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Petrogenesis of late Carboniferous sanukitoids from northern West Junggar of China in the Central Asian Orogenic Belt

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Sanukitoid is a type of high-Mg andesite that is distinct from typical andesite in being characterized by elevated MgO contents and/or $Mg^{\#}$[=100* Mg/(Mg + Fe)]. They represent rare mantle-derived rocks that are preserved in both modern and Archean subduction settings, as well as in accretionary orogenic belts. The Central Asian Orogenic Belt (CAOB) is a giant accretionary orogen and the most important area of Phanerozoic continental growth around the world. It is evolved through a long-lived orogeny involving multiple episodes of subductions and accretions marking a major phase of continental growth during the Paleozoic. The West Junggar is an important component within the core of the CAOB, and is located at the junction between the Siberian, Kazakhstan and Tarim blocks. The rocks in West Junggar preserve the amalgamation of the southern CAOB, and are subdivided into northern and southern parts by the Xiemisitai Fault. The study of Carboniferous magmatism in northern West Junggar plays an important role in understanding the tectonic evolution of that part of the Central Asian Orogenic Belt. In this study, we present petrology, zircon U–Pb geochronology, mineral and whole-rock geochemistry, and the Sr–Nd–Hf–Pb isotope compositions of volcanic rocks from the Hamutusi area of northern West Junggar. LA–ICP–MS zircon U–Pb analysis of a representative andesite yielded an early to late Carboniferous age of 324.4±6.9Ma. The volcanic rocks are calc-alkaline, with high SiO_2 (58.10–59.01 wt%), MgO (6.09–6.99 wt%), $Mg^{\#}$ (60.7–62.2), Cr (147–403 ppm), and Ni (29–119 ppm) contents, and are enriched in large ion lithophile elements (LILE) and light rare earth elements (LREE), but depleted in high field strength elements (HFSE), These characteristics are similar to those of typical sanukitoids within the Setouchi volcanic belt in Japan. All samples have radiogenic initial Sr and Pb isotopic compositions, and low $\varepsilon_{Nd}(t)$ and $\varepsilon_{Hf}(t)$ values, indicating the sanukitoids were generated by partial melting of subducting sediments in which the melts interacted with the mantle. Geochemical modeling calculations indicate a proportion of 3-10% sediment melt and slab-derived fluids were mixed with the depleted mantle to produce the bulk of the Hamutusi rocks. We conclude that the studied rocks from Northern West Junggar record the transition from normal subduction to subduction of young and hot oceanic lithosphere between the early and late Carboniferous.

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