Hydrothermal and Supergene Alterations in the Granitic Cupola of Montebras, Creuse, France

P. Dudoignon, D. Beaufort and A. Meunier

Université de Poitiers, U.F.R. Sciences, Laboratoire de pétrologie des altérations hydrothermales E.R.A. 220 du C.N.R.S., 40, Avenue du recteur Pineau 86022 Poitiers Cedex, France

Abstract: A mineralogical investigation of the highly kaolinized Chanon granite and albite-muscovite granite of the Montebras cupola, Creuse, France, indicates that the magmatic stage was followed by two hydrothermal events related to successive cooling stages and by late weathering. The hydrothermal alteration was accompanied first by greisen formation and then a broad kaolinization process, which pervasively affected the granitic bodies. In the Chanon granite, the greisens are characterized by a trilithionite-lepidolite-quartz-tourmaline assemblage and are surrounded by concentric alteration zones. From the greisen to the fresh granite three zones were distinguished: (1) a zone characterized by secondary brown biotite (<400 ° C), (2) a zone characterized by secondary green biotite and phengite (300 – 350 ° C), and (3) a zone characterized by the presence of corrensite (180 ° – 200 ° C) located around greisen veinlets. In the albite-muscovite granite the greisen is composed of lepidolite and quartz. This mineral assemblage was followed locally by Li-tosudite crystallization. During the second hydrothermal event (<100 ° C) an assemblage of kaolinite, mixed-layer illite/smectite (I/S), and illite formed pervasively and in crack fillings; the smectite layers of the US are potassic. Weathering produced Fe oxide and kaolinite. This kind of alteration developed mainly in the overlying Chanon granite. Here, Ca-Mg-montmorillonite formed in subvertical cracks, which transect the two granitic bodies, and hydrothermal I/S was obliterated by Ca-Mg-montmorillonite.

The hydrothermal parageneses were apparently controlled by magmatic albitization and the bulk chemistry of the two granitic bodies. The albitization, the formation of large micaceous greisens, and the successive recrystallizations of biotite (which was the most susceptible phase to alteration) provide information on the temperature range and chemical mobility during successive cooling stages. Si and Mg activities increased as the temperature of alteration decreased, and secondary Mg-biotite and Mg-phengite crystallized as long as the K activity was sufficient. The crystallizations of secondary biotite and phengite were followed by the crystallization of I/S during stages of low K activity. Secondary hydrothermal phases in the Chanon granite contain substantial Fe and Mg. Secondary hydrothermal phases in the albite-muscovite granite contain only small amounts of Fe and Mg, suggesting a lack of chemical exchange between the enclosing Chanon granite and the albite-muscovite granite, which is depleted in Fe-Mg-rich primary phases, such as biotite.

Key Words: Biotite • Chlorite • Corrensite • Granite • Greisen • Hydrothermal • Kaolin • Petrography • Weathering

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