

Geochemical features of the mafic rocks in the Khangai-Daur belt, central Mongolia

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The Late Paleozoic–Early Mesozoic accretionary complexes of the Khangai-Daur belt, in central Mongolia, lie between the Siberian craton and the North China block. These complexes consist of Silurian mafic rocks (basalt, dolerite, and gabbro), Silurian–Devonian radiolarian cherts, and Carboniferous clastic rocks. While the mafic rocks are considered oceanic island alkaline, few studies have been conducted, and their classification is still under discussion. Understanding the petrogenesis and tectonic setting of these mafic rocks within the accretionary complexes is crucial for comprehending the tectonic evolution of ancient oceanic plates.

This study involves geochemical analyses of 39 mafic rock samples and whole rock Sr-Nd isotopes from 24 mafic rock samples collected from four localities within the Khangai-Daur belt: Uubulan, Ikh-Oortsog, Takhilt area in the Ulaanbaatar terrane, and the Burd area in the Kharhorin terrane. Geochemically, all mafic rocks from the Uubulan, Ikh-Oortsog, and Takhilt area exhibit the signature of ocean island basalt (OIB). They are characterized by alkaline affinity with enrichment in large ion lithophile elements (LILE)

and light rare earth elements (LREE), as well as depletion in high field strength elements (HFSE) and heavy rare earth elements (HREE), resulting in a high concentration of $((La/Yb)_{cn} = 4.5–15.6)$. In contrast, the mafic rocks from the Burd area exhibit tholeiitic-like affinity with less enrichment in LILE and LREE, and depletion in HFSE and HREE, resulting in a concentration of $((La/Yb)_{cn} = 1.4–3.0)$. Therefore, the Ti/Y vs. Nb/Y and Ti vs. Zr ratio diagrams suggest that the samples were formed in a within-plate setting.

Our latest study reveals that the hornblende K-Ar age (412.7 Ma \pm 8.6 Ma) of the mafic rocks and the reconstruction of the oceanic plate stratigraphy of the accretionary complex at Uubulan indicate a Late Silurian age. The Sr-Nd isotopic compositions ($(^{87}Sr/^{86}Sr)_i = 0.7040–0.7078$, $\epsilon Nd(t) = 5.0–9.3$) suggest that the magmas were derived from a deep OIB reservoir, indicating slightly heterogeneous magma sources. Overall, the results of this study suggest that alkaline and tholeiitic magmatism may have occurred during the Late Paleozoic within the oceanic plate between the Siberian craton and the North China blocks.