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Late Carboniferous to Early Permian magmatic pulses in the Uliastai continental margin linked to slab rollback: Implications for evolution of the Central Asian Orogenic Belt

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Abstract

The Paleo Asian Ocean underwent a protracted closure history during Late Paleozoic. Here we investigate the magmatic evolution during this process based on a detailed study in the Baiyinwula region along the Uliastai continental margin. The major rock types in this area are Late Carboniferous-Early Permian volcanic sequences and coeval intrusions. We identified four stages of magmatic evolution based on the diverse assemblages and their precise isotopic ages. The first stage is represented by andesites with a zircon $^{206}\text{Pb}/^{238}\text{U}$ age of ca. 326 ± 12 Ma. These rocks are metaluminous to weakly peraluminous, high-K calc-alkaline, and possess high $\text{Na}_2\text{O}/\text{K}_2\text{O}$ ratios in the range of 1.23 to 2.45. They also display enrichment of large ion lithophile elements (LILE) and depletion of high field strength elements (HFSE), with markedly positive zircon $\varepsilon_{\text{Hf}}(t)$ varying from 8.1 to 15.6. The geochemical features of these andesites are similar to those of typical arc volcanic rocks. The second stage includes granodiorites emplaced at 318.6 ± 1.8 Ma. The rocks are high-K calc-alkaline with A/CNK values ranging from 0.95 to 1.06, and show enrichment in LILE and depletion in HFSE. They show geochemical affinities to adakites, with high Sr and low Y and Yb contents, indicating magma derivation from thickened lower crust. Zircon grains from these rocks display positive initial $\varepsilon_{\text{Hf}}(t)$ values ranging from 11.1 to 14.6 with corresponding two-stage Hf model ages ($T_{\text{DM}2}$) of 394-622 Ma. The third stage

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