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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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THE KALAHARI AND GRUNEHOGNA CRATONS, AND THEIR PLACEMENT WITHIN NEOPROTEROZOIC RODINIA, DEFINED BY NEW U-PB GEOCHRONOLOGY ON LARGE IGNEOUS PROVINCES

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Keywords: *Fingeren, Mutare, dyke swarm, Neoproterozoic, Rodinia*

The Grunehogna Craton of Dronning Maud Land in Antarctica and the Kalahari Craton of southern Africa are generally accepted to have been contiguous, in either close or far fit configurations, between 1.11 Ga and 0.18 Ga. In this study, dykes of the Fingeren dyke swarm in Grunehogna and dykes of the Mutare dyke swarm in Kalahari were dated using U-Pb on baddeleyite and apatite. The ages reveal similar mafic magmatism at ca. 720 Ma in both areas, which has not been reset by later metamorphic events. This confirms the relationship whereby Grunehogna is a rifted fragment of Kalahari, which was severed during the Jurassic breakup of Pangea into Africa and Antarctica. It also confirms a close fit between the cratons at ca. 720 Ma. The possibility that Kalahari was adjacent to north-western Laurentia during the Neoproterozoic should be considered, based on geological evidence. This includes shared magmatism at 790-780 Ma between the Gannoukouriep and Gunbarrel large igneous provinces (LIPs) as well as a connection between various LIPs at 730-710 Ma making the combined Franklin-Mutare-Fingeren-Irkutsk LIP one of the largest in geological history (also including Siberia), and an ideal trigger for the Cryogenian to Ediacaran glacial period that followed. Interplay between mantle plumes, LIPs, glaciation and Rodinia fragmentation likely led to the rise in free oxygen and multi-cellular life toward the Cambrian boundary.

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ULKAN-BILYAKCHAN LIP (CA. 1.7 GA), SE SIBERIAN PLATFORM, ASSOCIATED TRIPLE JUNCTION RIFTING, AND ORE DEPOSITS

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Keywords: *LIP, ore deposit, Siberia*

The Ulkan paleorift system (SE Siberia) has characteristics of a three-armed structure indicative of the intense rifting in response to hotspot activity; The triple junction appears as a zone that underwent intense intra-plate A-type alkaline-granitic magmatism in the Late Paleoproterozoic. (Guryanov, 2007; Guryanov et al., 2012; Larin, 2011; Guryanov & Peskov, 2017). The presence of both subalkaline granitoids and volcanic rocks (K-series) and alkaline granites, comendites and pantellerites (Na-series) intensely fractionated, is characteristic of the Ulkan anorogenic magmatism. A specific feature of these granites is that they contain iron-enriched ferromagnesian silicates, and alkaline granites that contain alkali amphibole and pyroxene and astrophyllite.

Globally, A-type granites are often associated with deposits of Sn, W, Be, Nb, Ta, REE, Au, U and Fe, such as Piting in Brazil, Thor Lake and Strange Lake in Canada, Zaiplats in South Africa, Katuginskoe of the Aldan-Stanovoi shield (Larin, 2011).

The Ulkan intraplate alkali-granite magmatism of the Ulkan massif is host to endogenous ore deposits unique in dimensions and diversity (Be, Ta, Nb, Zr, REEU, Au, Li, Sn, W, Mo, Ti and (Pt)) (Guryanov, 2007). Rare metal and rare earth

deposits are genetically associated with alkaline granites and their derivatives. Almost all of them occur in exocontact zones (adjacent host rock) of the Nygvagansky alkaline granite stock located in the central part of the Ulkan massif of subalkaline granitoids. The most important elements in these deposits are Be, Ta, Nb and REE. The U-Pb and Pb-Pb ages of REE deposits range from 1720 ± 23 to 1670 ± 70 Ma, closely matching the age of alkaline granites (Goroschko et al., 2006).

U-Pb zircons dating of the Early Precambrian crystalline basement rocks in the southern flanks of the Ulkan trough showed a range from 1769±9-1690±14 Ma (Guryanov et al. 2012). This intense tectonothermal reworking of crystalline basement rocks of the south-eastern Siberian Platform, is related to the development of the Ulkan, Bilyakchan and other proto-aulacogens; emplacement of voluminous intrusions of normal and alkaline granites, syenite, monzonite of the Ulkan, Nudymi and other complexes.

Komatiite dyke swarms and rare subalkaline granitic intrusions of the Ulkan complex can be traced on the southern periphery of the Ulkan trough among Archean granulites and anorthosites of the Dzhugdzhur block (Guryanov, 2007). Economic sulfide copper-nickel mineralisation with platinum-group elements (PGE) is found to be komatiite- associated. Estimates for the age of komattite are 1690+14, 1700+12, 1710+10, 1720+12 and 1730+15 Ma (Kun-Manie Cu-Ni deposit; U-Pb SHRIMP-II age on zircons Guryanov et al., 2016).

It appears evident that in the south-eastern part of the Aldan-Stanovoy shield there occurred tectonic and metamorphic events at 1.77 - 1.69 Ga accompanied by intense metamorphism (up to granulite facies) of Archean anorthosites of the Old Dzhugdzhur complex and enclosing rocks.

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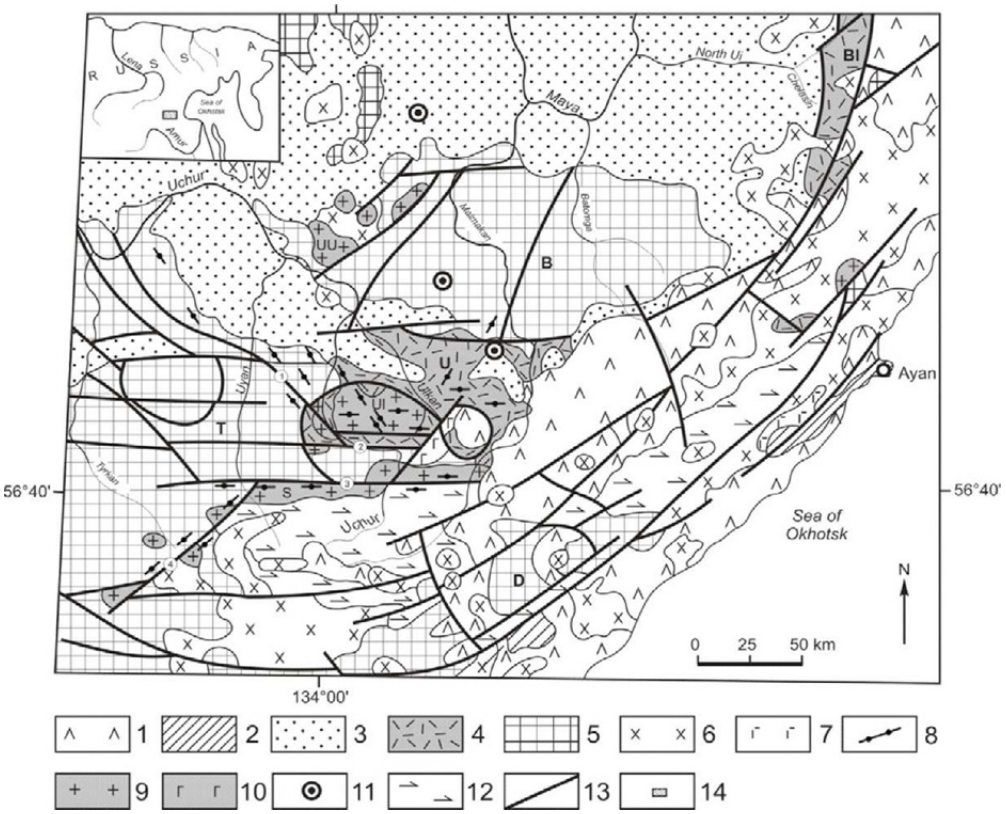

Fig. Geological map of southeastern margin of the Siberian Platform (Guryanov, 2007).

1 - Cretaceous volcanics of Okhotsk-Chukotka volcanic belt; 2 - Paleozoic terrigenous and carbonate sequences of Ayan-Shevli Pericratonic Trough; 3 - Cambrian-Mesoproterozoic volcanic-sedimentary and terrigenous-carbonate rocks of Uchur-Maya Plate; 4 - Paleoproterozoic Ulkan (U) and Bilyakchan (Bl) volcanic-sedimentary troughs; 5 - Archean crystalline rocks of Siberian Platform basement: Batomga (B), Tyrkan (T), and Dzhugdzhur (D) blocks; 6 - Cretaceous granitoid plutons; 7 - Paleozoic gabbroic rocks; 8-11 - Paleoproterozoic intrusions: 8 - basic dykes of the Maimakan Complex, 9 - granitic rocks of Ulkan Complex, 10 - gabbroic rocks of Gekundan Complex, 11 - ultramafic rocks of Konder Complex; 12 - anorthosite of Old Dzhugdzur Complex; 13 - fault; 14 - studied area (inset). Faults (numbers in circles): 1 - Uchur-Elgetei; 2 - North Uchur; 3 - South Uchur; 4 - Ukikan. Plutons (letters in figure): Ul, Ulkan; S, South Uchur; UU, Upper Ugayan.