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Granitoid magmatism of Alarmaut granite-metamorphic dome, West Chukotka, NE Russia

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Main tectonic elements of West Chukotka are Alazey-Oloy, South-Anyui and Anyui-Chukotka fold systems, formed as a result of collision between structures of North-Asian continent active margin and Chukotka microcontinent [1–3]. South-Anyui fold system, separating Alazey-Oloy and Anyui-Chukotka systems, is considered as suture zon, formed as a result of oceanic basin closing [4–6]. Continent–microcontinent collision resulted in formation of large orogen with of northern and southern vergent structures, complicated by strike-slip deformations [7, 8].

Within Anyui-Chukotka fold system several rises, where most ancient deposits (crystalline basement and Paleozoic cover of Chukotka microcontinent) are exposed, were distinguished [2, 9–11]. Later they were considered as granite-metamorphic domes [12–14].

Alarmaut dome is located at West Chukotka to the north from Bilibino city and is traced from south to north in more than 120 km. General direction of structure is discordant to prevailing NW extensions of tectonic elements of the region. Paleozoic-Triassic deposits are exposed within the Alarmaut dome: 1) D3–C1 – crystalline schists, quartz-feldspar metasandstones, quartzites, marbles (700 m) [11]; 2) C1 – marblized limestones, quartz-feldspar metasandstones, quartzites, amphibole-pyroxene crystalline schists. Limestones contain corals, indicating Visean age of deposits [11].

Metamorphism reaches amphibolite facies, maximum P–T conditions are 660º and 5 kbar. Migmatites, indicating in situ partial melting, are observed.

Intensity of deformations of Paleozoic rocks increases at the boundary with Triassic deposits [11]; in the western part of dome slices of Pz rocks are separated by blastomylonite horizons [14].

Within Alramaut dome granitoids of Lupveem batholith (central part of dome), Bystrinsky pluton (southeastern part), and small Koyvel' and Kelil'vun plutons were studied. New U-Pb SHRIMP zircon data indicate Early Cretaceous (117–112 m.a.) age of granitoids [15]. Analyses of cores of some zircons from granodiorites of Lupveem batholith indicate Precambrian age of protolith (717, 1070.4 and 1581.5 m.a.) [15]. 40Ar-39Ar age of synmetamorphic biotite varies from 108 to 103 m.a. [15].

Intrusive rocks of Alarmaut dome are represented by wide spectrum of rocks: diorites, Q diorites, Q monzodiorites, granodiorites, tonalites, granites. Granodiorites and granites contain mafic enclaves of monzonites and Q monzonites.

SiO2 contents in rocks of Alarmaut dome varies from 58,55% in diorites to 71,3% in granites; in enclaves – from 54,6% in monzonites to 61.89% in Q monzonites. Granitoids are normal and subalkaline rocks according to SiO2 vs K2O+Na2O and belong to high-K calc-alkaline and shoshonite series according to K2O vs SiO2. They are mainly metaluminous rocks (ASI < 1.0).

REE patterns of intermediate rocks are characterized by LREE enrichment, HREE depletion and insignificant negative Eu-anomaly (LaN/YbN=8,42–15,69; Eu/Eu*=0,66–0,94). Granodiorites and granites REE patterns are more enriched in LREE, more depleted in HREE and have deeper negative Eu-anomaly (LaN/YbN=11,48–45,6; Eu/Eu*=0,47–0,81). REE patterns of monzonites from enclaves in granites and granodiorites are similar to patterns of host rocks. REE patterns of intermediate rocks and granodiorites are well correlated with those of "mafic root" rocks of K2 Kigluaik pluton from the core part of the same name gneiss dome, Seward Peninsula, Alaska [16], and K1-2 granitoids of Chauna fold zone, West Chukotka [17].

Spidergrams of granitoids and enclaves are similar and characterized by LILE, LREE enrichment and Nb, Sr, P, Ti depletion, typical for supra-subduction magmatites.

On F1–F2 diagram [18], separating granitoids by geodynamic settings, granitoids fall in the field of collisional granites; on Rb vs Y+Nb diagram, along the boundary between the fields of syncollisional granites and volcanic arc granites, but within the field of postcollisional [19].

Geochronological and structural data indicate temporal relation between magmatism, metamorphism and deformations, accompanying formation of dome structure. Structural data also indicate the dome formation between two regional strike-slips. Strike-slip deformations of terminal stage of collision might have resulted in local zones of extensions [6, 8]. Intrusive contacts of studied granitoid plutons with already deformed host deposits indicate their postcollisional origin.

Wide petrographical spectrum of granitoids, hornblende and biotite existence in granites, metaluminous high-K and shoshonite character, biotites compositions allow belonging them to high-K granites of I-type.

Appearance of I-type granites in postcollisional setting is usually related to crustal anatexis under the influence of hot asthenospheric mantle due to delamination of lower parts of lithosphere. At the same time the processes of mingling of magmas of different composition, assimilation, fractional crystallization take place. Thus, in tectonic scenario of Alarmaut dome formation except dominating submergence of Chukotka microcontinent margin beneath the structures of North-Asian craton active margin we should assume slab-breakoff or delamination of lithospheric mantle which might have facilitated heat transfer, necessary for melting of granite magma. Aptian-Albian volcanism, localized in postcollisional extensional structures, confirms this assumption.

Interrelations of major oxides in granitoids show that compositions of Alarmaut intermediate rocks fall in the fields of melts, experimentally obtained during partial melting of amphibolites, and compositions of granodiorites and granites, along the boundary zone of partial melts of greywackes and dacites, tonalites. Heterogeneity of granitoids source composition or different level of magma contamination by ancient crustal material is confirmed by Sr-Nd data. It is expressed in significant dispersal of Nd() and 87Sr/86Sr values in granitoids.

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References

1. Parfenov L.M. Continental margins and island arcs of Mesozoides of North-East Asia. Novosibirsk, 1984. 192 p. (in Russian)

2. Zonenshain L.P., Kuz'min M.I., Natapov L.M. Tectonics of lithospheric plates of USSR territory // .: Nauka, 1990. V. 2. 327 p. (in Russian)

3. Sokolov S.D. Classification and hierarchy of fold constructions. . GEOS. 2008. P.71–100. (in Russian)

4. Seslavinsky K.B. South-Anyui suture zone (West Chukotka) // Dokl. AN USSR. 1979. V. 249. P. 1181-1185 (in Russian)

5. Natal'in B.A. Early Mesozoic eugeosynclinal systems in the northern part of Circum-Pacifica. .: Nauka. 1984. 136 p. (in Russian)

6. Sokolov S.D., Bondarenko G.Ye., Morozov O.L.,. Shekhovtsov V.A., Glotov S.P.,. Ganelin A.V., Kravchenko-Berezhnoy I.R. The South Anyui Suture, NE Arctic Russia: facts and problems to solve. Tectonic Evolution of the Bering Shelf-Chukchi Sea-Arctic Margin and Adjacent Landmasses. Geol. Soc. Amer. Spec. Paper, 2002, 360. P. 209-224

7. Sokolov S.D., Bondarenko G.E., Morozov O.L., Luchitskaya M.V. Tectonics of junction zone between Verkhoyan-Chukotka and Koryak-Kamchatka fold // Byul. MOIP. Otd. Geol. 2001. V. 76. Is.6. P.24–37. (in Russian)

8. Bondarenko G.E. Tectonics and geodynamic evolution of Mesozoides of north framework of Pacific Ocean. .: MGU, 2004. 46 p. (in Russian)

9. Til'man S.M. Comparative tectonics of Mesozoides of northern part of Pacific rim. Novosibirsk: Nauka. 1973. 325 p. (in Russian)

10. Grantz A., Moore T. E., Roeske S.M. Gulf of Alaska to Arctic Ocean: Geological Society of America Continental-Ocean Transect A-3, scale 1:500,000. Menlo Park, California, 1991, 72 .

11. Sadovsky A.I. Geologic map of USSR, scale 1:200000. Anyui-Chauna series. Paper R-58-XXVII, XXVIII. (Ed: Gel'man M.L.) Explanatory report. Leningrad: VSEGEI, 1970, 84 p. (in Russian)

12. Gel'man M.L. Phanerozoic granite-metamorphic domes at Russian North-East. Paper 2. Magmatism, metamorphism and migmatization in Late Mesozoic domes // Pacific geology. 1996. V. 15. № 1. P. 84-93. (in Russian)

13. Bering Strait Geologic Field Party, Koolen metamorphic complex, NE Russia: implications for the tectonic evolution of the Bering Strait region // Tectonics, vol. 16, no. 5, p. 713-729
14. Bondarenko G.E., Luchitskaya M.V. Mesozoic tectonic evolution of Alarmaut rise // Byul. MOIP. Otd. Geol. V. 78. Is. 3. P. 25–38. (in Russian)
15. Katkov S.M., Strikland A., Miller E.L. Age of granite batholiths in the Anyui-Chukotka Foldbelt // Doklady. Earth Sciences. 2007. Vol. 414. № 4. P. 515-518.
16. Amato J.M., Wright J.E. Potassic mafic magtism in the Kigluaik gneiss dome, northern Alaska: a geochemical study of arc magmatism in an extensional tectonic setting // J. Geophys. Res. 1997. Vol.102. N B4. P.8065-8084
17. Tikhomirov P.L., Luchitskaya M.V., Kravchenko-Berezhnoy I.R. Comparison of Cretaceous granitoids of the Chaun tectonic zone to those of the Taigonos Peninsula, NE Asia: rock chemistry, composition of rock forming minerals, and conditions of formation // Stephan Mueller series. Geology and Tectonic Origins of Northeast Russia: A Tribute to Leonid Parfenov (in press)
28. Velikoslavinsky S.D. Geochemical typification of acid magmatic rocks of leading geodynamic settings // Petrology. 2003. V. 11. № 4. P.363–380. (in Russian)
19. Pearce J.A. Sources and settings of granitic rocks // Episodes. 1996. V. 19. N. 4. P. 120–125