ENRICHMENT OF LIGHT RARE EARTH ELEMENTS IN ADVANCED ARGILLIC ALTERATION FROM THE HUGO DUMMETT DEPOSIT,MONGOLIA

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The advanced argillic zone associated with the Hugo Dummett porphyry Cu-Au deposit, South Gobi desert, Mongolia, consists of residual quartz, pyrophyllite, kaolinite, zunyite, alunite, topaz, andalusite, aluminium phosphate-sulfate (APS) minerals and corundum (in approximate order of abundance), and is geochemically is characterized by moderate enrichment of the light REE's and strong depletion of heavy REE's. Calcium, Sr, and Pb-bearing APS minerals such as woodhouseite CaAl3(PO4)(SO4)(OH)6), svanbergite SrAl3(PO4)(SO4)(OH)6 and hinsdalite (Pb,Sr) Al3(PO4)(SO4)(OH)6 occur as euhedral crystals (up to 0.2 mm) with oscillatory and core to rim zonation, and enclose earlier formed light REE-bearing APS minerals. The inner parts of APS crystals are P and LREE enriched but depleted in S and outer parts are Ca, Ba enriched, but with relatively lower Sr content. Florencite (La,Ce)Al3(PO4)(SO4)(OH)6 has been found for the first time in this deposit. Light REE enrichment is up to x 3 for La and Ce, and x 2 for Nd, compared to REE abundance of La: 7, Ce:16 and Nb:12 ppm, compared to relatively unaltered basaltic protolith. The light REE's may originally have been held mainly by apatite, which breaks down during intense hydrolytic alteration to form APS minerals. The APS minerals provide a carrier for light REE's, whilst the heavy REE's, are strongly depleted in the advanced argillic zone, with complete destruction of ferromagnesian minerals. The occurrences of APS minerals are in close association with alunite, diaspore and other hydrothermal minerals indicating a hypogene origin for these phases. Although, examples of economic REE mineralization formed by advanced argillic alteration are apparently not known, the occurrence of REE-bearing APS minerals show there is potential for such deposits to form.