

## MICA-VERMICULITE INTERGROWTH EXPANSION THROUGH NATURAL PROCESSES IN PYROCLASTIC CARBONATITES FROM CATANDA (ANGOLA)

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Catanda carbonatites are found in the Kwanza Sul province, about 350 km SE of Luanda (Angola). These are formed by small volcanic cones consisting of a series of pyroclastic rocks with minor interbedded carbonatitic lavas [1]. Phlogopite as a carbonatitic mineral and annite as xenocrystal provided from hosted granites are found in the Catanda pyroclastic carbonatites. Secondary minerals such as vermiculite have also been reported [1].

Under petrographic study, phlogopite and annite present textures as non-expanded, slightly expanded and strongly expanded defining accordion texture. Vermiculite can be distinguished using SEM-EDS in back-scattered electron (BSE) mode. Both phlogopite and annite are affected by the vermiculitization process.

Previous work [2,3] has proposed that vermiculitization of micas proceeds through the sequence: mica to interstratified mica-vermiculite to vermiculite, and this is determined by XRD as peaks at 10, 12 and 14 Å, respectively. In the present study of the Catanda samples, diffraction peaks were identified at 10 and 14 Å only, and no 12 Å peak was found. We propose that the Catanda intermediate product of phlogopite-vermiculite should not be considered as an interstratified phlogopite-vermiculite but a mixture of phlogopite and vermiculite, consisting of intergrowths of both minerals in an intermediate stage of alteration, similar to the intergrowth of phyllosilicates described in other works [4,5]. By EMP analysis, vermiculite generated by the alteration of phlogopite is dominated by Ca in the interlayer position, it has  $d_{002}$  values of 14.6-14.8 Å identified by XRD, so the alteration of phlogopite produced Ca-vermiculite. For the alteration of annite, all analysis shows Mg < 0.5 and K<sub>2</sub>O contents of > 5 wt.%. We propose that annite altered to K-vermiculite which has  $d_{002}$  spacing of 10.42 Å, so the intermediate product between annite and K-vermiculite has  $d_{002}$  about 10 Å. The  $d_{002}$  spacing of 10.07 Å corresponds to annite and phlogopite, also could be K-vermiculite, so as intergrowth or interstratified annite and K-vermiculite.

Pure vermiculites have little ability to expand but do increase in polyphase intergrowths, which are defined as intra-particle mosaics between mica and vermiculite, a rapid heating (>300 °C) may generate the expansion of mica-vermiculite intergrowths [4]. We propose that the formation of the accordion texture as product of expansion is related to the rapid heating caused by the volcanic process that occurred in the Catanda area [1]. The intergrowth vermiculite-phlogopite stimulated the expansion. To the authors' knowledge, this is the first report of the accordion texture related to the vermiculite expansion occurring under natural conditions.

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