

## Research Advances

## Discovery and Significance of the Wusunshan Early Carboniferous Nb-Enriched Arc Basalts in the Yining Block, West Tianshan

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Nb-enriched arc basalts, an extremely special rock type, were formed in a specific tectonic setting, which have attracted much attention in recent years. Although Nb-enriched basalts in the Yining Block were interpreted as arc-affinity basalts, some geologists suggested that they should be Nb-enriched continental basalts and not arc-related. Recently, the Nb-enriched arc basalts have been first identified from the Dahalajunshan Formation in southern Wusunshan, Yining.

The Dahalajunshan Formation consists of basalts and basaltic andesite in southern Wusunshan, covered by the Akeshahe Formation limestone with angular unconformity. The basalts show pore and amygdaloidal structure with intergranular-interstitial texture (Fig. 1a). Zircon U-Pb analyses show that all 10 spots yield a weighted mean <sup>206</sup>Pb/<sup>238</sup>U age of 339.6 Ma, together with 344.1 Ma for the rhyolite 2 km north of the basalt sample site, which indicates that the Dahalajunshan Formation is of the Early Carboniferous. This suite of volcanic rocks is characterized by (1) high TiO<sub>2</sub> (1.66%–3.04%) and Na<sub>2</sub>O, but low K<sub>2</sub>O with Na<sub>2</sub>O/K<sub>2</sub>O ranging from 2.04 to 4.96; (2) elevated Nb (Nb = 9.21–23.57 ppm), Sr (Sr = 553.56–1146.46 ppm) and Zr (Zr = 184.74–514.48 ppm) concentrations; (3) high Zr/Y > 4, (Nb/Th)<sub>PM</sub> > 0.6 and but low (La/Nb)<sub>PM</sub> < 3.3, and (4) negative Nb and Ta anomalies (Fig. 1b), high HFSE content and relatively-enriched Ti-Y-Yb. These geochemical

characteristics are similar to those of typical Nb-enriched arc basalts in the Zamboanga Peninsula of the Philippines, Superior of Canadian and the other places worldwide. In addition, this suite of rocks shows geochemical characteristics similar to the Barnuke Nb-enriched basalts newly found in West Junggar, Xinjiang. Therefore, we interpret that this suite of mafic rocks from the Yining Block indeed belongs to typical Nb-enriched arc basalts series (Fig. 1c).

The Wusunshan Nb-enriched basalts, like the typical Nb-enriched arc basalts, were derived from partial melting of the mantle wedge of metasomatized by adakitic melts in a subduction environment. Slab-derived adakitic magma interacted with the mantle wedge peridotite when it rose through the overlying mantle wedge, which resulted in more elevated Nb, Ti and Na<sub>2</sub>O than typical arc basalts. This finding provides important geochemical constraints on the formation mechanism of the Nb-enriched arc basalts in the Yining Block and even in western Tianshan, and further supports the presence of an Early Carboniferous arc in western Tianshan.

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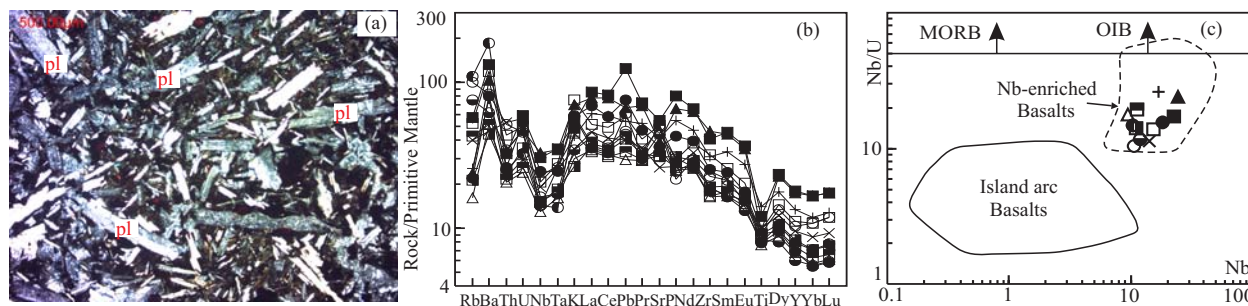


Fig. 1. (a), Microscope characteristic of Wusunshan Nb-enriched basalts; (b), Primitive mantle normalized trace element spider diagram; (c), Nb/U-Nb diagram of the Wusunshan Nb-enriched basalts.

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