Origin of the Archean potassic granitoids: Mg isotopes evidences

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The primary upper continental crust (UCC) is dominantly made up of sodic Archean TTG rocks (tonalite, trondhjemite and granodiorite). However, the composition of UCC show an abrupt transition towards more potassic at the late Neoarchean, in good agreement with the increased abundance of potassic granitoids. It is still a considerable debate what processes caused such compositional changing and increased the crustal maturation. Whether it's resulted by reworking of igneous rocks (TTGs and medium-high K basalts) alone, or input of the supracrustal sedimentary rocks into the magma sources? Mg isotopes are the effective tracer to distinguish the above two possible mechanisms.

We carried out high-precision magnesium isotopic analysis on Neoarchean TTGs (2558-2595Ma) and potassic granitoids (2520-2545Ma), collected from Xingcheng area, North Chian Craton (NCC). TTGs show mantle like Mg isotopic composition of -0.39 to -0.22 ‰, which agree with the partial melting origin of basaltic precursors. By contrast, potassic granitoids possess highly variable δ^{26}Mg of -0.43 to 0.90‰, which can be subdivided into two groups: Group Ⅰ have TTG-like δ^{26}Mg values range from -0.43 to -0.21‰, suggesting an igneous source; Group Ⅱ is characterised by significantly high δ^{26}Mg values of 0.63 to 0.90‰. Such heavy Mg isotopic compositions cannot be resulted by secondary alteration, since no correlation between δ^{26}Mg values and CIA or LOI has been found. Instead, the involvement of supracrustal sedimentary rocks with heavy Mg isotopic composition into the granitic sources was required. Consequently, weathering had an important effect on the crustal maturation.