Origin and Evolution of REE-Nb Enriched Carbonatites: Constraints from The Miaoya Syenite-Carbonatite Complex, China

JIAN-HUI SU[1]*, XIN-FU ZHAO[1,2]

[1] Faculty of Earth Resources, China University of Geosciences, Wuhan 430074, China (*correspondence: jhsu@cug.edu.cn)

[2] State Key Laboratory of Geological Processes and Mineral Resources, Wuhan 430074, China (xfzhao@cug.edu.cn)

Carbonatites are well kown as enconomic resources for rare metals such as REE and Nb. Experimrntal results have confirmed that carbonatites can be directly formed by low degree partial melting of a carbonated mantle source, or evolved from parental carbonated silicate melts through either crystal fractionation or liquid immiscibility[1]. However, the origin and evolution processes, especially enrichment mechanism of rare metals, of carbonatites and related silicate rocks are not well understood. The early Silurian Miaoya syenite-carbonatite complex, located in central China, hosts the second largest Nb-REE source in China, and consists of syenites, calcite carbonatites, and ferrodolomite carbonatites. Based on the fieldtrip relationship, similar zircon U-Pb ages and Sr-Nd isotopes, the syenites and carbonatites were suggested to form from a same source. The Syenites consist predominantly of k-feldspars, indicating the accumulation of K-feldspars at the early stage. Nb was initially enriched in the carbonated silicate magmas, and gradually reached pyrochlore and columbite saturation level in syenites due to fractional crystallization. Subsequently,calcium carbonatitic melts were separated from the carbonated silicate magmas when the parental magmas reached a carbonate saturation level after crystallization of most silicate minerals. The ferrodolomite carbonatites are the last products of the evolved carbonatitic melts. REEs are mainly enriched in carbonatite melts, and are improved to economic values during the fractionation processes from calcite carbonatite to ferrodolomite carbonatite. The magmatic event was likely related to a rifting event occurred in the northern part of the South China Block and followed by the opening of Paleotethys during the late Paleozoic[2].

[1] Gittins, J (1988) Nature 355.295-296. [2]Wu et al. (2013) Gondwana Research 23. 1402-1428.