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Origin and tectonic evolution of the accretionary complex in north-central Mongolia

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Introduction Mongolia occupies a part of the Central Asian Orogenic Belt and consists of complicated collage of terranes. Despite various previous geological studies, we do not share a common scenario on the origin and assemblage process of these terranes. This study aims to clarify the origin and tectonic evolution of an accretionary complex (AC) in north-central Mongolia from detrital zircon geochronology.

Geologic setting North-central Mongolia consists of the following three terranes: **Haraa** and **Bayangol terranes** consisting of shallow-marine formations and an AC with many pyroclastic-rock layers, and **Khangai-Khentei terrane** consisting of an AC overlain by shallow-marine formations. The AC of the Khangai-Khentei terrane trend northeast and dip north. The pelagic chert of the AC yields Late Silurian conodonts and Early-Late Devonian radiolarians (Kurihara et al., 2009), whereas the overlying mudstone yields Early Carboniferous brachiopods.

Method We extracted detrital zircons from 13 sandstone samples of the accretionary units in the Khangai-Khentei (6 samples), Haraa (5), and Bayangol (2) terranes and measured their U-Pb ages with the Laser Ablation Inductively Coupled Plasma Mass Spectrometer equipped in the Graduate School of Environmental Studies, Nagoya University. In addition, we compiled detrital-zircon-age data of 19 sandstone samples from previous studies (Kelty et al., 2008; Bussien et al., 2014).

Results We recognized two types of detrital-zircon-age spectra. One was a multimodal pattern with small peaks at 420-650 Ma, 700-1000 Ma, 1600-2200 Ma, and 2300-2700 Ma and had 75 % or more Precambrian zircons. Three samples from the upper part of the AC showed this pattern. The other was a unimodal pattern with a large single peak between the Devonian and Early Triassic and has virtually no Precambrian zircons, indicative of an oceanic-island-arc setting. Eleven samples from the lower part of the AC showed this pattern.

Discussion We assumed, from the volcaniclastic nature of most of the sandstone samples, that the youngest peak of the spectrum is the depositional age of each sample. The depositional ages of multimodal-type sandstone clustered at 526-426 Ma, whereas those of unimodal-type sandstone clustered at 409-374 Ma (Early Devonian), 358-339 Ma (Early Carboniferous), and 289-245 Ma (Early Permian-Early Triassic). Moreover the depositional age clearly showed a downward-younging age polarity. There is a rough coincidence between the older time-interval (404-348 Ma) and the hiatus of Paleozoic igneous activity in the Tuva-Mongol Massif to the northeast of the study area (385-350 Ma). These facts indicate that the studied AC intermittently grew downwards in front of the Tuva-Mongol Massif. The multimodal-type sandstone, on the other hand, settled in the Cambrian-Ordovician and contained Pan-African (550-750 Ma) zircons indicative of their derivation from Gondwana. Among Cambrian-Ordovician sandstone along the northern Gondwana margin, that of the Kufra Basin in the Saharan Metacraton has close similarity with that of north-central Mongolia. The detrital zircons from the Kufra Basin have age peaks at 450-750 Ma, 800-1000 Ma, 1600-2200 Ma, and 2300-2800 Ma. This study hence concludes that the unimodal-type AC of north-central Mongolia grew along the subduction zone in front of the oceanic island arc of the Tuva-Mongol Massif, rifted from the Saharan Metacraton in the northern margin of Gondwana.

Keywords: U-Pb age, detrital zircon, LA-ICP-MS, Mongolia, CAOB, province