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Source of enrichment of Paleoproterozoic Jhamarkotra Phosphorite using Petrographical and Geochemical studies, Aravalli Supergroup, Rajasthan, NW India

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The late Paleoproterozoic Jhamarkotra stromatolitic phosphorite deposits of Aravalli Supergroup, NW India (> 1700 Ma; McKenzie, 2013) serve as India's most prominent phosphate source. The drill core samples representing primary stromatolitic phosphorites and the hydrothermally altered and enriched phosphorite zone are collected to understand the origin of phosphorites. The P_2O_5 contents in the stromatolitic primary phosphorite columns vary between 6 and 20 wt. %, whereas the enriched zone phosphorite layers samples have very high concentrations between 20 and 40 %. Such enrichment is related to the structurally controlled hydrothermal alteration leading to the leaching of the host carbonates and enrichment of the phosphate content. The correlations between MgO and CaO (R^2 = 0.49) and MgO and P_2O_5 (R^2 = -0.92) indicate that the dolomites are leached out. To know the alteration percentage, petrographic studies of both the stromatolitic phosphorite and hydrothermally enriched layers are carried out using geochemical mapping using SEM-EDS. Multiple SEM images are taken on the 200-micron scale then the percentage minerals abundance is calculated using ImageJ software. The cumulative abundance of different minerals in stromatolites and enriched samples indicates that dolomites content decreased from 69 to 19 %, the concentration of quartz increased from 3.2 to 17.8 %, P_2O_5 rose from 21 to 47 % and calcite from 1.7 to 13.8 %. The changes in the mineral composition between the stromatolitic columns and the enriched zone indicate that the hydrothermal fluid was rich in calcium and silica. The above observations also support a reverse dolomitization reaction. The increased concentration of Sr compared to Mn in the alteration zone indicates the role of hydrothermal alteration is more than diagenetic alteration. Moreover, the presence of sulfide minerals and the enrichment of U (~ 40 ppm) in the phosphorite-enriched zone indicates the reducing environment.

Reference: -

1. McKenzie, N. R., Hughes, N. C., Myrow, P. M., Banerjee, D. M., Deb, M., & Planavsky, N. J. (2013). New age constraints for the Proterozoic Aravalli–Delhi successions of India and their implications. *Precambrian Research*, *238*, 120-128.