

Volcanic rocks and pseudotachylytes from sources of crust-mantle complementary layers: Insight into geodynamics of the Baikal Rift System, Southern Siberia

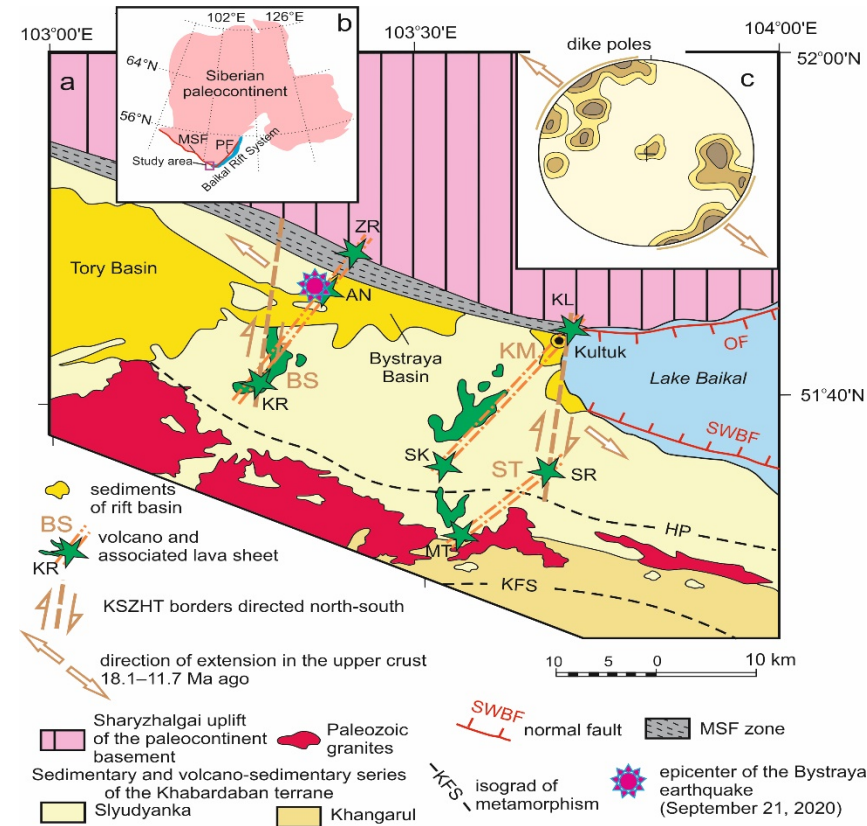
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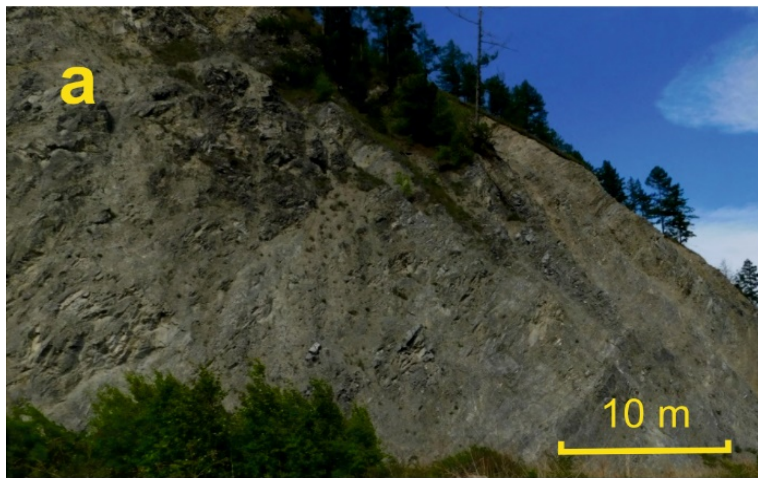
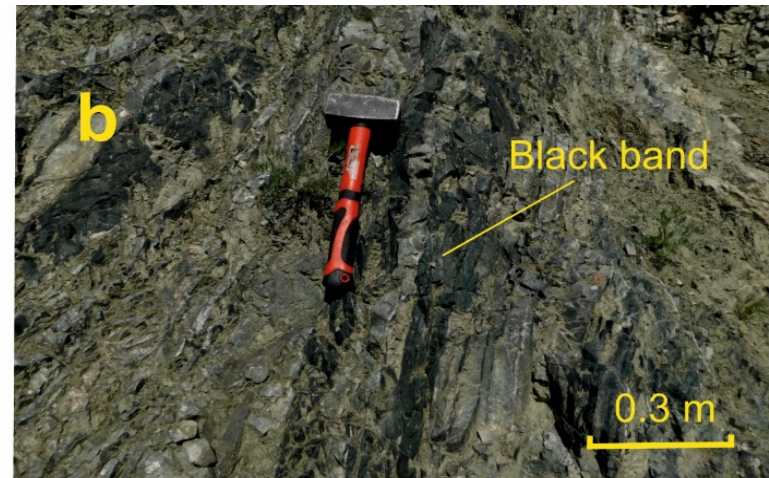
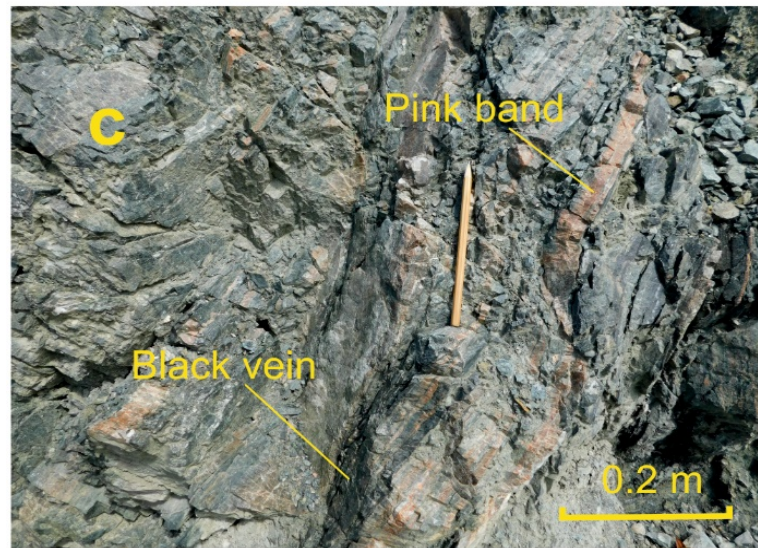
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We present results of detail geochemical study of 18–12 Ma volcanic rocks from the Kamar-Stanovoy Zone of Hot Transtension (KSZHT), located in the central Baikal Rift System (BRS), and older pseudotachylytes from the Main Sayan Fault (MSF).

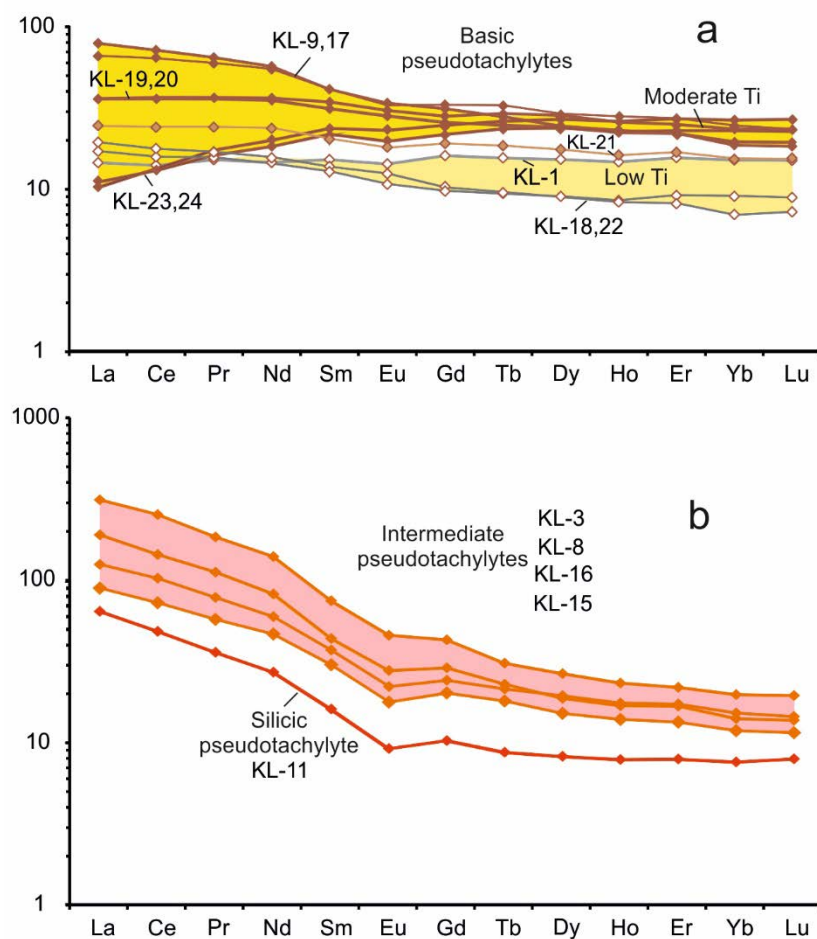
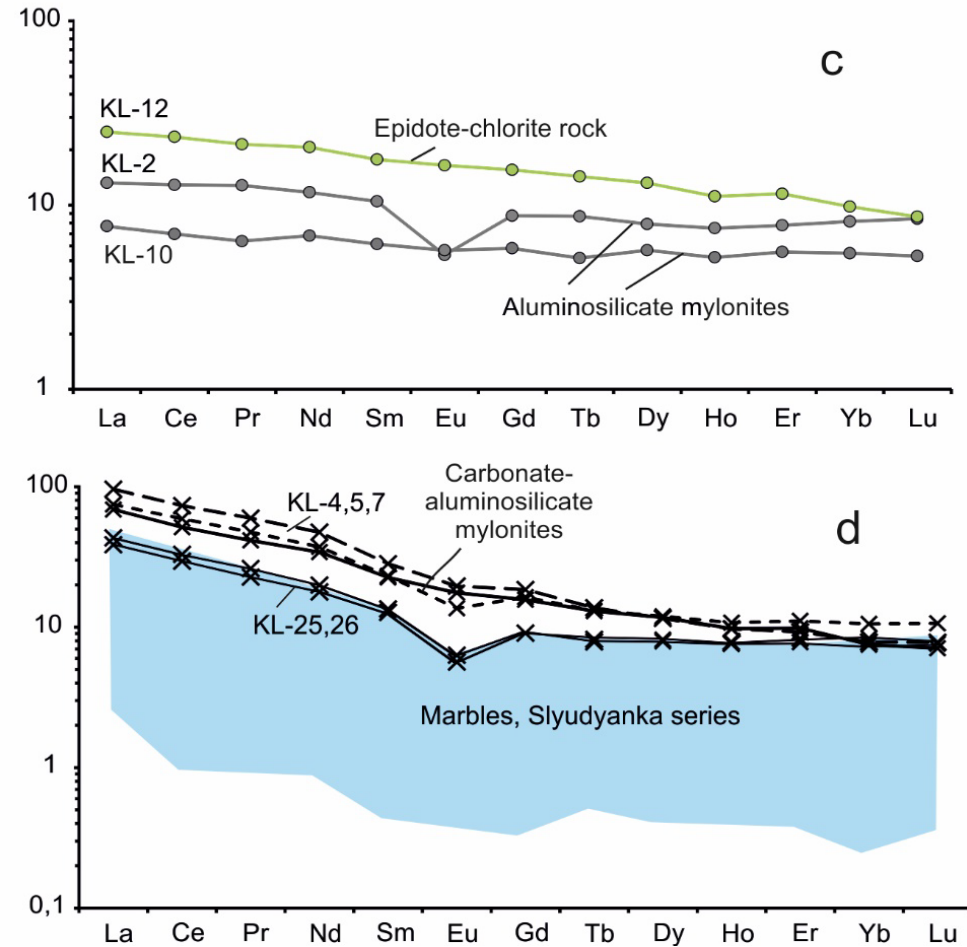




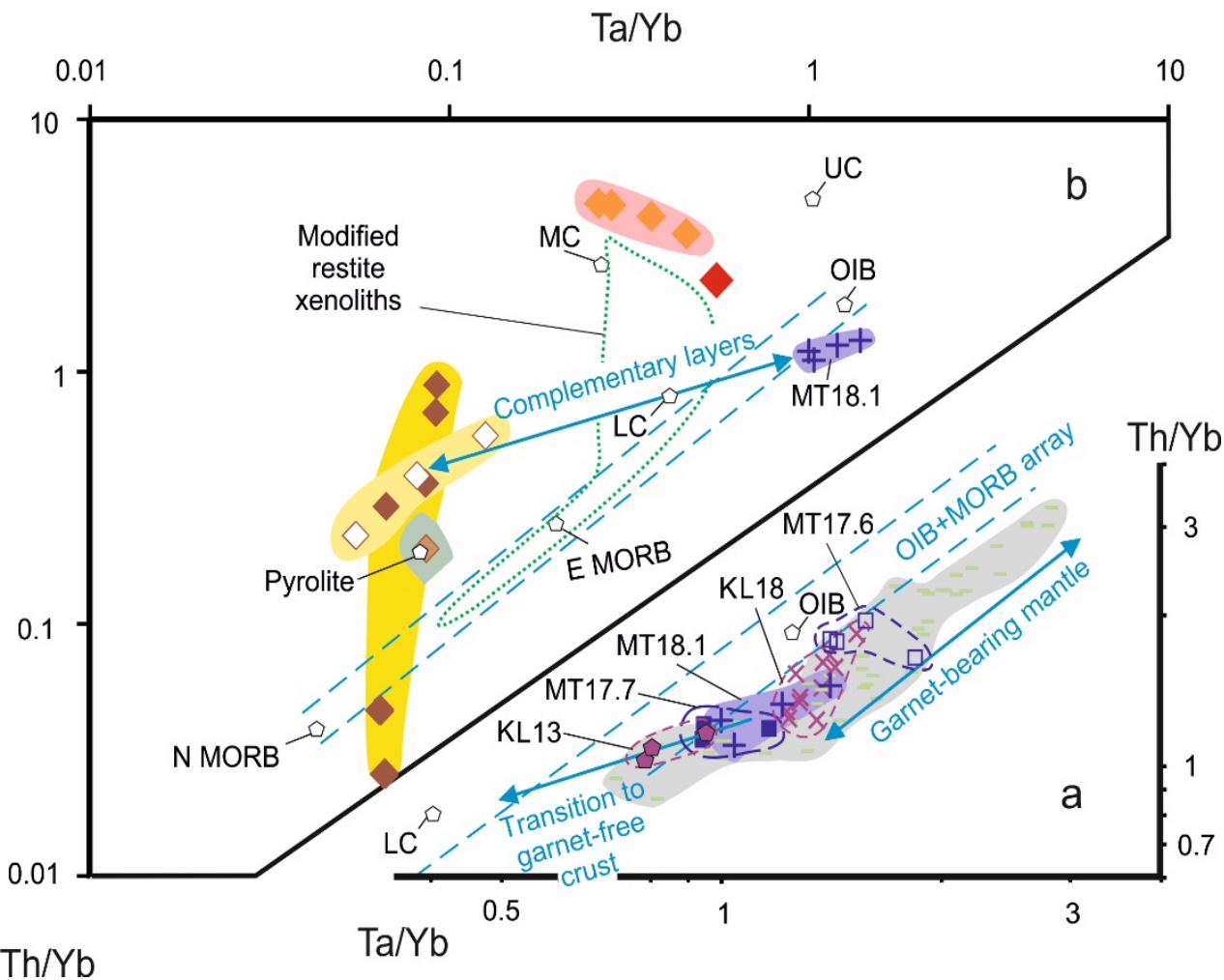
General view of the MSF outcrop located 1 km west of the Kultuk village (a), black band series (basic composition) (b), pink band series (silicic composition), cut by black veins (c), and a wedge-shaped body of dark-gray rock (intermediate composition) (d). In photograph a, dark saturated by injected rocks stripes dip under a slope of a quarry. In photograph d, a wedge-shaped fragment is cut at the base by a horizontal rupture.

Volcanic rocks from the KSZHT and older pseudotachylytes from the MSF designate geochemically distinguished from the OIB sources that are referred to the Slyudyanka zone of paleocollision occurred between the Khamardaban terrane and Siberian paleocontinent about 488 Ma ago.

Rock/chondrite

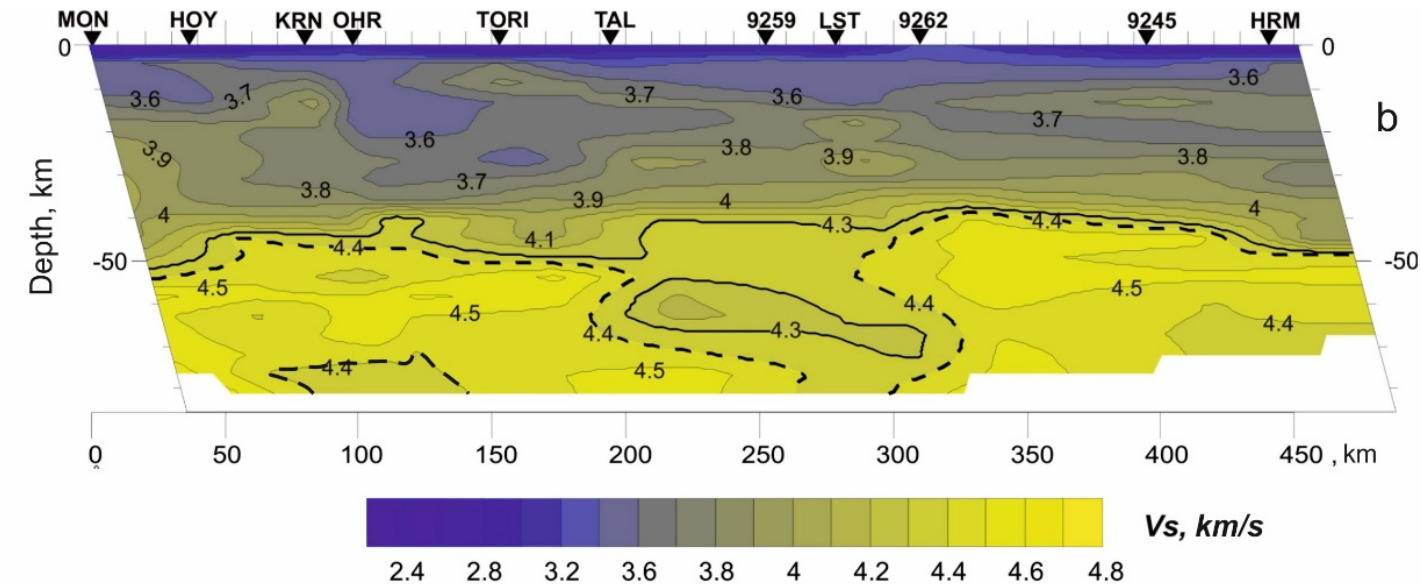
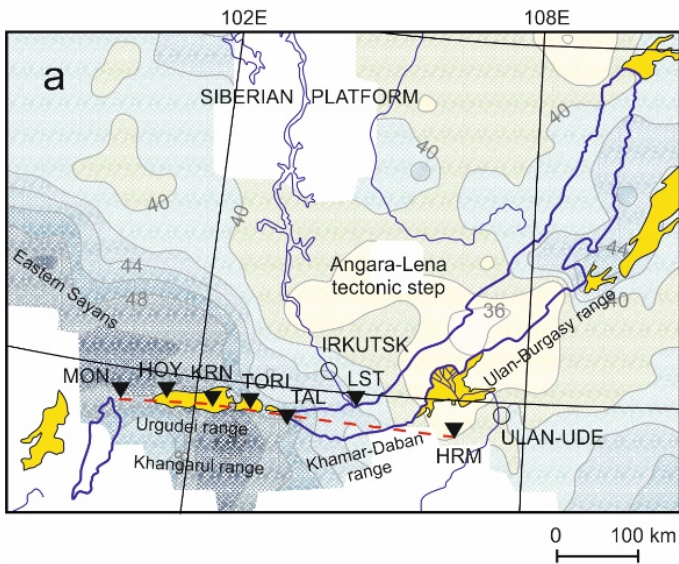
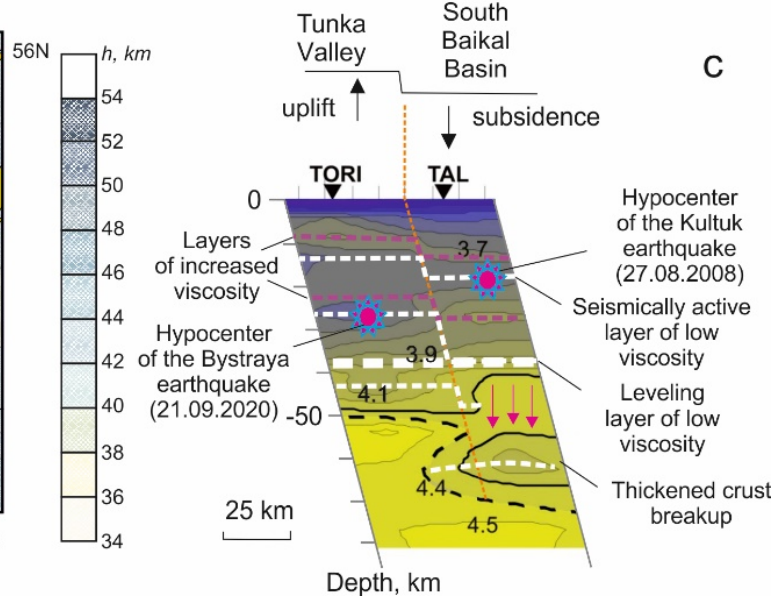


Chondrite-normalized REE spectra of rocks from the MSF: *a* – basic pseudotachylytes; *b* – intermediate and silicic pseudotachylytes; *c* – aluminosilicate mylonites and epidote-chlorite rock; *d* – carbonate-aluminosilicate mylonites. Shown for comparison in panel *c* is the range of carbonate rocks of the Slyudyanka complex (without fine-crystalline marbles with lower REE abundances) [Stepanov et al., 2011]. For normalization, the chondrite composition was used after [McDonough, Sun, 1995].



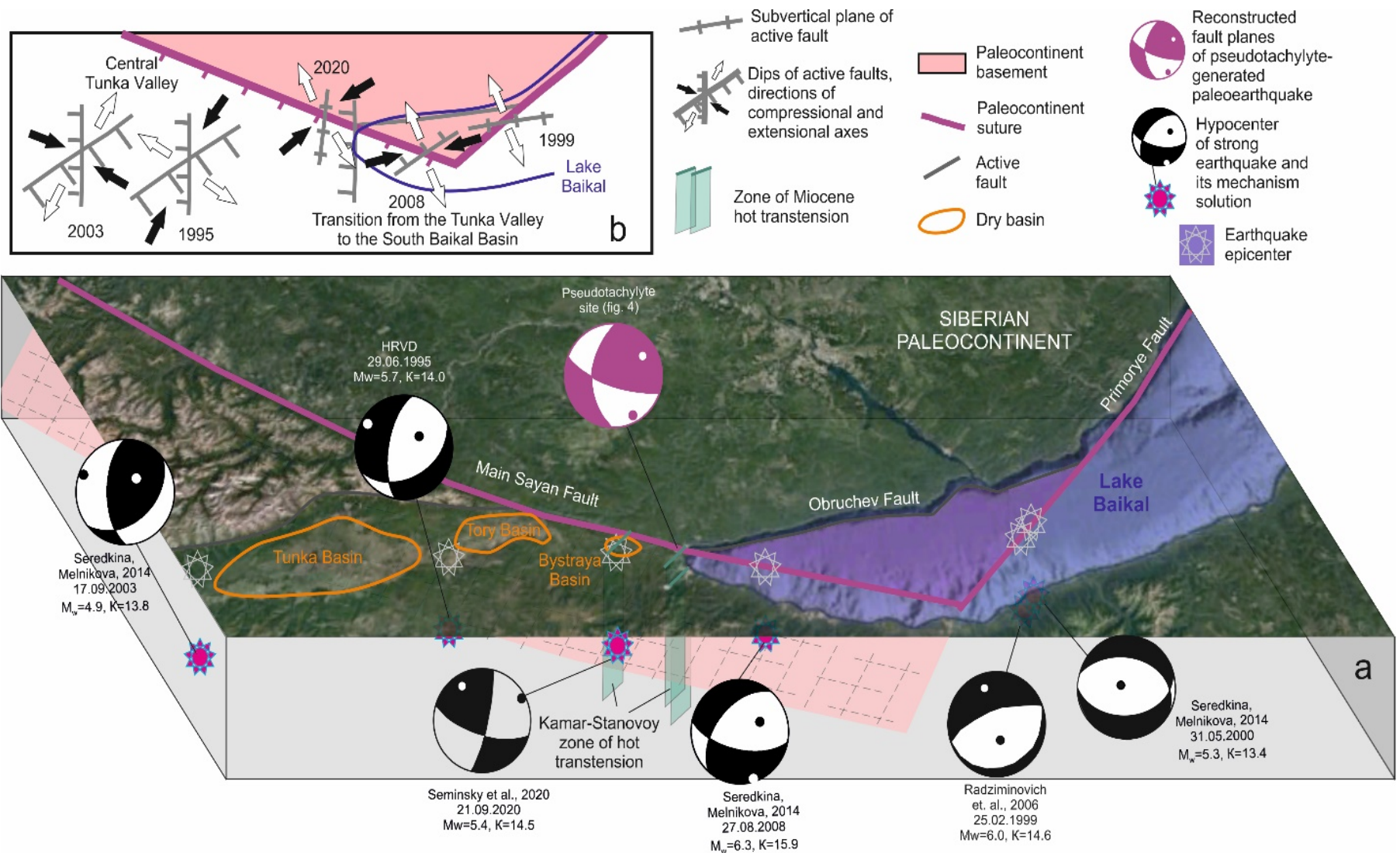
On the Th/Yb versus Ta/Yb diagram, rocks of the continental crust are plotted above the mantle array displayed by OIB and MORB [Pearce, 1983]. In a garnet-bearing source, both ratios increase; while in absence of garnet, both ratios decrease. Melts of basic pseudotachylytes from the garnet-free crust, on the contrary, are complementary depleted in tantalum (with a relative decrease in Ta/Yb). The KSZHT magmas erupted from sources of modified restite material that had lost the basic pseudotachylyte component.

Th/Yb – Ta/Yb diagrams of the initial basalts from the Meteo Volcano erupted about 18.1 Ma (MT18.1) in comparison with other volcanic rocks from the KSZHT (a) and with pseudotachylytes from the MSF (b). On the diagram b, a data field of peridotite nodules from trachybasalts of the Karerny volcano is shown as a possible source of the KSZHT melts after [Ailow et al., 2019]. Additional abbreviations: N MORB and E MORB – normal and enriched basalts of the mid-ocean ridge, respectively [Sun, McDonough, 1989], LC, MC, and UC – lower, middle, and upper crust, respectively [Rudnick, Fountain, 1995].



The depths of the hypocenters of the 2008 Kultuk and 2020 Bystraya earthquakes (16 and 26 km) are shown after Melnikova et al. [2013] and Seminsky et al. [2021]. The map on panel *a* is modified after Mats et al. [2001]. The section on panel *b* is adopted from Mordvinova et al. [2019].

Map of the crustal thickness from data of deep seismic sounding (V_p) in the Baikal Rift Zone and adjacent areas of the Siberian platform and Western Transbaikial (*a*), V_s -section along the Mondy–Khuramsha profile (*b*) and a scheme of vertical displacement of layers in the South Baikal Basin and Tunka Valley on a fragment of this section (*c*).

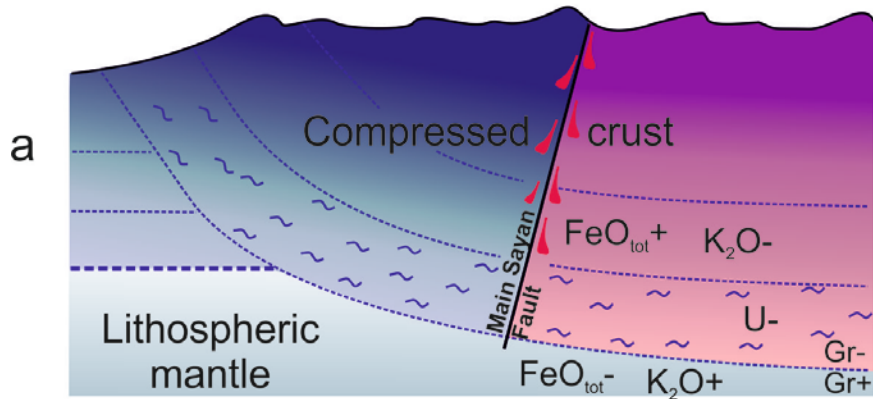


Schematic block-diagram of the Tunka Valley and South Baikal Basin for comparison between the fault planes shown for the pseudotachylyte site in the MSF and the nodal planes, reconstructed from focal mechanism solutions of earthquakes in seismically active faults (a) and schematic change in compression and extension forces in active faults of the Tunka Valley and South Baikal Basin (b). Hypocenter depths are shown arbitrarily.

CONCLUSION

70-20 Ma

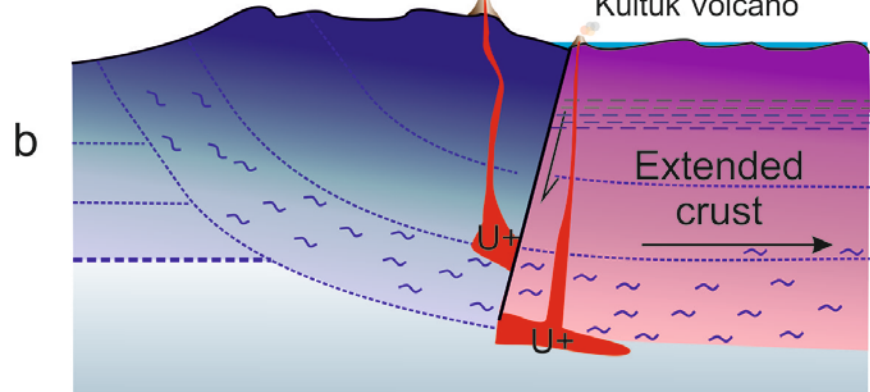
South Baikal Orogen



~18 Ma

Meteo Volcano

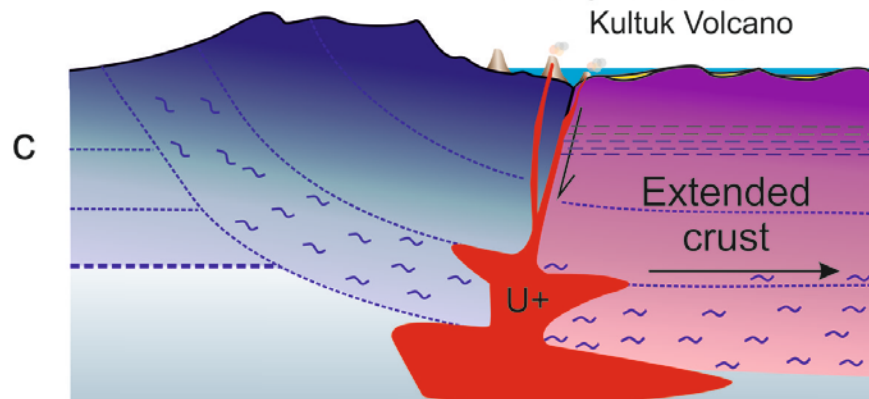
Kultuk Volcano



16-12 Ma

Karerny, Sukhoy,
Shirokiy volcanoes

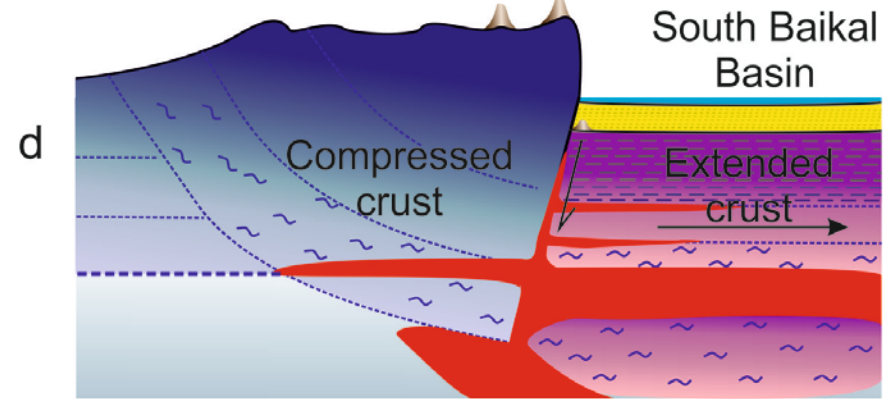
Kultuk Volcano



<12 Ma

Tunka Valley

South Baikal
Basin



Crust of orogen base
and its side deformed
at high pressure
Neoproterozoic

Brittle upper crust

Neoproterozoic Paleoproterozoic

Old pseudo-
tachylytes

Basin
subsidence

Extention

Volcano
active extinct

Magma
source

Sediments
and water

Paleoproterozoic

