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Geology and geochemical characteristics of lithocap in the Lu-Zong basin, Anhui, China

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The Lujiang-Zongyang ore cluster is an important part of Middle-Lower Yangtze mineral belt. It contains many iron deposits (e.g., Luohe, Nihe), vein-type Cu and Pb-Zn deposits, and many nonmetallic deposits, particularly of alunite. Its alunite reserves are the second largest in China.

The Fanshan alunite deposit is located in the northern part of the Lu-Zong basin, and is the largest alunite deposit in the basin. The host lithocap has an area of >50 km^2. Based on whole rock and SWIR analyses, the lithocap is divided into three types: siliceous altered rocks, alunite altered rocks, and clay altered rocks. All previous studies in the area concentrated on the alunite deposit geology and alunite mineral reserves. Our study aims to determine the mineral assemblages present in the lithocap and their geochemical characteristics. The Fanshan alunite deposit occurs in the Zhuanqiao Formation, and is hosted by the lower tuff and upper trachyandesite units. Two N-trending faults formed after the deposit. In the northeast part of the deposit, syenite to monzonite intrusions cut the lithocap. The alunite at Fanshan is both massive and disseminated. It shows textures varying from euhedral-subhedral and coarse-grained, and lath-shaped, to cryptocrystalline. Associated minerals are quartz, kaolinite, dickite, pyrophyllite, illite, and nacrite. The alunite and associated clay minerals are zoned horizontally away from Fanshan; assemblages are quartz+alunite+Fe-oxide, quartz+kaolinite±dickite+alunite, quartz+kaolinite±dickite, and kaolinite+pyrophyllite+illite outwards from the deposit. Except for SiO_2, other major element oxides (K_2O, Na2O, Al_2O_3, Fe_2O_3, TiO_2, P_2O_5) decrease in the siliceous rocks as a result of acid leaching. Other altered rocks show similar geochemical characteristics, but the contents of SiO_2, Al_2O_3, Fe_2O_3, and P_2O_5 have a wider range; K_2O and Na_2O decrease, particularly Na_2O, whereas TiO_2 contents are mostly unchanged. Chemical changes in the lithocap are closely related to the composition of the hydrothermal fluids.

Lithocaps form in near-surface environments (<1km) as a result of leaching of permeable rocks by acid fluids. In the acid fluids, SO^{2-} and HCl-bearing volatiles exsolve from underlying magmas, and mix with ground water. Low pH solutions are generated by dissolution of HCl and by disproportionation of SO_2 to produce H_2SO_4 and H_2S. Residual or vuggy quartz and minor rutile are produced in the most acid parts, whereas under less acid conditions quartz-alunite is produced with pyrite where Fe is available. The result is zoning from vuggy quartz to quartz+alunite+pyrite zones, and further from the center, clay minerals are formed. Later, near the surface, pyrite is oxidized to Fe oxides, producing Fe oxide-bearing assemblages. The extensively developed lithocap in the Lu-Zong basin opens the possibility that high-sulfidation epithermal gold-bearing systems may be present.