THE SHOSHONITIC GRANITOIDS OF ALTAI-SAJAN FOLDED AREA: PETROLOGY AND ORE MINERALIZATION

[1]Gusev A.I., [2]Gusev N.I., [2]Karpinsky A.P.
[1]Biisky pedagogical state university, Biisk
[2]Russian Geological Research Institute, Saint-Petersberg
e-mail: anzerg @ mail. ru

In the paper presented data about shoshonitic granitoids Altai-Sajan folded area. Petrology of granitoids and link with them ore mineralization considered. Deposits of W, Mo, Ta, Nb, Au, Be, REE known in paragenesis and space link with shoshonitic granites.

Keywords: shosonitic granitoids, ore mineralization, petrology, fluid regime

For the first time the shoshonitic type granitoids (SH) derived China' s investigaters in during study intrusive bodies N-W part of China (Jiang, Jiang et.all, 2002). The shoshonitic group of granitoids incorporate assemblages monzogabbro – monzodiorite – monzonite – quartz syenite, or monzonite granite – granite, or biotite (monzonite) granite – diopside granite – diopside syenite. Its type granitoids described by us in Altai-Sajan area (Altai Mountain) and classified to post collisional setting, initiation by function Siberian superplum (Gusev, Gusev, Tabakaeva, 2008; Gusev, 2010).

The shoshonitic granitoids founded on Altai-Sajan region in much sites: Savvushinskiy (Rudnyi Altay), Aiskiy, Terandjikskiy, Tarchatinskiy areals (Gornyi Altai), Zhernovskoi, Borsukskiy, Gornovskoy (Salair), Saksyrskiy (Sajan), Askizskiy (Batenevskiy krjadg), Borok-Bibeevskiy (Tom-Kolyvanskaja zone), Beloiussko-Tuimskiy (Kuzneckiy Alatau). It type granitoids and of its areals occurred in the edges of stocks (square 2 – 96 km^2) that has composite composition from monzogabbro to leicogranites. The stable paragenesis of dikes different composition from dolerites to granites with lamprophyres and massifs with appinites are watched in all areals. The lamprophyres are varies on different types of rocks (spessartites, vogesites, minetts, kersantites), but minetts occur in all areals from mafic to felsic types, that its relate to alkaline-basaltic of mantle magmas.

The shoshonitic granitoids are characterized by contents SiO_2 from 52,77 to 71,85% and high sum alkali $K_2O + Na_2O$ (more > 8%, average 9,14%), ratio K_2O/Na_2O (more > 1, average 1,50) and ratio Fe_2O_3/FeO (0,85–1,51, average 1,01) and low content TiO_2 (0,15–1,12%, average 0,57%). It type granitoids are characterized by high conctntrations Ba and Sr. J. Tarney and C. Jones (1994) drew specific attention to these elements, together with low Rb and consequent high K/Rb, low Th, U and Nb, and very low Y and heavy REE relative to other trace elements, the combination of which defines the high Ba-Sr granitoid group in Scotland. Before L.V. Tauson separated latite geochemical type granitoid (Tauson, 1977), that it is correspond shosonite and high Ba-Sr types. The content of Al_2O_3 in rocks vary from 13.01 to 19,20% and very variable. The granitoids enrich by LILE, LREE and volatile components, such as F, B and other. The biotite of shoshonitic granitoids classify to ferruginous phlogopite with minor fraction estonite and high ratio $Mg/(Mg + Fe_t)$ and $Fe_3 + /Fe_2 +$. Amphibole classify to edenite hornblende and

magnesian hastingsite with some fraction edenite and high ratio Mg/(Mg + Fe_t) и Fe_3 + /Fe_2 +.

The representable analysis of rocks some intrusive massifs with shoshonitic granitoids tabulate in table 1.

Table 1

The representable analysis of shoshonitic granitoids some intrusive massifs (main components in %, elements – ppm)

Components	1	2	3	4	5	6	7	8
SiO_2	70,31	66,31	71,97	61,87	66,11	72,87	75,05	76,88
TiO_2	0,42	0,49	0,17	1,20	0,47	0,16	0,13	0,11
Al_2O_3	14,08	16,44	14,16	17,28	16,64	13,96	13,67	12,92
Fe_2O_3	2,09	1,39	0,72	2,12	1,44	0,75	0,56	0,37
FeO	1,10	1,35	0,81	2,01	1,37	0,83	0,65	0,36
MnO	0,06	0,08	0,04	0,12	0,09	0,04	0,03	0,03
MgO	1,10	1,11	0,33	0,67	1,01	0,37	0,22	0,11
CaO	2,65	2,13	0,5 9	2,12	2,10	0,49	0,59	0,32
Na_2O	3,82	4,91	4,65	3,04	4,89	4,61	3,89	4,09
K_2O	3,58	5,15	4,62	8,95	5,12	4,72	4,65	3,93
П.п.п	0,05	0,21	0,31	0,40	0,23	0,32	0,42	0,41
P_2O_5	0,58	0,18	0,05	0,16	0,16	0,05	0,03	0,03
∑	99,23	99,73	99,27	99,96	99,63	99,17	99,89	99,56
Li	43,1	27,5	30,4	18,8	27,6	55	4,5	10,8
Rb	107,2	94,2	125,5	109	78,9	145	164	172
Cs	2,4	2,4	3,1	2,2	2,8	3,6	7,5	1,9
Be	5,1	1,5	5,5	3,8	0,7	5,3	6,7	0,7
Sr	1063	2520	2200	8750	630	2280	20	8
Ba	1100	1990	2500	1956	750	2310	40	20
La	47,0	66	47	46	73	74	55	32
Ce	69,3	74	86	58	86	97	63	36
Nd	28,2	22	25	24	24	29	16	8,6
Sm	5,67	4,6	5,5	5,4	4,2	5,5	2,2	0,9
Eu	1,44	1,37	1,64	1,42	1,23	1,21	0,68	0,13
Gd	5,0	3,6	4,5	6,1	3,3	4,1	2,1	0,9
Tb	0,73	0,9	1,11	0,94	0,52	0,61	0,26	0,11
Dy	1,21	2,3	4,1	3,9	2,3	1,2	1,6	0,7
Tm	0,3	0,3	0,5	0,4	0,3	0,2	0,2	0,2
Yb	1,18	2,4	3,1	2,8	1,22	1,6	1,1	1,4
Lu	0,16	0,3	0,5	0,4	0,3	0,25	0,21	0,2
Y	9,6	11,8	13,7	14,7	7,8	13,6	13,4	10,4
Sc	4,3	5,7	6,5	5,7	5,6	4,2	3,3	1,3
Th	1,56	4,5	15,8	5,4	24	27	41	48
Hf	4,6	4,8	4,9	18	5,2	6,9	4,6	4,6
Ta	0,6	1,5	0,5	0,9	1,66	3,2	2,2	4,8
Nb	3,2	5,2	6,3	22,7	35,3	87,6	85,2	77
Zr	221	318	334	276	243	238	204	215

The analysis complete: for main components – by chemical method, for elements- by method ICP-ms IMGRE (c, Moscow), Salair: Gornovskoy massif: 1 – granite; Zhernovskoi massif: 2 – syenite; Gornyi Altai: Terandjikskiy massif: 3 – granite; Gornyi Altai: Aiskiy massif: 4 – syenite, 5 –granosyenite, 6 – granite, 7 – leicogranite, 8 – leicogranite with fluorite

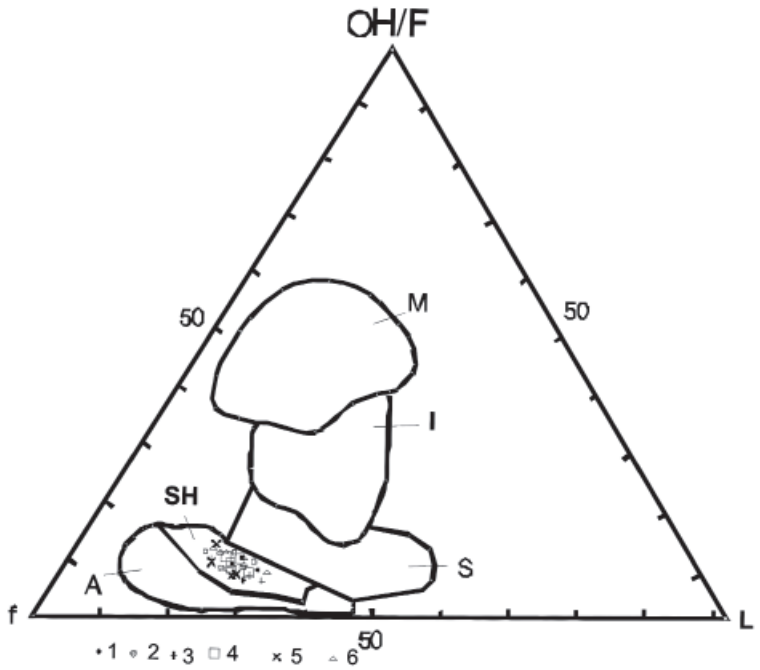

Fig.1. Diagram f- L- OH/F in biotites of granitoids:
f – total mafic index of biotites (f = Fe + Mn/Fe + Mn + Mg); L – aluminous of biotites (L = Al/Si + Al + Fe + Mg); OH/F – ratio hydroxyle group to fluorine in composite biotites. Standard type granitoids: M – mantle MOR, backarc basins (in composition of ophiolite complexes); I – mantle-crustal of island arc, transform, active continental margins, collision settings; S – crustal and mantle-crustal of collision settings and complexes metamorphic cores; SH – shoshonitic type granitoids of post collision settings, initiating by plum tectonic; A – mantle-crustal and mantle of anorogenic settings (intracontinental rifts, hot spots, mantle plumes). The shoshonitic granitoids of massif region: 1 – Aiskiy; 2 – Gornovskoy; 3 – Terandjikskiy; 4 – Tarchatinskiy, 5 – Tarchatinskiy; 6 – Beloiussko-Tuimskiy

The under study rocks of region fall on diagram (on composite of biotites) in field of shoshonitic granitoids (fig. 1),

A potential ore mineralization of intrusive complexes and separate bodies can be determine by path of calculation rare metal index – F(Li + Rb)/(Sr + Ba) to L.V. Tauson (1977) with account of distinction fluid regime and concentration of volatile components in it (F, H_2O, B).

The values of rare metal index and other necessary dates on example Aiskiy massif actuation in table 2. Analysis of table 2 show that appreciable increase concentration F and rare metal index occur from monzogabbro to leicogranite. The values of rare metal index (6178,3) and petro-geochemical parameters are very closely to peraluminous rare metal leicogranites (rare metal index 6800). The analogous parameters for leicogranite with fluorite, that it is paragenetic connect greisens and pegmatites deposits of Sn, Ta, Nb under investigation region.

Table 2

Concentration rare elements and values of rare metal index in rocks of Aiskiy massif

Rocks	F, %	Li, г/т	Rb, г/т	Sr, г/т	Ba, г/т	F(Li+Rb)/(Sr+Ba)
Monzogabbro	0,02	21,2	95	1950	2070	5,78
Monzonite	0,03	20,5	104	2720	1970	7,96
Melanosyenite	0,04	30,1	125	2200	2500	13,2
Syenite	0,08	18,8	109	8750	1956	9,54
Granosyenite	0,10	27,6	78,9	630	750	77,2
Granite	0,12	55	145	280	310	406,8
Leicogranite	0,22	4,5	164	20	40	6178,3
Leicogranite with fluorite	0,85	10,8	172	7	20	57548,1

The intrusive massifs of shoshonite granitoids in Altai-Sajan region, with it connect W-Mo skarns (Plitninskoe, Aturkolskoe deposit), W-Mo greisens (Orlinoe, Osokinskoe, Osinovskoe deposits) and lode W-Mo deposits (High-Belokurikchinskoe, Dmitrievskoe, Batunkovskoe), lode Be (Kazandinskoe), pegmatitic and greisens beryllium (Kuranovskoe), Ta-Nb (River Slepoy), Li deposits, so lode gold-sulfide-quartz (Atbashi) manifestations. The skarns deposits complex W-Sn with Au known in the contact of massif Karagu (West Karagu, East Karagu).

The pegmatitic deposit Ortitovoe confine in Savvushinskiy massiv of shoshonitic granitoids in Rudnyi Altay. The allanite is main ore mineral on it pegmatite. Allanite occur in disseminate form and it form large crystals to 30 sm in length. It associated with schörl, albite, muscovite, rauhtopaz.

The complex deposit Au-U-W confine in the contact of intrusive Tarchatinskiy areal of shoshonitic granitoids (Gornyi Altay). The lodes of deposit Elangash contain nasturane, gold, scheelite, wolframite.

In the final report follow to say, that the shoshonitic granites of Altai-Sajan region derived in compound post collision setting, initiation by function Siberian superplum and it characterized by saturate volatile components (F, H_2O, B). There are define of it potential ore mineralization.

The different deposits and manifestations of W, Mo, Ta, Nb, Au, Be, REE known in paragenesis and space link with shoshonitic granites in Altai-Sajan region (Kuzneckiy Alatau, Salair, Sajan).

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