

ABSTRACT

This project was a joint effort between the Ministry of Agriculture and the Centre for Nuclear Sciences, U.W.I. The experimental work was shared between myself and Christopher Knight who is also to submit an M.Phil thesis entitled "Elemental Mapping of Jamaican Soils".

Sampling and analytical methodologies for the determination of elemental concentrations in Jamaican surface soils were established. Over 200 samples from 165 sites were analysed for some 37 elements. Thirty three of these elements (Al, As, Au, Ba, Br, Ca, Ce, Cl, Co, Cr, Dy, Eu, Fe, Hf, Ho, I, K, La, Lu, Mg, Mn, Na, Sb, Sc, Sm, Sr, Tb, Th, Ti, U, V, W and Yb) were determined by Instrumental Neutron Activation Analysis (INAA) and five (Cu, Rb, Sr, Pb and Zn) by X-ray Fluorescence (XRF) analysis. Of these elements, Au, Cl, Ho, K, Rb, Sr and W were close to or below their respective detection limits for most samples and were not discussed while some (As, Ba, Br, Ce, Dy, Eu, Ho, I, K, La, Lu, Mn, Sb, Sm, Tb, Th, Ti, U, V, W and Yb) are discussed by Christopher Knight in his thesis.

The results for ten elements, namely Al, Ca, Co, Cr, Cu, Fe, Mg, Na, Pb and Zn are presented and discussed in this thesis.

The elemental data were entered into a computer readable database containing other relevant information. Statistical computations and data summary were executed within the database and a Geographic Information System (GIS) used to access the information from which maps of the elemental distributions were created and plotted.

The elements, aluminium, iron, chromium, cobalt, lead and zinc were found to be statistically correlated in the soils, with correlation coefficients above 0.47.

The distributions of these elements show a clear areal correlation with the bauxitic soils overlying the White Limestone Group.

High copper levels in Jamaican soils were found in the mineralised areas of the cretaceous inliers. Zinc and lead anomalies which are reportedly associated with some of these copper occurrences were not evident from the results of this work.

High levels of sodium and magnesium are associated with the volcanic rocks of the inliers particularly the Blue Mountain Inlier and Wagwater conglomerates. Sodium, magnesium and calcium are enriched in the alluvial plains of the south coast except in the Black River Morass where the calcium levels are low.

The calcium levels in Jamaican soils are generally low and do not reflect the predominant underlying limestone geology. Higher levels are associated with either the calcareous soils underlain by white limestone or those overlying the fairly recent rocks of the Coastal Group Formation.

Several areas have been highlighted for more detailed studies using higher sampling densities.