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# Late Paleozoic magmatic record of Middle Gobi area, South Mongolia and its implications for tectonic evolution: Evidences from zircon U–Pb dating and geochemistry

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ABSTRACT

Late Paleozoic subduction–accretion complexes occur widely in Middle Gobi area and provide a good opportunity for unraveling the Paleozoic tectonic evolution of South Mongolia. The magmatic rocks in the Tsavchir hudug district mainly consist of rhyolites and volcaniclastic rocks. The rhyolites show enrichment in LREE and LILE and negative Nb, Ta and Ti anomalies, indicating genesis in the subduction zone. A rhyolite sample from the Tsavchir hudug region yielded a SHRIMP $^{206}Pb/^{238}U$ zircon age of 315 ± 4 Ma (MSWD = 0.79, $n$ = 15). The andesite overlying the Namdain hundy Early Paleozoic ophiolite shows adakite geochemical features, and the two andesite samples yielded SHRIMP $^{206}Pb/^{238}U$ zircon ages of 325 ± 3 Ma (MSWD = 1.6, $n$ = 14) and 319 ± 4 Ma (MSWD = 0.56, $n$ = 13), respectively, suggesting that the Carboniferous island arc formed on the basis of Early Paleozoic accretionary complex. The granodiorite sample that intrudes the Early Paleozoic accretion complex with adakite geochemical features yielded a SHRIMP $^{206}Pb/^{238}U$ zircon age of 333 ± 4 Ma (MSWD = 1.6, $n$ = 16), representing the Late Paleozoic island arc intrusive. The SHRIMP U–Pb analyses for the tuff sandstones that occur associated with Early Paleozoic oceanic inliers in Middle Gobi area suggest detrital zircons mainly stem from the Devonian–Carboniferous arc. The age data obtained from the ophiolite (528–509 Ma) and tuff sandstone indicate the accretion in Middle Gobi area lasted from Early Paleozoic to Late Paleozoic for at least ca. 200 Ma, suggesting the ocean of the accretionary complex was the major Paleo-Asain ocean basin. The subduction related magmatic belt in Middle Gobi area includes both Early Paleozoic and Late Paleozoic island arc activities, which is consistent with the accretion duration time obtained from accretionary complex and also attests the argument of major Paleo-Asain ocean basin.



## 1. Introduction

The Middle Gobi region of Southeast Mongolia lies in the heart of the Central Asian Orogenic Belt, which represents the most significant crustal growth in the Phanerozoic and documents multistage processes of terrane accretion and amalgamation (Şengör et al., 1993; Badarch et al., 2002; Jahn, 2004; Windley et al., 2007; Xiao et al., 2009; Wilhem et al., 2012). Concerning the evolution of the Middle Gobi area, there are mainly three models: (1) accretionary wedge which grew to the south of Tuva–Mongolia microcontinent from the Ordovician to the Early Carboniferous with Upper Silurian to Lower Carboniferous magmatic arc (Şengör et al., 1993); (2) forarc/backarc basin terrane in the northern part and Middle-Late Paleozoic island arc terrane in the southern part (Badarch et al., 2002; Windley et al., 2007); (3) Middle-Late Ordovician active margin with Late Ordovician–Silurian accretionary wedge during the Early Paleozoic and peri-continental arc with back-arc basin during the Middle-Late Paleozoic (Wilhem et al., 2012).

Previous studies have demonstrated the existence of the Early Paleozoic subduction–accretion complex south of MML (Main Mongolia lineament) (Zhu et al., 2014a,b), which helps us better understand the Early Paleozoic accretionary tectonics in the Middle Gobi region. However, the relationship between Early Paleozoic subduction–accretion complex and the widely distributed Late Paleozoic magmatic rocks is not well constrained. In this paper,

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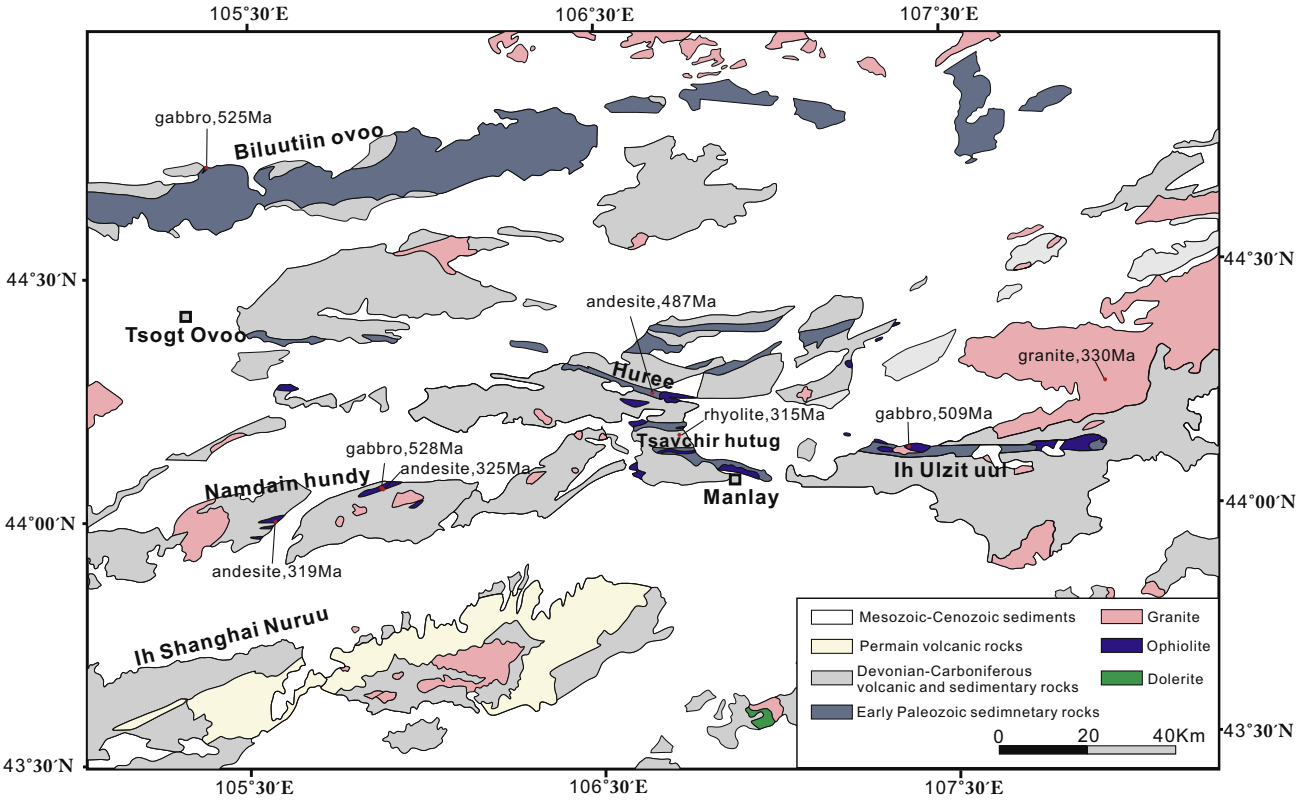


**Fig. 1.** Simplified geological map of Middle Gobi area, south Mongolia (compiled from Geological Map of The Central and Eastern Mongolia with a 1:500000 scale (Jamyandorj et al., 1990)).


**Fig. 2.** Field photos of the Late Paleozoic subduction-related volcanic rocks. (a) The rhyolite and volcaniclast in Tsavchir hutug region; (b) the graded bedding developed in volcaniclast of Tsavchir hutug; (c) the andesite overlying on the eastern part of Namdain hundy ophiolite and (d) the andesite overlying on the ultramafic rocks from the western part of Namdain hundy ophiolite.