Geochemical and Raman Spectral Constraints of Alteratioin in Pyrochlore from the Kuiqi granites (East China)

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Pyrochlore is a good geological repository for the disposal of highly radioactive materials. Many studies have been made on its stability with synthetic samples. In this study, we present a phenomena of alteration in natural pyrochlore grains from the Kuiqi granites (East China).

Abundant pyrochlores occur in interstices. The grains are ~100－400 μm in size, and generally display zoned texture consisting of three distinctive compositions (Pyc-I, -II and –III from the core to the rim). EMPA results indicate all three zones belong to the pyrochlore subgroup (Nb+Ta>2Ti; Nb≥Ta). However, they have different contents of Na, Ca, U, Pb in the A-site (Fig. 1a). In addition to Na and Ca, Pyc-I also contains 12-14 wt.% UO_2 and can be consequently termed as uranian pyrochlore. Contents of Na, Ca and U in Pyc-II decrease markedly, but Pb becomes dominant. Thus, Pyc-II is classfied into the uranian plumbopyrochlore field. The fissured texture of Pyc-II suggests metamictization due to radioactive element (such as U and Th), in consistent with low total element values. The highest content of Pb is measured in Pyc-III with PbO up to 57.3 wt.%. In contrast, Na, Ca, U and Th contents are very low. Pyc-III can also be considered as a typical plumbopyrochlore.

Three zones are also distinctive in the Raman spectrum between 200 and 1200cm^{-1} (Fig. 1b). Although the core contains 12-14 wt.% UO_2, it displays a typical Raman peaks for pyrochlore. In contrast, Pyc-II is characterized by very broad FWHM, even flat Raman spectrum, thus indicative again of strong metamictization of this zone. The rim (Pyc-III) show well-resolved Raman bands with slight shifts related to difference in atomic sizes between Pb and Na.

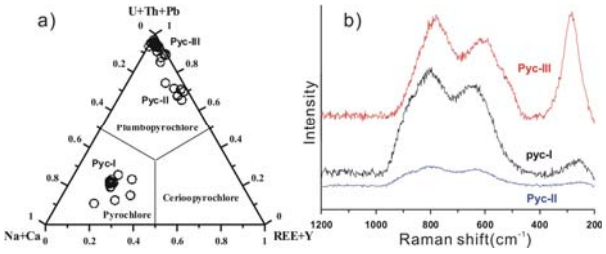

Fig.1. a) Classification of pyrochlore-group minerals from Kuiqi granite; b) Micro-Raman spectra collected from three types of pyrochlores in one grain.