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The early Paleozoic tectonic evolution of the Russian Altai: implications from meta-sedimentary complexes in the Charysh-Terekta-Ulagan-Sayan suture zone

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The Charysh-Terekta-Ulagan-Sayan (CTUS) suture zone is an important tectonic boundary between the Gorny Altai and Altai-Mongolian terranes in the northwestern Central Asian Orogenic Belt (CAOB). When did these two terranes amalgamate and whether the metamorphic complexes in the suture zone represent Precambrian micro-continental slivers are critical for our understanding of the accretionary orogenesis and crustal growth rate in the CAOB. A combined geochemical and detrital zircon U-Pb-Hf isotopic study was conducted on the meta-sedimentary rocks from the Ulagan and Teletsk Complexes in the suture zone. The results indicate that the protoliths of these rocks were dominated by immature sediments deposited in ca. 470-420 Ma. Thus, Precambrian micro-continental slivers may not exist in the suture zone and even the whole Russian Altai.

The meta-sedimentary rocks from the Ulagan Complex yield geochemical compositions between those of common intermediate and felsic volcanic rocks, implying that these kinds of igneous rocks possibly served as dominant sources. Detrital zircons from this complex consist of a major population of ca. 620-468 Ma, a subordinate one of ca. 931-671 Ma and rare grains of ca. 2899-1109 Ma. This age spectrum is compatible with the magmatic records of the western Mongolia. We propose that the Ulagan Complex possibly represents part of a subduction-accretion complex built upon an active continental margin of the western Mongolia in the early Paleozoic. The remarkable similarities in source nature, provenance and depositional setting to those early Paleozoic meta-sedimentary rocks from the northern Altai-Mongolian terrane imply that the Ulagan Complex was possibly fragmented from this terrane during its amalgamation with the Gorny Altai terrane.

The meta-sedimentary rocks from the Teletsk Complex show similar detrital zircon populations but contain higher proportions of mafic components and have younger whole-rock two-stage Nd model ages. Their protoliths came from the same source as that for the counterparts from the Ulagan complex, with addition of detritus from the Gorny Altai terrane. This implies that the Gorny Altai and Altai-Mongolian terranes possibly amalgamated prior to the early Devonian, not middle Devonian to early Carboniferous as previously thought. Thus, the widespread Devonian to early Carboniferous magmatism within these two terranes was possibly generated in the same tectonic environment. Moreover, the Neoproterozoic to early Paleozoic detrital zircons from the Teletsk Complex yield largely varied $\epsilon_{\text{Hf}}(t)$ values of -23.8 to 12.4, highlighting both crustal growth and reworking during the subduction-accretion process to form the Russian Altai.

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