Geochemical Approach of Phosphate Mineral Exploration in Lake Sediments around Eppawala Phosphate Deposit, Sri Lanka

***Dushyantha[1] NP, Hemalal[1] PVA, Jayawardena[1] CJ, Ratnayake[2] AS and Ratnayake[1] NP**

[1]Department of Earth Resources Engineering, University of Moratuwa, Sri Lanka
[2]Faculty of Science and Technology, Uva Wellassa University, Sri Lanka

*Corresponding author – nimila.dush@gmail.com

Abstract

Mineral exploration is a stochastic process of finding and locating commercially viable mineral resources. In this regard, lake sediment is an important material in exploration as it contains three distinct types of minerals i.e. allogenic or detrital minerals (minerals brought into the lake from outside of the lake), endogenic minerals (minerals originated within the lake) and authigenic minerals (minerals formed during the diagenetic alteration of sediments). Koon-wewa, Ihalahalmilla-wewa and Kiralogama-wewa are three lakes connected with a man-made water canal, namely Jaya-Ganga flowing across the Eppawala Phosphate Deposit (EPD). Kiralogama-wewa is located downstream of the EPD whereas other two lakes are located upstream. Thus, lake sediments in the downstream lake could be influenced by the phosphate-bearing minerals derived from the EPD. The bulk chemical analyses of surface lake sediments showed that average P_2O_5 concentrations were 0.80% and 0.45% in downstream and upstream, respectively. Further, in downstream, P_2O_5 significantly and positively correlated with Al_2O_3, CaO, Fe_2O_3, K_2O and MnO whereas no such correlations were observed in upstream sediments. Presence of calcium-iron-aluminum phosphate minerals such as fluorapatite, crandallite, millisite and strengite in downstream sediments, revealed via mineralogical analyses, delineated the above correlations. Moreover, high Chemical Index of Alteration (CIA) values were observed in the downstream sediments which indicate intense chemical weathering conditions in the source area. It is justified by the presence of weathering products of the EPD such as crandallite and millisite in the downstream sediments. Grain size analyses displayed a dominant silt fraction in both upstream and downstream areas. Textural analyses in downstream revealed the relative proximity of the source and nature of the material deposition through solid suspension. Presence of fluorapatite (detrital mineral) in downstream is corrobarated the conclusion in textural analyses. Four representative core samples were obtained from both the upstream and downstream lakes. In upstream core samples, P_2O_5 concentrations varied from 0.03% to 1.81% whereas P_2O_5 concentrations in downstream core samples varied from 0.26% to 2.22%. Continuous sediment supply via Jaya-Ganga can also improve the fertilizing capacity of downstream lake sediments, eventually; becoming a commercially viable phosphate mineral resource.

Keywords: Eppawala Phosphate Deposit, Lake sediments, Phosphates, Weathering