

Argon-Argon Dating of Basanites from Volcanic Pipes of the Minusa Region SW of the Siberian Craton

Vladimir Malkovets (vomal@uiggm.nsc.ru)¹, Alexei Travin (travin@uiggm.nsc.ru)²,
Vadim Reutsky (travin@uiggm.nsc.ru), Dmitri Shevchenko (shevchen@uiggm.nsc.ru)² &
Konstantin Litasov (klitasov@cneas.tohoku.ac.jp)³

¹ Prospekt Acad. Koptyuga 3, Institute of Mineralogy and Petrography SB RAS, Novosibirsk, 630090, Russia

² Prospekt Acad. Koptyuga 3, United Institute of Geology, Geophysics and Mineralogy SB RAS, Novosibirsk, 630090, Russia

³ Center for Northeastern Asian Studies, Tohoku University, Aoba, Aoba-ku, Sendai, 980-8578, Japan

The North Minusa depression is a part of the Minusa trough, the Salair range, in the southwestern margin of the Siberian platform. Early-Middle Devonian trachibasalt-trachite-trachirhyodacitic and basanite-phonotephritic volcanism was followed by Middle Devonian-Early Permian accumulation of carbonate-terrigenous deposits, which infilled the depression. The activation of faults in the basement of the depression resulted in the flexion of its sedimentary cover and intrusion of numerous basaltic dikes and pipes.

There are few geochronological data on the Minusa pipes (Bragin et al., 1999). Luchitsky considered the Permian-Triassic age of the pipes basing on the fact that basanites intruded Devonian-Carboniferous volcano-sedimentary units and Jurassic deposits have restricted distribution and no geological contacts with the pipes. Isotope dating of zircons from a heavy separate of the Bele pipe performed in the Geophysical Laboratory at the Carnegie Institute, USA, has yielded a U-Pb age of 77.9 Ma (Sobolev et al., 1988). Whole rock K-Ar analysis showed a wide range of ages from the Late Mesozoic to Early-Middle Cenozoic – 71-28 Ma (Zubkov et al., 1988).

Xenoliths of garnet-spinel peridotite and pyroxenite and megacrysts were studied in details (Ashchepkov et al., 1995). Geochemical data on garnet-spinel and spinel lherzolite from the Tergesh, Kongarovsk and Krasnoozersk-satellite pipes showed the heterogeneous mantle beneath the North Minusa depression (Malkovets et al., 1998; Malkovets et al., 2000). Two mantle layers are recognized basing on mineralogical and geochemical data: the deeper Ga-Sp and Sp-lherzolite layer and the upper Sp-lherzolite layer. The deeper garnet-spinel and spinel lherzolites from the Tergesh pipe have nearly fertile modal compositions and slightly depleted trace element patterns. The shallow level spinel lherzolites of Krasnoozersk and Kongarovsk pipes are mainly less fertile and have strong LREE, Th, U, Sr enrichment and negative Nb-Ti-Zr-Hf anomalies indicating a complicated history which may have involved repeated depletion and metasomatic events by a variety of fluids/melts. ⁴⁰Ar/³⁹Ar ages for seven basanite samples from several pipes have been obtained. Two more samples were taken for comparison – from EW-striking Permian dike and Devonian trachybasaltic flow. Typical Ar

release spectra for basanites from the Bele and Tergesh pipes have a clear plateau with 79 (2) and 77 (1.9) Ma, correspondingly. The age of 77 (3.9) Ma was obtained for the Krasnoozersk-major pipe. The age of the Krasnoozersk-satellite pipe - 74 (2) Ma - is comparable with that of the major pipe within the accuracy of the analysis. The age of the Kongarovsk pipe - 74 (5.5) Ma is also within the measurement error in comparison with the other pipes.

The ⁴⁰Ar/³⁹Ar ages of sanidine megacryst (sample BG-671) and host rock (sample BG-1) of 77 (5) and 77 (2.1) Ma, correspondingly, were obtained for the Baradzhol pipe. The ⁴⁰Ar/³⁹Ar age of 79 (2) Ma of basanite from the Bele pipe is close to the U/Pb age of zircon from the Bele pipe heavy concentrate - 77.9 Ma (Sobolev et al., 1988).

The numerous Early Permian EW-striking dikes were formerly referred to the Mesozoic-Cenozoic subvolcanic complex. They are different from the basanitic pipes in less alkali and ⁴⁰Ar/³⁹Ar age 262 (2.5) Ma. The ⁴⁰Ar/³⁹Ar age of trachybasalts is 392 (11) Ma, i.e. Devonian.

All the ⁴⁰Ar/³⁹Ar ages of the North Minusa depression pipes overlap within the accuracy of analysis and, therefore, we can conclude about their synchronous formation at about 77 Ma. Obviously, the pipes exploded during a rather short Late Cretaceous magmatic stage.

Since no ⁴⁰Ar/³⁹Ar analysis of Late Mesozoic magmatic rocks in Central Asia - besides the North Minusa depression - has been carried out, we can make only tentative conclusions about the lateral evolution of Late Mesozoic magmatic events. The available K-Ar ages of basanitic extrusions, stocks and laccoliths in the Nomgon and Barun-Tsokhe ranges of the South Hangai show their close-in-time formation at 81-71 Ma. The nephelinites occurring near Komsomolsk Village in South Transbaikalia have nearly the same age range of 70-72 Ma. A trustworthy reconstruction of Mesozoic and Early-Middle Cenozoic volcanic and subvolcanic processes in Central Asia requires age estimations by ⁴⁰Ar/³⁹Ar method.

The work was financially supported by the Russian Foundation for Basic Research grant 00-05-65329.

Sobolev NV, Pokhilenko NP, Ovchinnikov Yu I & Kepezhinskas VV, *Field Trip Guide of Intl. Symp. Composition and Processes in the Deep Seated Continental Lithosphere, Novosibirsk*, 76, (1998).

Zubkov VS, Smirnov VN, Plusnin GS, Al'mukhamedov EA, Nikolaev VM, Paradina LF & Kuznetsova SV, *Doklady Akad. Nauk SSSR*, **307**, 1466-1469, (1989).

Malkovets VG, Ionov DA, Griffin WL, O'Reilly SY, Pokhilenko NP & Litasov KD, *7th Intern. Kimberlite Conference Abs., Cape Town*, 543-545, (1998).

Ashchepkov IV, Malkovets VG, Ovchinnikov YuI & Kepezhinskas VV, *Field Guide Book of the 6th Intl. Kimberlite Conference, Novosibirsk*, 39, (1995).

Malkovets VG, Ionov DA, Agashev AM, Litasov YuD, Orihashi Y, O'Reilly S & Griffin W, *10th Ann. Goldschmidt Conference Abs, Oxford*, (2000).

Bragin VYu, Reutsky VN, Litasov KD, Mal'kovets VG, Travin AV & Mitrokhin DV, *Phys. Chem. Earth (A)*, **24**, 545-945, (1999).