

D-10 Formation of secondary minerals due to weathering of some phosphate rocks of the Sri Lankan Precambrian

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Two phosphate deposits, Eppawala (Anuradhapura district) and Kawisigamuwa near Ridigama (Kurunegala district) occur as residual weathering sections developed on apatite-bearing carbonate rocks and apatite-rich pegmatitic intrusions respectively. Yellowish green, subhedral apatite crystals of size varying from a few mm to several cm are embedded in fine matrices composed of ferruginous, aluminous, siliceous and secondary phosphatic materials. The mineralogical composition of primary apatite and the fine matrix were studied by the X-ray diffraction method (XRD). The pre-treatments were carried out to remove the organic matter and the free iron oxides of the fine matrix prior to XRD. The fractions of clay, fine silt and coarse silt were separated by sedimentation based on Stock's law, whereas fractions of very fine, fine, medium, coarse, and very coarse were mechanically sieved.

According to XRD analyses, yellowish green primary crystals from both Eppawala and Ridigama have chlor-fluor-hydroxylapatite (CFHA) and fluorapatite (FA) as major and minor components, respectively. The mineralogical composition of single crystals of apatite is not homogeneous and it shows 2 phases: CFHA and FA. The detailed mineralogical investigation on the various size fractions of the fine matrix showed that coarse fractions of the matrix are dominant in minerals such as CFHA and FA whereas the finer portion of the matrix is rich in crandallite, kaolinite, goethite and quartz. Carbonate-fluorapatite is the major component in the fine matrix, and it was identified in every size fraction of the matrix. Due to substitution of CO_3^{2-} to PO_4^{3-} in fluorapatite structure, carbonate-fluorapatite forms as a secondary product under intense weathering conditions of the Sri Lankan tropical environment. Clay minerals, mainly kaolinite and goethite are formed due to weathering of aluminosilicates. Crandallite, a common calcium-iron-aluminium phosphate could form in the matrix by the reaction of primary apatite with meteoric water which is rich in Al and Fe.