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Paleozoic geodynamics and architecture of the Mongolian Altai Zone

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The Mongolian Altai Zone is a part of the extensive Cambrian–Ordovician accretionary system located at the junction of the Siberian craton to the north and Tarim and North China cratons to the south. It extends approximately 2,000 km from Russia to Mongolia and represents one of the critical elements for reconstructing the early Paleozoic geodynamics of the Central Asian Orogenic Belt (CAOB). The studied section comprises a succession of deformed low- and high-grade metasedimentary rocks characterised by dominant terrigenous components mixed with volcanogenic material. The detrital zircons analysis revealed two separate groups a) more mature siliciclastic sediments (mostly sandstones) with maximum depositional age of Cambrian–Ordovician (ca. 463–489 Ma; zircon U-Pb) and b) more juvenile greywacke type sediments with Ordovician–Silurian (ca. 438–446 Ma; zircon U-Pb) maximum depositional age. U-Pb ages of detrital zircons show Cambrian-Ordovician (ε_{Hf}(t) values –24.8 to +16.0) and Late Archean to Neoproterozoic source (ε_{Hf}(t) values –35.5 to +10.4) and are interpreted as derived from the Ikh Mongol continental arc and the Baydrag continent. The greywackes, in addition, contain Silurian detrital zircons, with ε_{Hf}(t) values from –0.5 to +13, suggesting syn-depositional contribution of juvenile material from a nearby magmatic arc. Both types of sediments are affected by Devonian (ca. 369–382 Ma; zircon U-Pb) metamorphism and magmatism granites, as well as stroingly reworked during the Permian (ca. 271–296; zircon U-Pb) under various metamorphic conditions. Late Devonian granitoids associated with felsic migmatites, and their zircon ε_{Hf}(t) values from –9.5 to +13.5, indicate extensive melting of the sedimentary pile. A Permian high-temperature metamorphism is associated with granodiorite intrusions (ε_{Hf}(t) values from –22.0 to +12.6) that contain Devonian zircon xenocrysts, suggesting melting of a Devonian source. The tectonic evolution of the Mongolian Altai Zone can be discretized in four events from which the first two were related to early Paleozoic metamorphic and magmatic evolution. The third one is associated with crustal-scale detachment that exhumed the early Permian migmatite-magmatite core complex in the south. The whole edifice was later affected by significant Permian-

Triassic horizontal N-S shortening leading to juxtaposition of contrasting crustal levels thereby forming “apparent” terrane structure of the Mongolian Altai Zone. The whole edifice is interpreted as a Cambrian to Silurian fore-arc, affected by Devonian syn-extensional deep crustal melting. In addition,the Permian anatectic zone is interpreted as a deep part of an inverted continental rift.