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New Contribution to Mineralogy of the Mussoorie Phosphorite

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In the Lesser Himalaya, the Mussoorie Synform is made up of Neoproterozoic-Lower Cambrian rocks and exposes several critical sections where the Pc-C boundary is marked by the prominent chert-phosphorite-black shale rock unit of the Tal Group resting on top of the Ediacaran Krol-E carbonates of the Krol Group. Tommotian age is indicated by the fauna recovered from these phosphorites. Carbon isotope excursions and trace element distribution patterns shown by the phosphate rocks evoked lot of interest amongst paleoenvironment modelers interested in the Pc-C boundary event. Sedimentologists, petrographers and geochemists have made significant contributions to our understanding of the genesis of Pc/C-boundary rock assemblage and phosphorites in particular [1]. Due to the high amount of opaque organic matrix, the very small grain size and low abundance of certain mineral species, mineralogical details could not be unraveled by conventional microscopy. An initiative was therefore taken to study phosphorites from the Durmala and Maldeota Mines of Dehradun District using SEM with EDAX, TEM with focused ion beam milling combined with wavelength dispersive analysis by field emission electron probe. For clarity of images, secondary electron images were used for estimating porosity and topographic effects. For all other investigations, back-scattered electron images were used. The study has shown that apatite, calcite, high Mg-calcite, dolomite, quartz, illite, and organic carbon are the most common constituents. Significant discovery is the identification of low temperature formation of flourophlogopite which is interlayer deficient and therefore analogous to illite. In Durmala sample K-Mg rich clay minerals are frequently observed in round-ellipsoidal structures of organic carbon which lines up the apatite grain margins. These are also found intergrown with flourphlogopite [2] and in Maldeota samples occur inside the phosphatic peloids. These clay minerals contain a high amount of fluorine and up to 5 wt% V_2O_3. It is suspected that these phosphate rocks contain substantial amount of Ba-rich minerals, suspected to be cymrite. Cymrite is distinguished from mica by higher Ba content and therefore appears brighter. Typically, barite, intimately associated with potash feldspar and minor albite are also recorded from Durmala and Maldeota phosphorites. Variable crystal sizes and shapes of framboidal pyrite and sphalerite are intimately associated with the phosphorite. In this study, we have made an assessment of the abundance of these newly identified minerals and interpret the role they must have played in the diagenetic modification of the original phosphatic mud.

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References:

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