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# 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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caused an intensive metasomatic reworking of the continental lithospheric mantle and provided storage of subducted plates in the deep mantle that gave rise to the enrichment in Fe and deep-seated melting.


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## THE ORDOVICIAN MAGMATIC EVENTS IN THE SIBERIAN PLATFORM AND MONGOLIAN TERRAINS – ARE THEY RELATED?


Savelev A. D.[1,2], Khudoley A. K.[1,2]

*[1]Saint Petersburg State University, St. Petersburg, 199034, Universitetskaya nab., 7–9, Russian Federation*
*[2]Tomsk State University, Tomsk, 634050, pr. Lenina, 36, Russian Federation*
*aleksandr.d.savelev@gmail.com*


The Ordovician mafic magmatic event, commonly known as the Suordakh event, based on U-Pb baddeleite dating was first reported 20 years ago and, after that, it age and distribution was supported by more recent SIMS study (Khudoley et al., 2013). However, tectonic setting of the Ordovician intrusions are still under question, and two possible scenarios have been discussed:

1) Suordakh event mafic intrusions are almost synchronous with a granite intrusion in the area between the Siberian craton and Okhotsk cratonal terrane: 445.7±1.5 and 444.1±1.5 Ma (Kuzmin et al., 2003), suggesting that rather than being orogenic related, this silicic magmatism may have resulted from partial melting of lower crust by magmatic underplating associated with the Suordakh event (Khudoley et al., 2013).

2) The assumption of the location of granitoids and mafic intrusions in a single LIP is unlikely due to the fact that the granite intrusions belong to I-type. Ordovician magmatism was most likely associated with the mantle plume, but not with intense rifting. The synchronous existence of passive and active margin is possible as well (Khudoley & Prokopiev, 2018).

However, new isotopic and paleomagnetic data on the Ordovician magmatism allow to propose another scenario for the formation of the Suordakh complex. Kilian et al. (2016) introduced U-Pb zircon age of 446.03 ± 0.21 Ma of a rhyolite in the Teel Formation on the Zavkhan terrane of Mongolia (Kilian et al., 2016). In study area within the Zavkhan terrane Ordovician to Silurian transtension resulted in narrow rift basins that accommodated volcanic and minor sedimentary rocks of the Teel Formation. The Teel Formation is composed of bimodal series of rhyolite and basalt, which intercalated with siliciclastic sedimentary rocks (Togtokh et al., 1995).

The paleolatitude of the Zavkhan terrane at ca. 446 Ma was 19±5°N, which is consistent with it being associated with the Siberia craton in the Late Ordovician (near the present-day southern Siberia margin). A similar geologic history potentially links the Zavkhan terrane with the southern Siberian margin from ca. 510 to 450 Ma, when the southwestern margin of the Zavkhan and Lake terranes may have accreted to southern Siberia (Bold et al., 2016). At the beginning of Ordovician, both southern Siberia and the Zavkhan and Lake terranes hosted rift-related extensional magmatism (Yarmolyuk et al., 2011; Bold et al., 2016), including the volcanics of the Teel Formation. Due to this constraint, Kilian et al. (2016) prefers a model whether Zavkhan terrane rifted off of a landmass, likely Siberia, during or soon after ca. 446 Ma eruption of the Teel Formation basalts in extensional basins (Kilian et al., 2016).

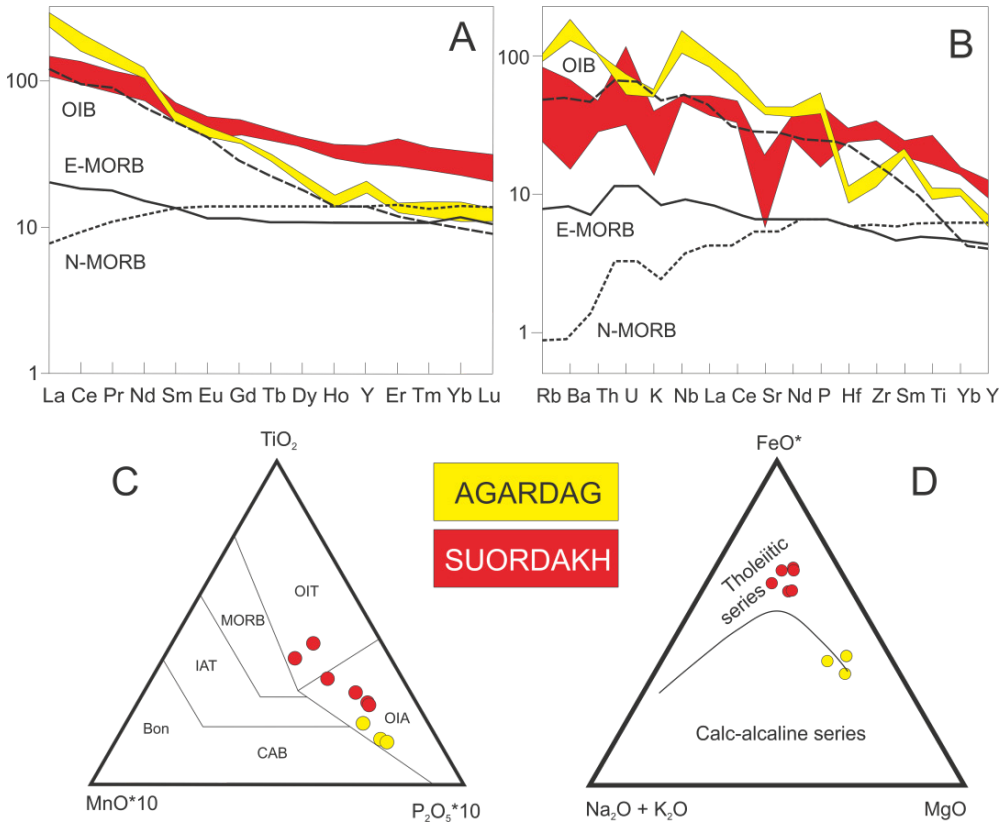


*Fig. 1. Agardag - a field of igneous rocks of the Agardag complex. Suordakh - a field of igneous rocks of the Suordakh complex; A, B - elements spidergrammes, normalized (A) - to chondrite, (B) - to the primitive mantle (according to Sun & McDonough, 1989); C, D - tertiary discrimination diagrams (Rollinson, 1993), OIT – ocean island tholeiite, OIA – ocean island alkalic, MORB - mid-ocean ridges basalt, IAT - island-arc tholeiite, CAB - island-arc calc-alkaline basalt.*

However, earlier Ordovician isotopic datings for the region are also known. The dikes of the Agardag complex, manifested to the north-western margin of the Sangilen block (southeast of the Tyva-Mongolian microcontinent), also showed Late Ordovician age (Izokh et al, 2001). The Sangilen and Zavkhan blocks have a common border, divided by the Bulnai fault (Bold et al., 2016) and are considered as parts of associated continent (Kilian et al., 2016). This allows usage of data from the Sangilen block for comparison with the Suordakh complex.

Samples of both complexes (fig. 1) follow OIB distribution on the spidergrams, however, Suordakh is enriched with heavy REEs, and Agardag is enriched with light REEs. Agardag complex are characterized by enrichment with large-ion lithophilic elements (Cs, Rb, Ba) and depletion of U and Th relative to Nb and Ta, whose contents on the distribution spectrum form a positive anomaly. Two large negative anomalies are fixed on K and Sr for Siberian magmatic rocks. In the discriminatory diagrams, both complexes occupied fields of intra-plate basalts, but Agardag samples fall into the zone of calc-alkaline series, while Suordakh rocks turned up in tholeiitic series fields (Shelepaev et al., 2018).

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## GLOBAL STRATALEVEL OF INCREASED AND INTENSIVE ORE-, OIL-, GAS- AND SHALE FORMATION AS A CONSEQUENCE OF THE MANIFESTATION OF GALACTIC, TECTONOMAGMATIC AND BIOTIC EVENTS AT THE TURN OF DEVONIAN AND CARBONIFERIOUS PERIODS

Sedaeva K. M.

*Lomonosov Moscow State University, Geological faculty, Moscow, Russia, E-mail: sedaeva-mgu@mail.ru*

The Tectonomagmatic processes at the turn of Devonian – Carboniferous periods ($D_3 - C_1$) are large-scale and relatively short-term geological processes that took place synchronously on different paleocontinents and in paleoseas. They caused a sharp increase in the number of ore and oil and gas formations due to enrichment of the Earth's crust by organic matter (OM) and chalcophyllic, noble and rare-earth elements. This predetermined the formation of evenaged large deposits, ore and oil and gas provinces and belts, defining endogenous mineralization in orogenic areas and exogenic mineralization - on ancient platforms. They were caused by the Early-Hercynian phase of tectogenesis, the nature and extent of crustal

*Figure 1. Nicaragua, volcano awakens.*