ISSN 0869-5911, Petrology, 2008, Vol. 16, No. 5, pp. 422–447. © Pleiades Publishing, Ltd., 2008.
Original Russian Text © T.V. Donskaya, E.V. Bibikova, D.P. Gladkochub, A.M. Mazukabzov, T.B. Bayanova, B.De Waele, A.N. Didenko, A.A. Bukharov, T.I. Kirnozova, 2008, published in Petrologiya, 2008, Vol. 16, No. 5, pp. 452–479.

Petrogenesis and Age of the Felsic Volcanic Rocks from the North Baikal Volcanoplutonic Belt, Siberian Craton

T. V. Donskaya[a], E. V. Bibikova[b], D. P. Gladkochub[a], A. M. Mazukabzov[a], T. B. Bayanova[c], B. De Waele[d], A. N. Didenko[e, f], A. A. Bukharov[g], and T. I. Kirnozova[b]

[a] *Institute of the Earth's Crust, Siberian Branch, Russian Academy of Sciences, ul. Lermontova 128, Irkutsk, 664033 Russia*
e-mail: tanlen@crust.irk.ru

[b] *Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, ul. Kosygina 19, Moscow, 119991 Russia*

[c] *Geological Institute, Kola Scientific Center, Russian Academy of Sciences, ul. Fersmana 14, Apatity, Murmansk oblast, 184209 Russia*

[d] *British Geological Survey, Nottingham NG12 5GG, United Kingdom*

[e] *Kosygin Institute of Tectonics and Geophysics, Far East Branch, Russian Academy of Science, ul. Kim Yu Chen 65, Khabarovsk, 680063 Russia*

[f] *Geological Institute, Russian Academy of Sciences, Pyzhevskii per. 7, Moscow, 119017 Russia*

[g] *Irkutsk Technical University, ul. Lermontova 83, Irkutsk, 664074 Russia*

Received July 20, 2007; in a final form, November 28, 2007

Abstract—Detailed geochemical, isotopic, and geochronological studies were carried out on felsic volcanic rocks from the southern part of the North Baikal volcanoplutonic belt. U–Pb zircon dating showed that the rocks previously ascribed to a single stratigraphic unit (Khibelen Formation of the Akitkan Group or the Khibelen Complex) have significant age differences. The Khibelen Formation was found out to include both the oldest dated rocks (1877.7 ± 3.8 Ma) of the North Baikal belt and the younger volcanic rocks (1849 ± 11 Ma). Two other dated volcanic rocks have intermediate ages (1875 ± 14 and 1870.7 ± 4.2 Ma). It was established that the volcanic rocks from various areas in the southern part of the North Baikal belt not only have different ages but also differ in geochemical and isotopic signatures. In particular, the felsic volcanic rocks from various sites show the following variations in trace-element composition: from 220–280 to 650–717 ppm Zr, from 8–12 to 54–64 ppm Nb, and from 924–986 to 1576–2398 Ba. The ε_{Nd} obtained for felsic volcanic rocks and comagmatic granitoids from various areas in the southern part of the North Baikal belt vary, respectively, from –1.7 to –2.8 and from –8.0 to –9.2. Based on geochemical and isotopic signatures, the felsic volcanic rocks in various areas of the southern part of the North Baikal volcanoplutonic belt were formed via the melting of a Mesoarchean crustal source of tonalite composition with contribution of variable amounts of juvenile mantle material at different magma generation conditions. Isotopic data indicate that the contribution of juvenile mantle material to their sources varied from ~33–40 to 77–86%. The maximal calculated temperatures of the parent melts for felsic volcanic rocks were 908–951°C, and the lowest temperatures were 800–833°C. The geochemical signatures of dacites with an age of 1877.7 ± 3.8 Ma such as high Th (46–51 ppm) and La (148–178 ppm) contents indicate that these rocks, along with Mesoarchean granitoid and juvenile mantle material, contain an upper crustal component with high Th and LREE contents. Extremely low Y and Yb contents in these dacites implies their formation at pressures of ~ 12–15 kbar in equilibrium with garnet-bearing residue. These rocks were presumably formed in the collisional–thickened crust at the earliest stages of its collapse, possibly during syncollisional collapse, with additional hear input to the lower crust. Other felsic rocks are geochemical analogues of A-type granites and were formed during the subsequent stages of collapse (post-collisional collapse).

DOI: 10.1134/S0869591108050020

INTRODUCTION

The formation of the Siberian craton by the accretion and collision of the Archean microcontinents and Early Proterozoic island arcs at ~1.9–2.0 Ga (Rosen, 2003; Larin et al., 2003) was finalized by large-scale magmatism duirng the collapse of the collisional system (post-collisional extension). The time span of 1.84–1.88 Ga was marked by the formation of numerous granitoid massifs, which are presently located in the southern marginal salients of the craton, and the emplacement of the North Baikal volcanoplutonic belt (Fig. 1). Larin with co-authors (Larin et al., 2003) combined all magmatic rocks dated at 1.84–1.88 Ga into a single South Siberian post-collisional igneous belt more than 2500 km long.

In recent years, numerous studies (Donskaya et al., 2002, 2003, 2005a; Levitsky et al., 2002; Larin et al., 2000, 2006; Nozhkin et al., 2003; Turkina, 2005;