Geochemistry and geochronology of OIB-type Early Jurassic magmatism in the Zhangguangcai range, NE China, as a result of continental back-arc extension

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Mafic intrusive rocks originated from subduction-induced magmas record valuable information on mantle processes, as their geochemical characteristics provide keys to the origin of mantle melt sources, magma evolution (partial melting, melt migration, assimilation contamination, fractional crystallization) and partial melting conditions (temperature, pressure, oxygen fugacity, aqueous fluid occurrence and compositions). Previous studies of Early Jurassic (190–180 Ma) bimodal volcanic rocks, ultramafic–mafic intrusions and A-type granitoids in the Songnen–Zhangguangcai Block (NE China) suggest a continental back-arc extensional setting of their formation related to westward subduction of the palaeo-Pacific plate. The Zhangguangcai Range in the Xing'an Mongolian Orogenic Belt, NE China, contains Early Jurassic (c. 188 Ma) Dabaizigou (DBZG) porphyritic dolerite. Compared with other island-arc mafic rocks, the DBZG dolerite is characterized by high trace-element contents, relatively weak Nb and Ta enrichments, and no Zr, Hf or Ti depletions, similar to OIB-type rocks. Analysed rocks have $(^{87}Sr/^{86}Sr)_i$ ratios of 0.7033–0.7044, relatively uniform positive εNd(t) values of 2.3–3.2 and positive εHf(t) values of 8.5–17.1. Trace-element and isotopic modelling indicates that the DBZG mafic rocks were generated by partial melting of asthenospheric mantle under garnet-to spinel-facies conditions. The occurrence of OIB-like mafic intrusion suggests significant upwelling of the asthenosphere in response to lithospheric attenuation caused by continental rifting. These processes occurred in an incipient continental back-arc environment in the upper plate of a palaeo-Pacific slab subducting W–NW beneath East Asia.