PLAGIOCLASE-BEARING LHERZOLITE XENOLITHS IN ALKALI BASALTS FROM HAMAR-DABAN, SOUTHERN BAIKAL REGION, RUSSIA

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Lherzolite xenoliths in Miocene to Pleistocene basalts from five sites in the Hamar-Daban range in southern Siberia (Ionov et al., submitted) provide sampling of the mantle close to the axis of the Baikal rift. The xenoliths from the Tumusun and Margasan vocanic centres and two lava flows in the Margasan river valley (Fig. 1) are spinel lherzolites that commonly have foliated fabrics and spongy rims around clinopyroxene (cpx), and many contain accessory feldspar. The feldspar occurs in reaction zones adjacent to resorbed spinel and orthopyroxene (where it appears to have been formed by the reaction: spl + opx + cpx = fs + ol) and less commonly as thin, irregular veins. The temperature range for the Hamar-Daban xenolith suite (950-1010°C and a single value of 880°C) is more restricted than those for spinel peridotite xenoliths from other occurrences in the Baikal area. The feldspar-bearing lherzolites yield T estimates similar to or slightly lower than feldspar-free ones. Xenoliths from a lava outcrop near Slyudyanka at Lake Baikal (Fig. 1) yield high T values (≥1120°C) and show mineral zoning indicating a major heating event. No amphibole or mica was found in the samples studied.

The majority of the Hamar-Daban lherzolites are fertile and cpx-rich, as for most other occurrences in the Baikal region. Trace element compositions of selected xenoliths and their clinopyroxenes were determined by ICP-MS, INAA and proton microprobe. All xenoliths analysed are enriched in alkalies (Fig. 2). Most xenoliths and their clinopyroxenes have contents of heavy REE, Sr and Y common for fertile or moderately depleted mantle peridotites but are depleted in light REE, Nb, Ta, Th and Ba and show minor negative Ti-Zr-Hf anomalies (Fig. 2). Few are moderately enriched in LREE, Sr, Th and U. Sr-Nd isotope compositions of cpx indicate long-term depletion (probably about 2 Ga) in incompatible elements similar to unmetasomatised xenoliths from other occurrences south and east of Lake Baikal (Ionov et al., 1992).

The feldspars have variable compositions but are generally alkali-rich, some are extremely rich in potassium. Bulk-rock enrichment in Na, K and Rb suggests the presence of about 1% of feldspar, an estimate consistent with petrographic observations. The formation of feldspar and of spongy aggregates after clinopyroxene, and the enrichment in alkalies appear to be recent phenomena related to infiltration of an alkali-rich, H_2O-poor fluid into spinel peridotites. Estimates of crustal thicknesses in the region (40-45 km) indicate pressures of about 12 kbar just below the crust/mantle boundary, i.e. higher than the upper limit of 10-11 kbar for plagioclase stability inferred for fertile peridotites at ~1000°C (Green and Hibberson, 1970). The alkali-rich

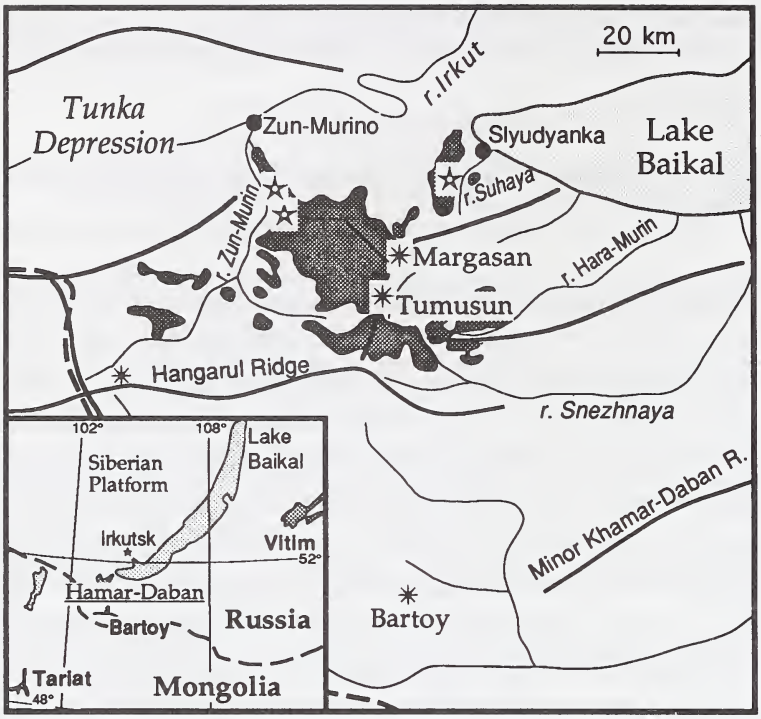

Fig. 1. Location map of basaltic fields and xenolith occurrences (stars) in the Hamar-Daban area (after Ionov et al, submitted).

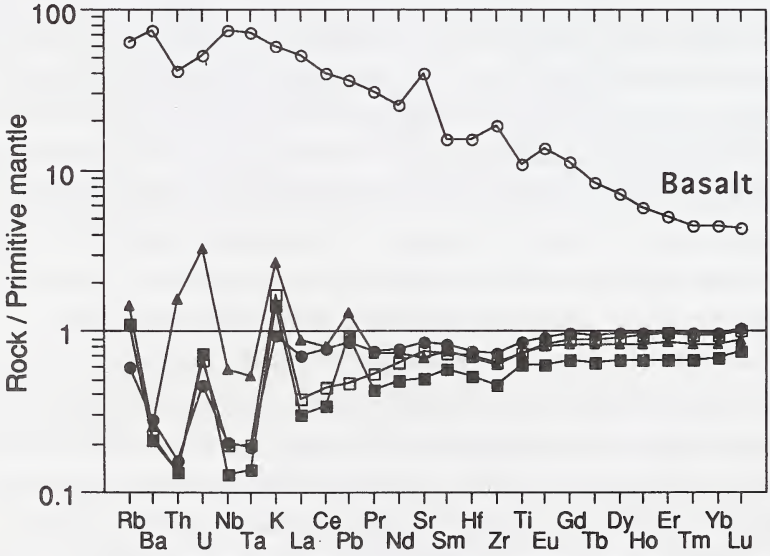

Fig. 2. Normalized (after Hofmann, 1988) abundance pattern diagrams for bulk-rock xenoliths and a host basalt

compositions of the feldspars appear to be responsible for their stability in the uppermost mantle beneath Hamar-Daban.

It can be concluded based on the limited number of mantle xenoliths studied that the mantle in northwestern Hamar-Daban (between the Margasan and Tumusun volcanic centres and lower Margasan river) has consistent characteristics for at least 50 km across at the depths sampled. Typical of this mantle domain is the fine grain size and foliation of the peridotites, fertile or moderately depleted modal and major element compositions, the absence (or extreme paucity) of volatile-bearing minerals and the ubiquitous presence of intergranular feldspar and spongy clinopyroxene. Equilibration temperatures of the xenoliths from northwestern Hamar-Daban are not higher than for those from other occurrences in the region located further from the rift and are well below temperatures expected for mantle diapirs (Logatchev and Zorin 1987). Our data do not indicate any significant differences between the younger Pleistocene (1-4 m.y.) and the older (probably "pre-rift") Miocene xenolith suites. Therefore, the northwestern Hamar-Daban area appears to be beyond the zone (probably restricted to the rift axis) where the recent active rifting has significantly affected the lithospheric mantle. This study and other work on mantle xenoliths in the Baikal region (Ionov et al., 1992; Kiselev and Popov, 1992) found no evidence that the "anomalous mantle" beneath the BRZ defined by low P-wave velocities immediately beneath the Moho (7.7-7.8 km/sec) consists of partially melted rocks.

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