Geochemical and Hf Isotopic Compositions of Late Jurassic Volcanic Rocks from the Central Great Xing'an Range, Northeast China: Petrogenesis and Tectonic Implications

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Abstract: No consensus has been reached regarding the geodynamic setting of the Jurassic magmatism in NE China, since few geochronological and geochemical studies have been performed on these Jurassic igneous rocks. We report geochronological, whole-rock geochemical, and zircon Hf isotopic data for Late Jurassic rhyolites in the central Great Xing'an Range of northeastern China, to determine their petrogenesis, source, and tectonic setting. Laser ablation–inductively coupled plasma–mass spectrometry (LA–ICP–MS) zircon U–Pb ages indicate that the rhyolites previously mapped as the lower Permian Dashizhai Formation in the Wuchagou region formed during the Late Jurassic (162–154 Ma). Geochemically, these rhyolites belong to the mid- to high-K calc-alkaline series and show peraluminous characteristics and consistent correlations between major elements and SiO_2. They are characterized by enrichments in large ion lithophile elements (LILEs; e.g., Rb and K) and light rare earth elements (LREEs), and depletions in high field strength elements (HFSEs; e.g., Nb, Ta, and Ti) and heavy rare earth elements (HREEs). In situ Hf isotopic analyses of zircons from the rhyolites reveal relatively homogeneous Hf isotopic compositions, with $\varepsilon_{Hf}(t)$ values of +4.84 to +9.44, and two-stage model ages of 606–895 Ma. Based on their eruption ages, geochemical characteristics, and Hf isotopic compositions, we conclude that the magmas that formed the Late Jurassic rhyolites were produced during partial melting of a Neoproterozoic quartz-bearing amphibolite-facies mafic crust. These magmas subsequently underwent extensive fractional crystallization of plagioclase, hornblende, Ti-bearing phases, monazite, and apatite. Combined with previous data, our results demonstrate that the Late Jurassic volcanic rocks in the Great Xing'an Range were formed in a post-collisional extensional setting. The gravitational collapse of the orogenically thickened crust was caused by break-off of the subducted oceanic slab and upwelling of asthenosphere after closure of the Mongol–Okhotsk Ocean.

Key words: Great Xing'an Range, Late Jurassic, volcanic rocks, geochemistry, Mongol–Okhotsk Ocean

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