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An Early Proterozoic metamorphic basement of the Tuva-Mongolia microcontinent as a part of the Tunka fold-nappe terrane (South Siberia): constraints from U/Pb geochronology

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The eastern Altai-Sayan orogenic belt in South Siberia was formed in the Ordovician as a direct result of the collision between the Siberian continent and the Tuva-Mongolia (TM) microcontinent. In this part of the Altai-Sayan, carbonate and terrigenous rocks are widespread and commonly regarded as deformed fragments of the sedimentary cover of the TM microcontinent. The TM microcontinent basement has a complex structure including small blocks of the Early Proterozoic continental crust and accreted Proterozoic island-arc units. The Gargan block, the western edge of which is considered to be Tuva-Mongolia, is the only reliable Early Proterozoic metamorphic unit of the TM basement. The ages of other high-grade metamorphic complexes in the region are Ordovician though, formed during the Siberia-TM collision, and therefore can not be regarded as fragments of the microcontinental basement as has been done hitherto.

Further eastward, tectonic nappes dominated by biotite gneisses occur within the fold-and-thrust structure of the Tunka terrane. The gneisses, which are hardly mylonitized and include boudins of garnet-amphibolite, which are intruded by migmatite veins. The gneiss nappes are thrust on the red Carboniferous conglomerates and sandstones of the Sagansair Formation, which is a synorogenic continental molasse. Zircon grains were extracted from the gneissic units and dated by ICP-MS (U/Pb). All the dated grains are (sub)rounded, mostly unzoned, however, several grains display core and rims. The U/Pb dating yielded the ages of 2.7 – 2.4 Ga in the cores and 2.0 – 1.7 Ga in the rims.

The gneiss nappe is one of a package of several nappes, all thrust over the Siberian Craton to the north. The gneisses nappe is thrust over the tectonically emplaced metacarbonate cover of the TM microcontinent. We suggest that these gneissic units are an eastern fragment of the TM microcontinent basement. Exhumation of the gneiss nappe consequently possibly took place during a Late Carboniferous – Early Permian orogenic event that (re)deformed the entire Ordovician orogenic edifice. That thick-skin tectonism not only involved the detached sedimentary cover, but clearly affected the underlying gneissic basement as well.