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Alteration Zonation and Genesis of the Houkeng Lithocap, East China

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Lithocaps are wildly distributed in southeastern China, but no research has been done related to the lithocaps before. So we are trying to explore for potential porphyry-epithermal deposits among these lithocaps.

We conducted SWIR mapping at Houkeng lithocap using Terrespec 3 aiming to understand vertical and horizontal hydrothermal alteration zonation. The results indicate the alteration grades vertically from corundum-sericite at depth, through quartz-sericite-pyrophyllite, to alunite-kaolinite assemblages at shallow levels. Laterally, vuggy quartz-rutile (Fig. 1a) develops in the core, grading outward to advanced argillic (alunite-pyrophyllite-kaolinite-diaspore-aluminum phosphate and sulphate minerals) and argillic (kaolinite-illite-montmorillonite) alteration. Moreover, The SWIR 1,480-nm absorption peak of alunite at Houkeng ranges from 1,478 to 1,493 nm. The absorbtion peak shifts to higher wavelengths when Na/(Na + K) are higher, which is consistent with the research done in Lenpato lithocap by Chang (2011). Backscattered electron images, CL, and EMPA analyses of alunites show that alunites are typically zoned, with the core high in Ca, Na, and P contents, whereas K and Al are enhanced in the rim. Locally there are small APS minerals included in alunite.

Pyrophyllite, whose SWIR spectrum absorption peak at 2,167 nm, shows two origins: sericite retrograde alteration (Fig. 1d) and kaolinite metamorphism (Fig. 1e). Corundum (Fig. 1h) is altered to sericite by hydrothermal alteration, and later dickite (Fig. 1g) crosscutting advanced argillic alteration indicates a retrograde process.

Alunite from Houkeng shows average $\delta^{18}O$ = 8.29‰ and δD= -52.83‰ that suggest a dominant magmatic water origin. Alunite yields $\delta^{34}S$ values from 16.1 to 19.4‰ (average 17.81‰), and the associated pyrite $\delta^{34}S$ values vary from -6.6 to -10.5‰ (average -8.55‰). Average $\Delta^{34}S_{Alun\text{-}Py}$ between alunite and pyrite is 26.36‰, further indicating their magmatic origin.

Secondary copper mineral veins (Fig. 1i) developed near the Houkeng lithocap indicate a potential for porphyry and high sulfidation in and below the lithocap.

Fig.1. Hand specimen photo, microphotographs, and SEM photos of alteration assemblages in Houkeng lithocap: a. vuggy quartz with coarse-grained pyrite; b. grey quartz and white alunite and fine grained pyrite; c. cross-polarized photograph of alunite and kaolinite; d. SEM photo of muscovite transforming into pyrophyllite; e. SEM photo of kaolinite transforming into pyrophyllite; f. cross-polarized photograph of diaspore, dickite; g. late dickite vein crosscutting advanced argillic alteration; h. SEM photo of corundum transformed into muscovite; i. secondary Cu minerals in Houkeng lithocap. Abbreviations: Alu = alunite, Cor = corundum, Dic = dickite, Dis = diaspore, Kao = kaolinite, Py = pyrite, Pyr = pyrophyllite, Q = quartz.