IGNEOUS PROVINCE ARE SIMILAR TO ISLAND ARC BASALTS?

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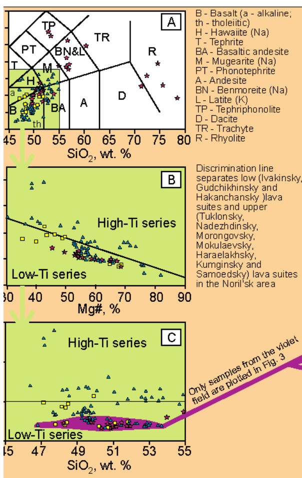
STATEMENT OF THE PROBLEM

e Permo-Triassic Siberian Traps Large Igneous Province (STLIP), comprising volcanic and intrusive rocks from the Siberian Platform and West Siberian Basin (Fig. 1), is the most voluminous (>10^6 km^3) among known Phanerozoic large igneous provinces. Tholeiites and alkaline salts with subordinate ultrabasic alkaline, intermediate and acidic rocks make up the STLIP (Fig. 2a). According to TiO_2 - Mg# (where Mg# Mg/(Mg+0.85Fe^{2+})) diagram, tholeiites and alkali basalts can be subdivided into low-Ti and high-Ti series (Fig. 2b). Here we focus on rocks n delta TiO_2 < -0.4 (where delta TiO_2 is the deviation from the discrimination line in Fig. 3 calculated as TiO_2=3.45-0.0317 x Mg#) (Fig. 2c). ch rocks are abundant in the STLIP. They are remarkably different from both the ocean-island-basalts (OIB) and enriched-middle-oceanic-ge-basalts (E-MORB) . Instead they resemble island-arc-basalts (IAB) (Fig. 3), which origin is related with melting of water-rich upper ntle above subduction slabs . The question is why large portion of the intra continental STLIP basalts are IAB-like? Do they have any links n Permo-Triassic subduction processes? What is the mechanism of this link?



2. Classification of volcanic and intrusive rocks of STLIP. A - TAS diagram (Le Bas et al., 1986); B - - Mg# diagram (Lightfoot et al., 1993; Ivanov & shev, 2005); C - delta TiO_2 - SiO_2 diagram. Data after Lightfoot et al., 1993 and Wooden et al., 1993 l'sk), Medvedev et al., 2003 (West Siberian Basin) authors (Kansk-Taseevskaya Basin). Symbols as g. 1.

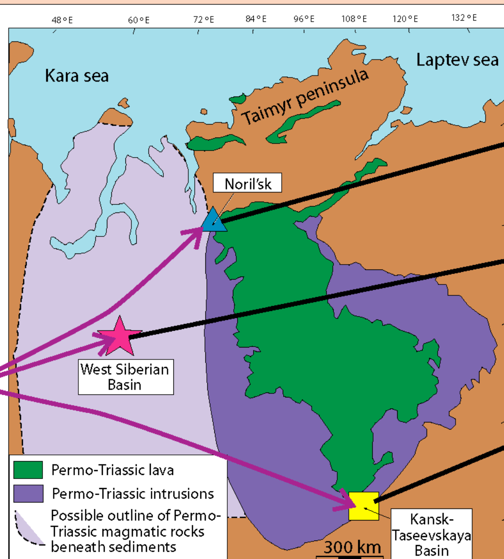


Fig. 1. Distribution of Late Permian and Early Triassic volcanic and intrusive rocks of the STLIP. Symbols mark three remote areas used for comparison of trace element geochemistry in low-Ti basalts (and dolerites).

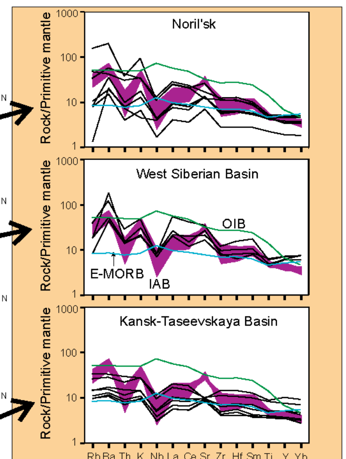
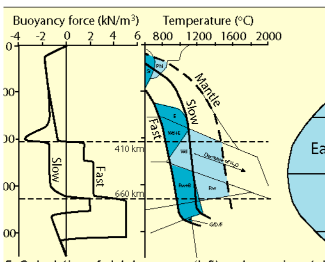


Fig. 3. Primitive mantle trace element normalized diagram for low-Ti basalts (and dolerites) of the STLIP. Data are from Medvedev et al, 2003 (West Siberian Basin), Lightfoot et al., 1993 (Noril'sk) and authors (Kansk-Taseevskaya Basin). OIB and E-MORB are average compositions after Sun and McDonough, 1989. IAB is the field of the subduction-related basalts of the Quaternary volcanic belt of the Sredinny Ridge, Kamchatka (Churikova et al., 2001; Ivanov et al., 2004).



5. Calculation of slab buoyancy (left) and experimental stability fields for hydrous minerals (right) (after Bina et 2000; Litasov & Ohtani, 2003). Sr - serpentine, Phl - ogopite, B, D, E, F, G - superhydrous phases, Wd - sleyite, Rw - ringwoodite.

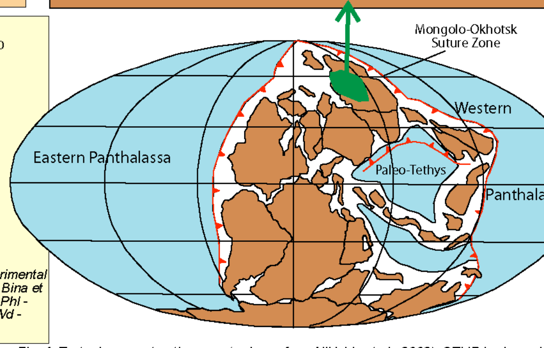


Fig. 4. Tectonic reconstruction map (redrawn from Nikishin et al., 2002). STLIP is shown in green .

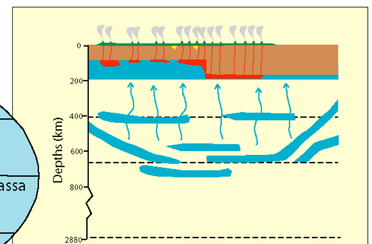


Fig. 6. A model of origin of IAB-like low-Ti basalts of the STLIP. The low-Ti basalts originated from upper mantle, which was metasomatized by water-fluid, derived from stagnated slabs in transitional mantle (Ivanov & Balyshev, 2005).

DISCUSSION

Permian, Siberian part of Pangaea was surrounded by subducting systems (Fig. 4). We suggest that subducting slabs brought water into nsitional zone of the mantle. Experimental data show that superhydrous minerals are stable at fast subducting slab conditions within two antle regions at about 410 and 660 km discontinuities (Fig. 5 right). Fast subducting slabs can not penetrate through the 660 km scontinuity, because they attain positive buoyancy (Fig. 5 left). Therefore, slabs that stagnated in the transitional mantle will enrich the nsition mantle in water. With heating slabs up the water will be released due to decomposition of the superhydrous minerals, followed by ater saturation of the upper mantle and consequent volumenous melting (Fig. 6).

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