

Sedimentary records on the subduction-accretion history of the Russian Altai, northwestern Central Asian Orogenic Belt

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The Russian Altai, comprising the northern segment of the Altai-Mongolian terrane (AM) in the south, the Gorny Altai terrane (GA) in the north and the intervening Charysh-Terekta-Ulagan-Sayan suture zone, is a key area of the northwestern Central Asian Orogenic Belt (CAOB). A combined geochemical and detrital zircon study was conducted on the (meta-)sedimentary sequences from the Russian Altai to reveal the tectono-magmatic history of these two terranes and their amalgamation history, which in turn place constraints on the accretionary orogenesis and crustal growth in the CAOB.

The Cambrian-Ordovician meta-sedimentary rocks from the northern AM are dominated by immature sediments possibly sourced from intermediate-felsic igneous rocks. Geochemical data show that the sediments were likely deposited in a continental arc-related setting. Zircons separated from these rocks are mainly 566-475 Ma and 1015-600 Ma old, comparable to the magmatic records of the Tuva-Mongolian terrane and surrounding island arcs in the western Mongolia. The similar source nature, provenance and depositional setting of these rocks to the counterparts from the Chinese Altai (i.e. the southern AM) imply that the whole AM possibly represents a coherent accretionary prism of the western Mongolia in the early Paleozoic rather than a Precambrian continental block with passive marginal deposition as previously thought.

In contrast, the Cambrian to Silurian (meta-)sedimentary rocks from the GA are characterized by a unitary zircon population with ages of 640-470 Ma, which were potentially sourced from the Kuznetsk-Altai intra-oceanic island arc in the east of this terrane. The low abundance of 640-540 Ma zircons (5%) may attest that this arc was under a primitive stage in the late Neoproterozoic, when mafic igneous rocks dominated. However, the voluminous 530-470 Ma zircons (95%) suggest that this arc possibly evolved toward a mature one in the Cambrian to early Ordovician with increasing amount of intermediate-felsic igneous rocks, highlighting both crustal growth and recycling.

Importantly, a significant amount of additional 2431-772 Ma zircons occur in the early Devonian sedimentary sequence of the GA. These detrital zircons possibly have the same source as their counterpart from the AM. This implies that the two terranes with contrary evolutionary history, i.e. the GA and AM, amalgamated before the early Devonian.

To summary, the AM and GA represented two separated subduction-accretion systems in the early Paleozoic and subsequently amalgamated prior to the early Devonian, documenting complicated accretionary orogenesis and significant lateral crustal growth in the CAOB.

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