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Multiple Isotopic Constraints on An EMI Affinity Ancient Mantle Segment beneath An Orogenic Belt

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It is well known that as a common sense in world-wide mantle geochemical community, one of the enriched mantle end-members, i.e. EMI in continental region has been constantly attributed to craton-related subcontinental lithospheric mantle (eg. Zindler and Hart, 1986, Hofmann, 2003). Here we present a case study on a suite of Quaternary high-K to ultrahigh-K volcanic rocks, erupted in northern part of NE China, which do show a strong EMI affinity for its mantle source located within a Paleozoic orogenic belt in NE China. This is so far a sole case at least in northern hemisphere to expose mantle-derived rocks with typical EMI geochemical signature in such a tectonic setting.

Based on multiple isotopic approach, including Sr, Nd, Pb, Hf and Os isotopic compositions, a systematic geochemical survey has been conducted. The major and trace element data show high K₂O, up to 9-11%, and low SiO₂ contents (42-45%), together with highly enriched in REE with extremely fractionated LREE/HREE ratios (55-70). Furthermore, results of radiogenic isotope analysis unambiguously indicate a typical EMI isotopic geochemical signature, especially in Pb isotope composition, such as ²⁰⁶Pb/²⁰⁴Pb could be as low as 16.3-16.4, which is comparable with the lowest Pb isotopic ratios recorded in leucite-bearing potassic volcanic rocks from Lucite Hill and Smoky Butte, North America. In addition, a series of metasomatic minerals, such as phlogopite, apatite and so on have been recognized from mantle-derived xenoliths. Detailed mineralogical and geochemical studies have demonstrated the multiple and

distinct mantle metasomatism, occurred in different geological episode, from ancient (Archean?) to recent time.

According to above observations, it is postulated that these ultrahigh potassic rocks were derived from an ancient phlogopite-bearing garnet facies lithospheric mantle, which is deagglomerated and detached from the overlying crust that was formed since Neoproterozoic accompanying with the evolution of Central Asian Orogenic Belt (CAOB). As two major Archean cratons, namely the Siberia and North China cratons exist on the northern and southern side of the CAOB, respectively, it is speculated that the mantle source feeding these potassic rocks is likely a relic cratonic keel or fragment of part of either Siberia or North China cratons during the formation of CAOB in Paleozoic. No doubt, since then, this mantle source has experienced a multiple stage reworking as demonstrated by a series of modal metasomatised products and cryptic metasomatized geochemical signatures.

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Key words: EMI, potassic volcanic rocks, subcontinental lithosphere, CAOB

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