Assessment of the geochemical processes and environmental pollution in the Trincomalee bay, Sri Lanka

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Trace and major elements of surface sediments in bay environment are often used to study the geochemical processes, environmental issues, transportation of weathered products. The Trincomalee bay can be divided into three parts as for sediment distribution; Koddiyar Bay (KB), Thanmbalagam Bay (TB) and Inner Harbor (IH). Surface samples from all three areas have been collected and XRF analysis was carried out to determine As, Pb, Zn, Cu, Ni, Cr, V, Sr, Y, Nb, Zr, Th, Sc, Fe_2O_3, TiO_2, MnO, CaO, P_2O_5 and total sulphur contents. Geographical Information System (GIS) maps for ratio plots Th/Zr was used to consider heavy mineral (HM) accumulation and dilution and the surface distribution of Th and Zr individually to further explain many HM faces involved. The GIS maps for other individual elements also were used to explain the geochemical processes within the bay area upon the input of the river sediments and also the pollution activities.

Th/Sc-Zr/Sc shows that the sediments are of andesite to rhyolite in composition, while the KB shows Zr enrichment. Cr/V-Y/Ni shows a Cr dilution with carbonates while the Cr-Ni shows a quartz dilution in the IH indicating marine influence. Environmental contamination of Cu, Pb As, Zn is seen in the IH due to the harbour and in the KB and TB with natural issues.

Weighting stream sediment geochemical samples as exploration indicator of deposit-type

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Factor analysis has been widely used for classification of stream sediment geochemical data in mapping of prospective areas for certain type of mineral deposits [1, 2]. However, interpretation of the results of factor analysis remains challenging in terms of selecting the factor (or association of elements) that best predicts the location of known mineral deposits of a certain type. Here, we used stepwise factor analysis to recognize and omit non-predictive geochemical elements from the data to elicit the best factor representing the presence of mineral deposits of the type being examined. Then, to obtain a geochemical mineralization probability index of mineral deposits of the type sought X ($GMPI_X$) for each stream sediment geochemical sample, we used multivariate and logistic regression analyses sequentially. The generalized model of $GMPI_X$ for mineral deposits of the type sought (X) is

$$GMPI_X = \frac{e^{\alpha_0+\alpha_1 y_1+\alpha_2 y_2+\cdots+\alpha_n y_n}}{1+e^{\alpha_0+\alpha_1 y_1+\alpha_2 y_2+\cdots+\alpha_n y_n}},$$

where $y_1, y_2, \ldots, y_n$ are ‘predictor’ elements of the deposit-type of interest, which were obtained from the results of stepwise factor analysis; $\alpha_1, \alpha_2, \ldots, \alpha_n$ are multivariate regression coefficients. The values of $GMPI_X$ range between 0 and 1. These values can be mapped to delineate areas upstream of geochemical samples where mineral deposits of the type sought are likely present. Successful application of the proposed methodology is demonstrated for fluorite deposits in a study area in Iran.

[1] Reimann *et al*. (2002) *Applied Geochemistry* **17,** 185-206.

[2] *Helvoort et al*. (2005) *Applied Geochemistry* **20,** 2233-2251.