Geochemical features of Meso-Neoproterozoic dolerite sills on the South-East margin of the Siberian Craton

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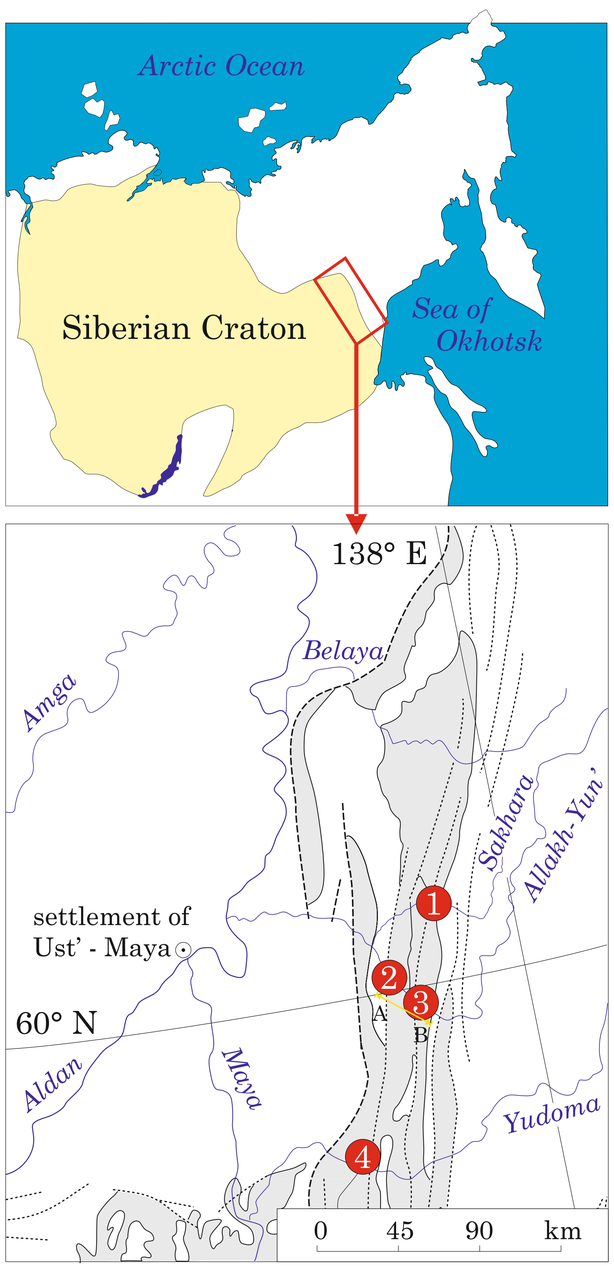
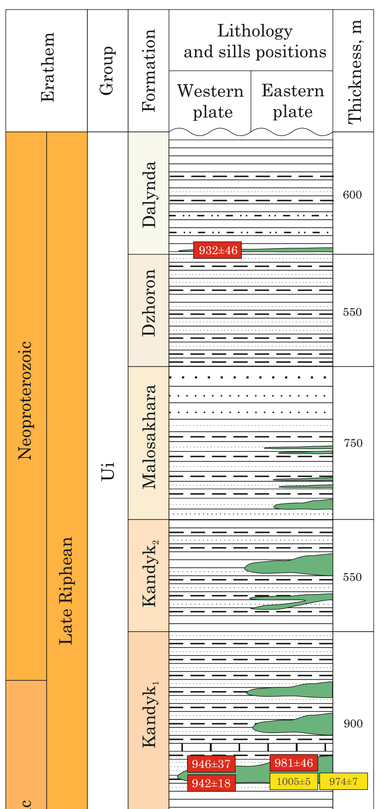
1 INTRODUCTION

Meso-Neoproterozoic dolerite sills and dykes of the south-east margin of the Siberian Craton are commonly known as linked to the Sette-Daban LIP-related event.

There are several U-Pb and Sm-Nd isochron isotopic dates for the rocks of the Ulakhanbam complex, giving a range of values from 930 to 1000 Ma. Although there is an overlap of several dates within error, sills become younger westward from 974-1005 Ma in the east part of the study area to 932-946 Ma in its west part. Due to wide range of ages they likely represent at least 2 different magmatic events, although long event is possible as well. To resolve this issue, new accurate dates are needed.

2 GEOLOGY





Map and geological cross-section legend:

- Phanerozoic rocks
- Riphean and Vendian rocks
- Main faults
- Subordinate faults (A - map; B - cross-section)
- Dykes on cross-section
- Geological cross-section line along the Allakh Yun' river
- The main areas of study of sills:

1 - Sakhara
2 - Allakh-Yun' West (Yukanda)
3 - Allakh-Yun' East (Chagda)
4 - Yudoma

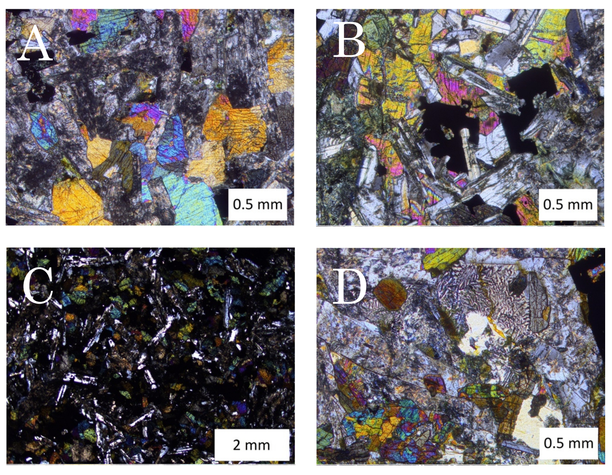
Composite stratigraphic section legend:

- Unconformity border
- Dolerite sill
- Limestone
- Dolomite
- Sandstone
- Siltstone
- Thin-layered siltstone
- Mudstone
- U-Pb age (baddeleyite)
- Sm-Nd age (isochron)

Geological setting of the study objects and the composite stratigraphic section of the Late Riphean deposits in Maya-Kyllakh zone

Mafic sill on the point AS17-22 (Sakhara river, 2017)

3 PETROGRAPHY



Photos of thin sections in transmitted light. Textural features of dolerites. (A) gabbroophitic, (B) poikilophitic, (C) doleritic, (D) micropegmatitic.

In the result of the studying petrographic thin sections all the samples are classified as fine to medium grained dolerites and quartz dolerites (grain size 0.2 to 2 mm).

4 GEOCHEMISTRY

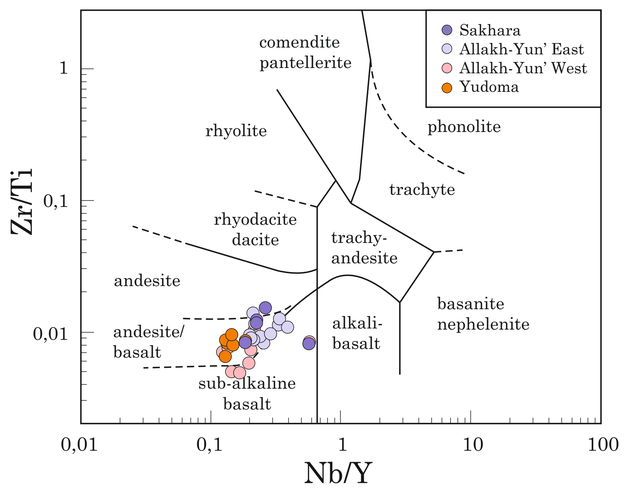
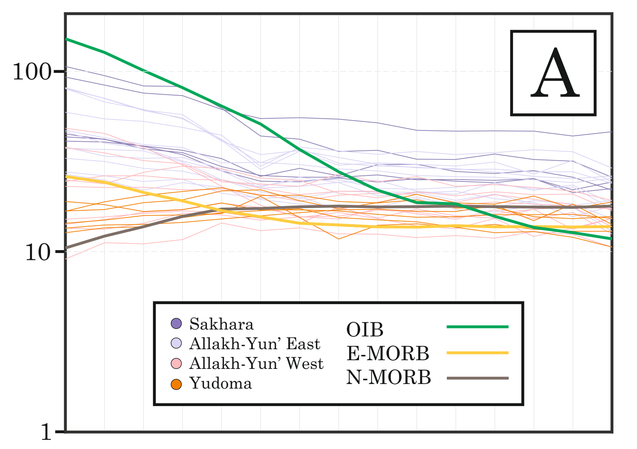
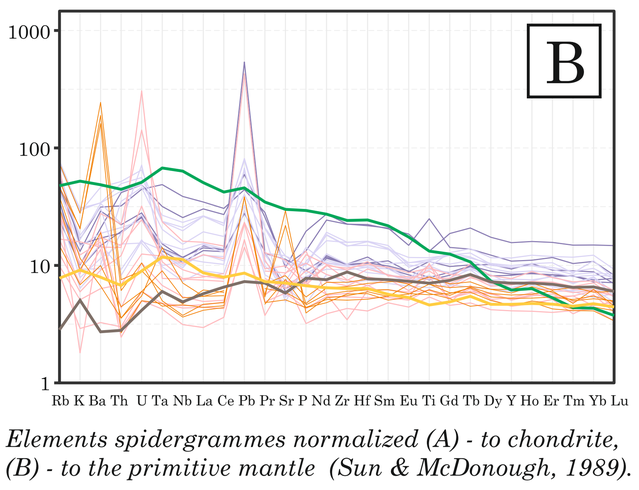
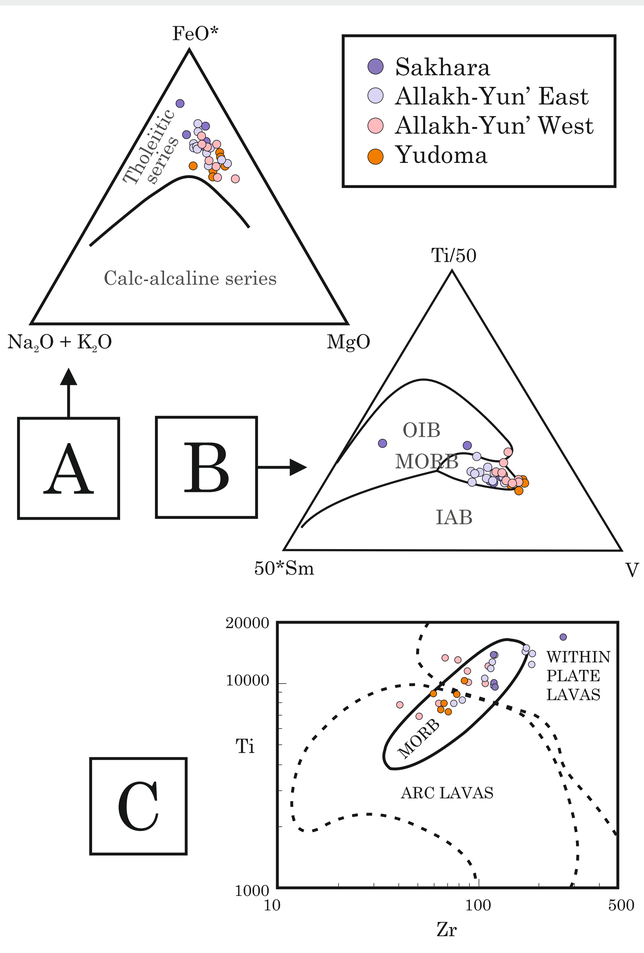


Diagram of Winchester (Winchester & Floyd, 1977) .



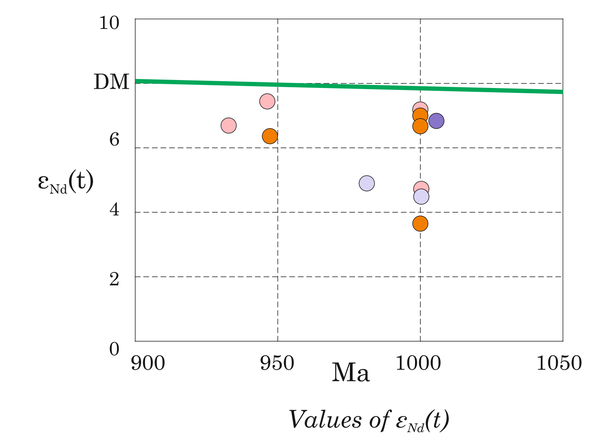


Elements spidergrammes normalized (A) - to chondrite, (B) - to the primitive mantle (Sun & McDonough, 1989).

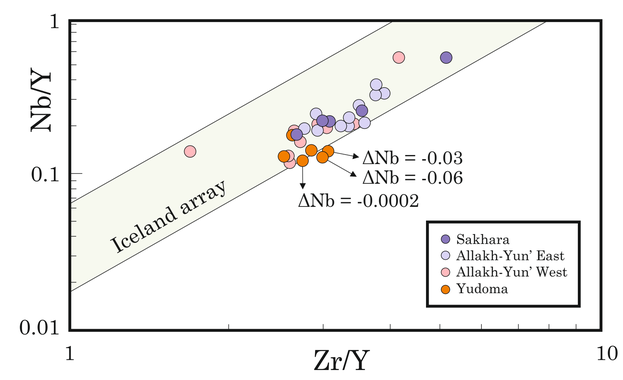


Diagrams for rocks of Sette-Daban event. (A) Discrimination diagram Na2O+K2O-FeO-MgO (Kuno, 1968) (B) – Sm*50-Ti/50-V diagram (Vermeesch, 2006). Legend: OIB - oceanic islands basalt; IAB - island-arc basalt; MORB - mid-ocean ridges basalt. (C) – Ti vs Zr diagram (Pearce,1982)*

5 RESULTS



Values of $\varepsilon_{Nd}(t)$



Nb/Y and Zr/Y variation in basalt from the neovolcanic zones of Iceland and from normal segments of mid-ocean ridges (N-MORB). The parallel lines mark the limits of the Iceland data (Fitton et al., 1997)

Mantle sources of the mafic intrusions of Sette-Daban event. Diagram A showing variations in $(Nb/Yb)_{PM}$ and $(Th/Yb)_{PM}$; Diagram B showing variations in $(Th/Yb)_{PM}$ and $(Nb/Th)_{PM}$; Upper Continental Crust (UCC) and Lower Continental Crust (LCC) compositions are from Taylor and McLennan (1985), and enrichedmantle (EMI, EMII) and HIMU (high μ, where $\mu = {}^{238}U/{}^{204}Pb$)mantle values are from Condie (2001).

A plot of Sm/Yb vs. La/Sm. (A) The shown melt curve of spinel lherzolite and garnet lherzolite are calculated using non-modal batch melting equations of (Shaw, 1970). Numbers along melting curves are the degree of partial melting. (B) Depths and temperature conditions of melt formation (according to Savatenkov)

6 CONCLUSIONS

Combined with previous geological, petrological and geochemical studies on the Sette-Daban event dolerites, the following conclusions can be drawn.

(1) The Sette-Daban event is represented by a single complex of rocks that has been formed over 50 million years, starting from 1 Ga. The complex isn't homogeneous, therefore, at different stages of its development, it is represented by rocks of different chemical composition, reflecting one riftogenic geodynamic setting.

(2) Geochemical characteristics disprove the plume origin of the complex; it is more likely to form as a result of stretching.

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