МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ

ТОМСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

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7th LARGE IGNEOUS PROVINCES CONFERENCE
SEPTEMBER 2-5, 2019
TOMSK, RUSSIA

25 YEARS RFBR

Laboratory of Geochronology and Geodynamics
Tomsk State University

LARGE IGNEOUS PROVINCES THROUGH EARTH HISTORY: MANTLE PLUMES, SUPERCONTINENTS, CLIMATE CHANGE, METALLOGENY AND OIL-GAS, PLANETARY ANALOGUES (LIP – 2019)

Abstract volume of the 7 International Conference
Tomsk, Russia, 28 August – 8 September 2019

КРУПНЫЕ ИЗВЕРЖЕННЫЕ ПРОВИНЦИИ В ИСТОРИИ ЗЕМЛИ: МАНТИЙНЫЕ ПЛЮМЫ, СУПЕРКОНТИНЕНТЫ, КЛИМАТИЧЕСКИЕ ИЗМЕНЕНИЯ, МЕТАЛЛОГЕНИЯ, ФОРМИРОВАНИЕ НЕФТИ И ГАЗА, ПЛАНЕТЫ ЗЕМНОЙ ГРУППЫ (КИП – 2019)

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LATEST PALEOPROTEROZOIC DYKE SWARMS OF THE SIBERIAN CRATON

Gladkochub D. P.[1], Donskaya T. V.[1], Ernst R. E.[2,3],
Söderlund U.[4], Kotov A. B.[5], Mazukabzov A. M.[1], Shokhonova M. N.[1]

[1]*Institute of the Earth's crust SB RAS, Irkutsk, Russian Federation*
[2]*Carleton University, Ottawa, Canada*
[3]*Tomsk State University, Tomsk, Russian Federation*
[4]*Lund University, Lund, Sweden*
[5]*Institute of Precambrian Geology and Geochronology RAS, St. Petersburg, Russian Federation*

Keywords: *Dolerite; dyke; geochemistry; Paleoproterozoic; Large Igneous Province; Siberian craton*

Introduction

The Latest Paleoproterozoic Timpton Large Igneous Province (LIP) of the Siberian craton, the center of which is located in the middle section of the Vilyuy river flow, includes the Chaya, Doros, Timpton-Algamay and Eastern Anabar swarms. Age of dykes is 1752 – 1759 Ma (Gladkochub et al., 2010; Ernst et al., 2016 and unpublished author's data). The dykes form an overall radiating swarm. We present new geochronological and geochemical data on a dolerite from the Chaya and Doros dyke swarms and discuss their origin and geodynamic interpretations.

Results

The Chaya dykes are located in the Baikal inlier, tracing more than 200 km. The dykes are sub-vertical with NNE trend in SW end of the dyke swarm and NE trend in the NE end of this swarm. Thicknesses of these dykes vary from few meters to 250 meters. U-Pb baddeleyite ages of the Chaya dykes are 1752 ± 6 and 1752 ± 3 Ma.

The Doros dykes and sills are situated in the western Aldan shield. Most of the dykes are NNW-NNE trending and some are ENE-NE trending. The dykes are up to 50 – 60 m thick. The thickness of mafic sills reaches 250 – 300 m. U-Pb baddeleyite age of the Doros dykes is 1757 ± 4 Ma.

The Chaya and Doros dykes are composed of fine to coarse grained dolerite. These dolerites consist of rock-forming plagioclase and clinopyroxene, minor orthopyroxenes hornblende, biotite, quartz.

The Chaya and Doros dykes demonstrate similar geochemical affinities. They are close to sub-alkaline basalts and basaltic andesites. They are characterized by low and moderate Ti, P, Nb, and moderate and high La and Th contents. Primitive mantle-normalized diagrams show that the Chaya and Doros dolerites are characterized by negative Nb-Ta, P and Ti anomalies. All analyzed samples are enriched in REE. Chondrite-normalized REE patterns of Chaya and Doros dolerites show a similar REE fractionation with $(La/Yb)_n = 2.5 – 9.3$. All dolerites demonstrate high $(Th/La)_{pm}$ ratios (> 1) and negative eNd(t) values. These dolerites could be produced from lithospheric mantle sources or crustal contaminated mantle sources.

The Chaya and Doros dyke swarms as well as other dyke swarms of the Timpton LIP were generated in an intracontinental extensional setting. We assume that this extension could have been caused by a rising mantle plume in the continental lithosphere of the Siberian craton. The location of the Chaya and Doros dyke swarms shows that they were generated and emplaced far from mantle plume centers. In this case, the dolerites were not produced from mantle plume-related source, and mantle plume supplied extra (additional) temperature and fluids to lithospheric mantle sources.

Conclusions

We conclude that 1.75–1.76 Ga Chaya and Doros dykes of the Timpton LIP of the Siberian craton are characterized by similar geochemical compositions and were generated from lithospheric mantle sources or crustal contaminated mantle sources in intracontinental extensional setting, which caused by a rising mantle plume.

Acknowledgements

This research was supported by grant 18-17-00101 from the Russian Science Foundation.

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