

Switch of geodynamic setting from the Paleo-Asian Ocean to the Mongol-Okhotsk Ocean: evidence from granitoids in the Duobaoshan ore field, Heilongjiang Province, Northeast China

Chao Zhao¹, Kezhang Qin², Guoxue Song³, and Guangming Li²

¹Chang'an University

²IGG Institute of Geology and Geophysics, Chinese Academy of Sciences

³UCAS University of Chinese Academy of Sciences

November 24, 2022

Abstract

This paper presents new zircon U-Pb ages and whole-rock geochemical data for Triassic granitoids in the Duobaoshan ore field, in the eastern Central Asian Orogenic Belt (CAOB). Dating results reveal that the Triassic granitoids in the Duobaoshan area were emplaced ca. 244–223 Ma. These samples are typical subduction-related arc magmatic rocks that are enriched with large-ion lithophile elements (LILEs), depleted in high field strength elements (HFSEs), and have relatively high Sr (average 1,036 ppm) and low Y (average 10 ppm) and Yb (average 1 ppm) contents that exhibit adakite-like geochemical properties. The samples feature a juvenile whole rock average initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.70394 and an average $\epsilon_{\text{Nd}}(t)$, zircon $\epsilon_{\text{Hf}}(t)$, and two-stage Hf model age of 4.62, 10.29, and 766 Ma respectively. These geochemical features reveal a thickened lower crust source. Comprehensive analyses of the early Paleozoic, Triassic, and early Jurassic granitoids in the Duobaoshan area indicate that the magmatism of these three stages was related to the melting of the juvenile lower continental crust materials. The early Paleozoic was the primary period of vertical crust growth, during which time the juvenile lower continental crust was formed. The Triassic granitoids derived from magma were generated by partial melting of the thickened juvenile lower crust and the Jurassic granitoids derived from the partial melting of the delaminated juvenile lower crust. Geological observation and tectonic setting analyses reveal that the Paleo-Asian Ocean tectonic regime in the Duobaoshan area switched to the Mongol-Okhotsk Ocean in the Mesozoic after its closure. The early Paleozoic granitoids were formed in a subduction setting related to the northwestward subducted Paleo-Asian Oceanic slab underlying the Erguna-Xing'an composite block. The Triassic granitoids were formed under a supra-subduction extensional regime related to the southward subduction of the Mongol-Okhotsk Ocean, and the Jurassic granitoids were generated under a slab rollback setting related to the late stage subduction of the Mongol-Okhotsk Ocean.



Switch of geodynamic setting from the Paleo-Asian Ocean to the Mongol-Okhotsk Ocean: Evidence from granitoids in the Duobaoshan ore field, Heilongjiang Province, NC

Chao Zhao

Key Laboratory of Mineral Resources, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China

This paper presents new zircon U-Pb ages and whole-rock geochemical data for Triassic granitoids in the Duobaoshan ore field, in the eastern Central Asian Orogenic Belt (CAOB). Dating results reveal that the Triassic granitoids in the Duobaoshan ore field were emplaced ca. 244–223 Ma. These samples are typical subduction related arc magmatic rocks that are enriched with large-ion lithophile elements (LILEs), depleted in high field strength elements (HFSEs), and have relatively high Sr (average 1036 ppm) and low Y (average 10 ppm) and Yb (average 1 ppm) contents that exhibit adakite-like geochemical properties. The samples feature a juvenile whole rock average initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.70394 and an average $\epsilon_{\text{Nd}}(t)$, zircon $\epsilon_{\text{Hf}}(t)$, and two-stage Hf model age of 4.62, 10.29, and 766 Ma respectively. These geochemical features reveal a thickened lower crust source. Comprehensive analyses of the early Paleozoic, Triassic, and early Jurassic granitoids in the Duobaoshan ore field indicate that the magmatism of these three stages was related to the melting of the juvenile lower continental crust materials. The early Paleozoic was the primary period of vertical crust growth, during which time the juvenile lower continental crust was formed. The Triassic granitoids derived from magma were generated by partial melting of the thickened juvenile lower crust and the Jurassic granitoids derived from the partial melting of the delaminated juvenile lower crust. Geological observation and tectonic setting analyses reveal that the Paleo-Asian Ocean tectonic regime in the Duobaoshan ore field switched to the Mongol-Okhotsk Ocean in the Mesozoic after its closure. The early Paleozoic granitoids were formed in a subduction setting related to the northwestward subducted Paleo-Asian Oceanic slab underlying the Erguna-Xing'an composite block. The Triassic granitoids were formed under a supra-subduction extensional regime related to the southward subduction of the Mongol-Okhotsk Ocean, and the Jurassic granitoids were generated under a slab rollback setting related to the late stage subduction of the Mongol-Okhotsk Ocean.

