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Geological characteristics and petrogenesis of the Cenozoic potassic volcanic rocks from the Wudalianchi area, NE China

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It is still hotly debated about the origin of the Cenozoic potassic volcanic rocks from NE China. One of the key questions concerned by scholars is to identify the source lithology of these rocks with EMI affinities: a peridotite-dominated source or a pyroxenite-dominated source? A detailed petrological and geochemical survey has been carried out to discover the nature of Wohushan potassic volcanic rocks in the Wudalianchi area. These volcanic rocks are mainly composed of tephriphonolite, phonotephrite, and basaltic trachyandesite. The geochemical analyses show that the Wohushan volcanic rocks are characterized by enrichement of LREE and some LILE e.g. Ba, K, Pb, Sr, and depletion of HREE and some HFSE e.g. Th, U, Nb, Ta, Ti without pronounced Eu and Sr troughs. They also exhibit enriched Sr–Nd–Hf isotopic compositions 87Sr/86Sr=0.7052∼0.7053, εNd=-5.4∼-5.1,176Hf/177Hf =0.28254∼0.28257, εHf=-8.1∼-7.1 and extremely unradiogenic Pb isotopic compositions 208Pb/204Pb = 36.798∼36.891, 207Pb/204Pb = 15.433∼15.438, 206Pb/204Pb = 16.835∼16.892. According to the petrographic, mineralogical and geochemical characteristics of the Wohushan volcanic rocks, we speculate that these rocks may be associated with low-degree partial melting of a phlogopite-bearing garnet pyroxenite source in the lithosphere, where EMI components are stored. The enriched components with EMI affinities were probably originated from MTZ Mantle transition zone where carbonate-bearing sediments were isolated for a long time ∼1.5 Gyr or ∼2.2 Gyr. The carbonate-bearing melts derived from these sediments mentioned above ascend to the asthenosphere-lithosphere boundary, thereby forming pyroxene-dominated veins in the lithosphere. These veins have a lower solidus than peridotite, they therefore are easy to trigger partial melting during fault activities or reginal thermal anomalies. This work gives insight into the petrogeneis of the Cenozoic potassic volcanism in NE China.