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Geochemical constraints on the petrogenesis of Devonian arc picrites and associated lavas from the North Junggar terrane, NW China

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The Junggar terrane in Xinjiang Province, sits adjacent to the Siberian and Kazakhstan plates. Recently, we recognized a near 100-m-thick picritic lava flow in a Devonian arc in Jungguar terrain. The picritic lavas, which occur in the lower part of the Middle Devonian strata, are overlain by basalts and andesites. The picrites are highly porphyritic. Olivine, clinopyroxene and rare chrome spinel with Cr# (Cr/Cr+Al) values (0.63–0.86) are phenocrysts, embedded in a matrix of groundmass plagioclase, clinopyroxene, and Ti-magnetite. Glass does not appear to be preserved, but minor metal sulfides are present. All lavas are characterized by negative Nb, Ta and Ti anomalies with similar abundances of HFSE with MORB, exhibiting typical for island arc volcanic rocks. The Zr/Nb ratios (23–66) of the picrites and basalts resemble the MORBs (10–66), suggesting the MORB-like sources. However, the Ti/V (23–35) and Zr/Sm (18–23) ratios of basalts are higher than those of picrites (14–17 and 14–15 respectively), and the basalts display flat-type REE-chondrite patterns whereas the picrites are characterized by lower total REE concentrations and slight enrichment of light REE. In contrast, the andesites have much higher total REE abundances and LREE/HREE. All suggest that they are not cogenetic related. However, they have similar ($^{87}Sr/^{86}Sr$)t (0.70328–0.70433) and $\varepsilon_{Nd}(t)$ values (6.4–7.3), overlapping with modern island arc field. Consequently, primary magmas were most likely generated in N-MORB-type mantle, which was modified by the addition of a fluid component derived from subducted basaltic crust. However, the basalts were generated by partial melting of amphibole-bearing spinel peridotite, and the picrites resulted from low degrees of partial melting of garnet peridotite with residual garnet, and the andesites may have been generated by partial melting of eclogites.

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