental crust when the thrust sheets were assembled during next orogenic event. Another problem - the unusual composition of the Gr granulites; we assume that they could be restites from partial melting of the rocks type tonalites, where mg# close to observed in the Gr granulites.

We suggest that Arbansky massif is an example of the ancient continental lower crust and upper mantle, which were formed in the places of descending flows of crustal material under typical for the Early Precambrian plume-tectonics regime. Such situations took place between granite-greenstone terranes (the early precambrian spreading areas) where granulite belts were forming. In our case it could be the Sharyzhalgay granulite belt.