

# GEOCHEMICAL STUDIES ON ALTERNATIVE PHOSPHORUS SOURCES IN LAKE SEDIMENTS AROUND EPPAWALA PHOSPHATE DEPOSIT, SRI LANKA

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Jaya-Ganga is a water canal constructed bisecting the phosphate deposit in Eppawala, Sri Lanka. It nourishes three lakes in the vicinity of Eppawala Phosphate Deposit (EPD). With a view to prospect for unconventional phosphate sources, surface and core sediment samples from three lakes were evaluated, especially to determine the P<sub>2</sub>O<sub>5</sub> concentrations and phosphate solubility. Additionally, surface sediments were analyzed to evaluate geochemical behaviour and mineralogical composition by X-ray fluorescence and X-ray diffraction, respectively. P<sub>2</sub>O<sub>5</sub>% in the surface lake sediments varied from 0.12 to 1.91 and from 0.33 to 1.24 in upstream and downstream, respectively. In upstream core sediment samples, P<sub>2</sub>O<sub>5</sub>% varied between 0.03 and 1.89, however, in downstream core samples, P<sub>2</sub>O<sub>5</sub>% varied from 0.01 to 2.22. The solubility of phosphates in lake sediments is assessed with respect to solubility of P<sub>2</sub>O<sub>5</sub> in 2% citric acid. Aligning with aforesaid, the solubility analysis performed upstream showed 14% to 37% in surface samples and from 4% to 71% in core samples. The corresponding values for the downstream samples fluctuated from 8% to 58% and from 1% to 50%, respectively. Moreover, geochemical analyses of the surface sediments in both upstream and downstream lakes revealed higher contents of P<sub>2</sub>O<sub>5</sub>, TiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub> and MnO and low levels of SiO<sub>2</sub>, MgO, Na<sub>2</sub>O, K<sub>2</sub>O and CaO, compared with the norms of Upper Continental Crust (UCC) values. The significantly positive anomaly of P<sub>2</sub>O<sub>5</sub> in downstream sediments against UCC comparison is noteworthy. In geochemical classification, log plots of (Na<sub>2</sub>O/K<sub>2</sub>O) vs log (SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub>) and (Fe<sub>2</sub>O<sub>3</sub>/K<sub>2</sub>O) vs (SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub>) divulged the chemical immaturity and mineralogical instability of the surface sediments in both areas. Meanwhile, the average Chemical Index of Alteration (CIA) values in upstream and downstream suggested the extreme chemical weathering conditions in the source area. Mineralogical analyses revealed the presence of phosphate-bearing minerals such as fluorapatite, crandallite and millisite in downstream surface sediments, which are the weathered products of the EPD. Overall, results of the study reflected the contribution of the EPD as a phosphate source to the downstream lake and the potential of secondary phosphate mineralization in downstream sediments.

High solubility values facilitated the applicability of downstream lake sediments as a low-grade phosphate additive/fertilizer. Continuous nourishment of phosphate-bearing materials via Jaya-Ganga, into the downstream lake sediments, steadily increases the quantity of phosphate content in downstream sediments and the mineable quality of the lake sediments as an economically viable source for future mining of phosphate.

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