Geophysical Research Abstracts, Vol. 7, 03191, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03191

Plagiogranite Magmatism of Supra-subduction Zone Origin on the Example of Heterogeneous Ophiolites of Kamchatsky Mys Peninsula, Eastern Kamchatka

M. Luchitskaya (1), N. Tsukanov (2), S. Skolotnev (1),W. Kramer (3), W. Seifert (3)

(1) Geological Institute, Russian Academy of Sciences, Moscow, Russia, luchitskaya@ginras.ru, skol@ginras.ru / Fax: (095) 9510443, (2) Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia, (3) Geological-Geophysical center, Potsdam, Germany

Introduction. The study of ophiolites as analogues of the ancient oceanic crust is hampered by the tectonic disintegration of rock complexes, which usually constitute separate tectonic sheets and blocks within a serpentinized melange. Paleotectonic settings of ophiolites are commonly indicated by ultramafic and basaltic rocks, although adequate interpretation of them is possible only if based on the entire spectrum of ophiolitic rocks. In Kamchatka Mys peninsula three ophiolites complexes different in age and in origin were recognized [Skolotnev et al., 2003]. This communication presents new geological, geochemical, and mineralogical data on gabbroids and plagiogranites that form a large massif within a serpentinite melange in the southern Kamchatsky Mys Peninsula.

Geological setting. Kamchatsky Mys peninsula has composite fold-and-thrust structure, constructed by Cretaceous and Paleocene-Eocene volcanic and terrigenous-tuffaceous rocks and tectonic slices of serpentinite mélange, gabbroids and ultrabasic rocks [Khotin, 1976; Zinkevich et al., 1985; Rasnitsyn et al., 1985; Fedorchuk, 1989; Shapiro, 1987; Accretional ... , 1993; Boyarinova et al., 2000, 2001; Saveliev, 2004].

Kamchatsky Mys peninsula is a composite terrane, accreted to Kamchatka peninsula in Cenozoic. Its southern part (Afrikansky block) according to [Zinkevich et al., 1985] is constructed by four allochtonous complexes. They are composed of: 1) Aptian-Albian and Albian-Cenomanian calcareous-cherty-effusive assemblages (Afrikansky complex), 2) Campanian-Maastichtian cherty-tuffaceous and terrigenous deposits, 3)

Paleocene-Lower Eocene chert-volcanic sequence (Kamensky complex), 4) serpentinite mélange and gabbroids. Serpentinite mélange contains unaltered ultrabasic rocks (Mountain Soldatskaya massif) and smaller bodies of gabbroids, Cretaceous and Paleogene tuffaceous and cherty rocks.

Gabbroids of Olenegorsky massif are paraautochthonous on which a package of allochtonous slices is overthrusted from northeast [Zinkevich et al., 1985].

Ophiolite fragments at Kamchatsky Mys peninsula are represented by gabbroids of Olenegorsky and ultrabasic rocks of Soldatsky massifs, by blocks of gabbroids with plagiogranites in serpentinite mélange, different basalts and calcareous-jasper-cherty deposits of Aptian-Cenomanian Afrikansky complex and tholeiite basalts, mudstones of Paleocene-Eocene Kamensky complex.

Field relations. Olenegorsky massif is composed of several tectonic slices, constructed by gabbroids with diabase dikes, rocks of layered complex and basalts. At the contacts of slices serpentinite mélange is developed.

The Mountain Soldatskaya massif is the block of fresh medium-grained peridotites 200 meters in thickness, disturbed by numerous faults and thin zones of cataclastic rocks, in serpentinite mélange.

Mélange also contains blocks of pillow-basalts, amphibolites, greenschists, tuffs, cherts, gabbroids. Large gabbroic body, 1.5 km in diameter, 50 meters in thickness, was studied.

Gabbroids contain plagiogranite material as a network of veins of irregular shape from 1 to 5–7 cm in thickness and as dike-shaped bodies, 1.5–2.0 meters in thickness, which intrude gabbros and enclose its xenoliths of angular form. Besides, plagiogranite-porphyre dikes, 5–7 meters in thickness, cutting gabbros and dolerite dikes exist.

*Block of gabbro with plagiogranites from serpentinite mélange***.** Gabbroids are represented by fine-grained hornblende gabbros and gabbro-norites and are intruded by dolerite dikes.

Plagiogranites have fine-medium-grained equigranular texture, rarely granophiric. Plagiogranites are mainly composed of plagioclase and quartz. Mafic minerals are represented by biotite and amphibole ($< 5\%$); accessory minerals are zircon, apatite, sphene, ore mineral; secondary minerals, chlorite, epidote, zoisite, sericite, saussaritezed aggregate.

Phenocrysts in plagiogranite-porphyres are represented by large quartz grains or aggregates of lesser quartz grains and plagioclase, rarely by biotite. The groundmass is fine-medium-grained, composed of quartz, plagioclase, chlorite and epidote. Acces-

sory minerals are apatite, sphene.

Geochemistry. Gabbroids have low TiO_2, Zr, Y contents (0.07 %, 15 p/m è 1.8 p/m respectively) which make them similar to gabbroids of Phillippine Sea, referred to boninite series [Zlobin, Zakariadze, 1985]. REE totals are nearly 1–4 chondrite norms. REE patterns are either subhorizontal or similar to those of N-MORB oceanic tholeiites.

Plagiogranites. Felsic rocks are classified as trondhjemites on the Ab–An–Or diagram; SiO_2 vs K_2O covariations indicate that they are low-K rocks; they are also low-Al granitoids (Al_2O_3=11.34–12.91%). ORG-normalized [Pearce et al., 1984] patterns of plagiogranites are characterized by low LILE, approximately on the hypothetic ORG level, and are depleted in respect of HFSE, distinct Ta, Nb, Zr minimum are fixed. Rb vs Y+Nb covariations [Pearce et al., 1984] refer plagiogranites to volcanic arc granites. All above-mentioned features indicate that plagiogranites have supra-subduction origin.

Plagiogranites are characterized by non-fractionated chondrite-normalized REE patterns with low REE totals at nearly 10 chondrite norms that are slightly higher than in gabboids. One part of patterns has REE contents as in gabbroids and positive Eu-anomaly; the other part is slightly LREE enriched and has weak negative Eu-anomaly.

Geochemical modeling shows that plagiogranites with LREE depletion may be formed as a result of 70–80% fractional crystallization of gabbroic liquid.

Mineralogy. Pyroxenes from gabbros are less titanium (TiO_2=0.19–0.24%; 0.16%, in Cpx and Opx respectively), chromian (Cr_2O_3=0.02–0.09%; 0,02% in Cpx and Opx respectively) and aluminium (Al_2O_3=1.22–1.39%; 1,25% in Cpx and Opx respectively), plagioclase is more calcic – An_{77-82}, than those of Olenegorsky massif. The latter are similar to derivates of ocenic tholeiites. Clinopyroxene compositions on the TiO_2 vs Al_2O_3 diagram [Zlobin, Zakariadze, 1985] fall in the field of clinopyroxenes from gabbroids, formed in supra-subduction zone setting.

Conclusions. (1) The complex geological, geochemical, and mineralogical study of plagiogranites and gabbroids indicates that the gabbro pluton, fragments of which were mapped, formed within the island-arc system above the subduction zone. Gabbroids and plagiogranites most likely originated from melts of island-arc tholeiites. (2) The performed study makes it possible to unite gabbroids, plagiogranites, extremely depleted peridotites of Mountain. Soldatskaya, and Maastrichtian-Eocene island-arc tholeiitic basalts and boninites into a common ophiolitic complex. (3) The gabbro-plagiogranite pluton represents a fragment of the basement underlying the Late Cretaceous (primitive) Kronotskii island arc.

The work was supported by the Russian Foundation for Basic Research (projects ź 01-05-64469, 02-05-64060, 04-05-65132).

References:

Skolotnev S.G., Kramer W., Tsukanov N.V., Seifert W., Freitag R., Saveliev D., 2003. The heterogeneity of ophiolite association in the Kronotsky paleoarc basement (Eastern Kamchatka**)** // Inter Ridge News, Vol. 12 (1), p. 30-34

Khotin, M.Yu., 1976. Effusive-tuff-siliceous formation of the Kamchatka Cape. Moscow, Nauka Publishers, 196 p. (in Russian);

Zinkevich, V.P., Kazimirov, A.D., Peyve A.A., and Churakov G.M., 1985. New data on the structure of the Cape kamchatskiy, eastern. Kamchatka. Trans. USSR Acad. Sci. Earth Sci. Sect., 285 (4), p. 89-92 (in Russian);

Raznitsyn, Yu.N., Khubunaya, S.A., Tsukanov, N.V., 1985. Tectonics of the eastern part of the Kronotskiy peninsula, and formational types of basalts (Kamchatka). Geotectonics 1, 88 – 101. (in Russian);

Fedorchuk, A.V., 1989. Ophiolites of the Kamchatsky Mys peninsula (Eastern kamchatka). Offioliti, 14, (1/2) 3-12;

Shapiro, M.N., Ermakov, V.A., Shantser, A.E., Shul'diner, V.I., Khanchuk, A.I., Vysotskiy, S.V., 1987. Tectonic evolution of Kamchatka. (Ed. Belousov, V.V.) Moscow, Nauka Publishers. 248 pp. (in Russian);

Accretionary tectonics of the Eastern Kamchatka. 1993. Moscow, "Nauka" Publ. 272 pp. (in Russian);

Boyarinova M.E., Veshnyakov N.A., Korkin A.G., Saveliev D.P. State geological map of Russian Federation, scale 1:200000. Series Eastern Kamchatka. Papers O-58-XXVI, XXXI, XXXII (second edition). Explanatory report. Saint-Petersburg, 2000;

Boyarinova M.E., Veshnyakov N.A., Korkin A.G., Saveliev D.P., Litvinov A.A. State geological map of Russian Federation, scale 1:200000. Series Eastern Kamchatka. Papers N-57-XII, N-58-VII, N-57-XVIII (second edition). Explanatory report. Saint-Petersburg, 2001;

Saveliev D.P. Within-plate volcanics in the Cretaceous oceanic complexes of Eastern Kamchatka. 2004. PhD. 23 p.

Pearce J.A., Harris N.B.W., Tindle A.G. // J. Petrol. 1984. V. 25. N. 4. P. 956–983.