GEODYNAMICS & TECTONOPHYSICS

PUBLISHED BY THE INSTITUTE OF THE EARTH'S CRUST
SIBERIAN BRANCH OF RUSSIAN ACADEMY OF SCIENCES

2017 VOLUME 8 ISSUE 3 PAGES 475–476 ISSN 2078-502X

https://doi.org/10.5800/GT-2017-8-3-0266

Proceedings of the Second Russia–China International Meeting on the Central Asian Orogenic Belt (September 6–12, 2017, Irkutsk, Russia)

PETROGENESIS AND RARE METAL MINERALIZATION OF THE ALKALINE GRANITIC MAGMA: A CASE STUDY FROM THE BOZIGUO'ER RARE METAL GRANITIC INTRUSION

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For citation: *Huang H., Wang T., Zhang Z., Qin Q.*, 2017. Petrogenesis and rare metal mineralization of the alkaline granitic magma: a case study from the Boziguo'er rare metal granitic intrusion. *Geodynamics & Tectonophysics* 8 (3), 475–476. doi:10.5800/GT-2017-8-3-0266.

The origination and differentiation of rare metal-bearing, alkaline granites has attracted extensive interests because of their economic significance. The Early Permian (~290 Ma) Boziguo'er alkaline granitic intrusion, exposed in the middle segment of the South Tianshan Terrane, Xinjiang, NW China, is enriched in Nb-Ta-, Zr-, Th-U- and REE-bearing accessory minerals, and can be regarded as a large rare metal deposit [*Huang et al., 2014; Liu et al., 2013*]. Although the subsolidus alteration occurred ubiquitously in the intrusion, the degree of enrichment of rare metal elements seems unrelated to that of the albitization or greisenization. The unalterated alkaline granites of the intrusion is mainly composed of orthoclase (~30 vol. %), albite (~40 vol. %), quartz (~15 vol. %), biotite (~10 vol. %) and arfvedsonite (~5 vol. %), with accessory minerals at least including zircon, Fe-Ti oxides, monazite, pyrochlore, xenotime, bastnasite and astrophyllite. The existence of two feldspars, which respectively show nearly pure Ab and Or end member compositions, suggest that the Boziguo'er alkaline granitic rocks can be classified as "subsolvus granites". The high contents of fluorine in the hydrous minerals suggest a fluorine-rich characteristic at the latest magmatic stage, which would not only prolong the duration of the magmatic differentiation but can also act as a complexing agent with HFSEs and REEs. A semiquantitative calculation, based on mineral compositions of analyzed biotites, yields results of 0.70 to 2.14 wt. % (with an average of 1.25 wt. %) for F contents in

granitic melts. Considering relatively low whole-rock fluorine concentrations (2187 to 8833 ppm) as well as the positively linear correlation between whole-rock CaO and F, implying that most fluorine initially incorporated in the melts were likely removed because of the separation of Ca-fluoride melt and silicate melt. Given the abundance of mineral and melt inclusions with fluorite, albite and monazite compositions enclosed by zircons crystallized at latest magmatic stage, the fluoride–silicate melt immiscibility likely took place at the late magmatic stage and represent the initiation of the rare metal minerallization.

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