Weathering dominated the Archean crustal evolution: Evidence from Mg isotopic compositions of Archean potassic granitoids

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The Archean Era is a main period for the growth of continental crust. In general, the primary continental crust is Na-rich TTG and modern continental crust is K-rich. Potassic granitoids are commonly considered to mark the increased crustal maturity. Their petrogenesis is crucial to understand the evolution of continental crust. However, the debate has occurred over whether the compositional evolution was dominated by remelting of pre-existing TTG [1], or by continental crust weathering and consequent sedimentary process [2]. Here, with a purpose to evaluate the role of the two mechanisms mentioned above, we measured Archean potassic granitoids (2.9 to 3.1 Ga) from Anshan area, North China Craton (NCC), and some NCC TTGs (2.6 to 2.8 Ga) for comparison. It is not surprising to find these TTGs have a mantle-like δ^{26}Mg (-0.13‰ to -0.36‰), consistent with that derivation by melting of a basaltic precursor do not fractionate Mg isotopes. By contrast, NCC potassic granitoids yield highly variable δ^{26}Mg values from -0.02‰ to -0.65‰. Such a Mg isotopic variation can not be attributed to secondary alteration since no correlation with CIA or LOI has been found. Instead, the involvement of carbonates and clastic sediments into the sources were required, suggesting a strong continental weathering event before 2.9-3.1Ga. This implies that chemical weathering has a dominant role in crustal evolution and contributes to the quick drop of atmospheric CO_2 during 3.2-2.9 Ga [3].

[1] Sylvester (1994) *DPG* **11**, 261-314. [2] Wan *et al.* (2015) *AJS* **315**, 620-670. [3] Lowe *&* Tice (2004) *Geology* **32**, 493-496.