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Peri-Pacific evolution and vertical stratification of the accretionary Altai Orogenic Belt, central Asia

Yingde Jiang (1), Karel Schulmann (2,3), Min Sun (4), Ondrej Lexa (2,5), Pavla Štípská (2,3), Alexandra Guy (2), Alfred Kröner (6), Vojtech Janoušek (2), Chao Yuan (1), and Pavel Hanžl (2)

(1) State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China (jiangyd@gig.ac.cn), (2) Czech Geological Survey, 11821 Praha 1, Czech Republic, (3) EOST, Institut de Physique du Globe, UMR 7516, Université de Strasbourg, 1 rue Blessig, 67084 Strasbourg, France, (4) Department of Earth Sciences, The University of Hong Kong, (5) Institute of Petrology and Structural Geology, Charles University in Prague, Czech Republic, (6) Institut für Geowissenschaften, Universität Mainz, Mainz 55099, Germany

The Cambrian–Ordovician pericontinental sedimentary succession, extending approximately 2,000 km from Russia to Mongolia along the Altai Range, represents one of the key elements for reconstructing the Neoproterozoic to early Paleozoic geodynamics of the Central Asian Orogenic Belt (CAOB)[Şengör et al., 1993]. In this work, we present integrated geological, geochemical, zircon U–Pb geochronological, thermodynamic modeling and geophysical data aiming at understanding the nature and evolution of such succession.
The succession is characterized by dominant terrigenous components mixed with volcanogenic material. It is chemically immature, compositionally analogous to graywacke and marked by significant input of felsic to intermediate arc components, pointing to an active continental margin depositional setting. Detrital zircon U–Pb ages suggest a source dominated by products of early Paleozoic magmatism prevailing during the Cambrian–Ordovician and culminating at ca. 500 Ma [Jiang et al., 2017]. We propose that the succession forms an "Altai sedimentary wedge", together with the contemporary "Ikh-Mongol Magmatic Arc System" [Janoušek et al., 2018], represents a huge subduction-related structure ("Altai accretionary system") riming the margin of the Mongolian Precambrian Zavhan-Baydrag blocks. Such an accretionary system probably shared the early Paleozoic Pacific oceanic accretionary with the Terra Australis Orogen (TAO) of NE Gondwana.
The roles of granitoid magmatism in differentiation and stabilization of the accretionary wedge are further evaluated. Emplacement of voluminous Silurian–Devonian granitoids along the southern margin of the studied succession (i.e. the Chinese Altai) has been increasingly noted in the recent years [e.g., Wang et al., 2006; Yuan et al., 2007]. The close temporal and spatial relationship between the anatexis of the sedimentary succession and the formation of granitoids, as well as their geochemical similarities, imply some genetic link. Whole-rock geochemistry and pseudosection modeling show that regional anatexis of fertile sediments could have produced a large amount of melts compositionally similar to the granitoids. Such process could have left a high-density garnet- and/or garnet–pyroxene granulite residue in the deep crust, which can be the major reason for the gravity high over the Chinese Altai. Our results show that melting and crustal differentiation can transform accretionary wedge sediments into vertically stratified and stable continental crust [Jiang et al., 2016]. This may be a key mechanism contributing to the peripheral continental growth worldwide.
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