

MULTI-ELEMENT STREAM SEDIMENT GEOCHEMISTRY OF SOUTH-WESTERN AND CENTRAL NIGERIA

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This paper presents preliminary results from geochemical baseline stream sediment surveys from two Cells (South-western Cell and Central Cell) in Nigeria completed in 2009. This work was part of the World Bank funded Nigerian Sustainable Management of Mineral Resources Project carried out by the Nigerian Geological Survey Agency in cooperation with the British Geological Survey. A total of 284 stream sediment samples were collected from the South-western Cell, with an average sampling density of 1 site every 90 km². A total of 1288 stream sediments were collected from the Central Cell, with an average density of 1 sample every 20 km². Geochemical analyses were by ICP-MS technique following sodium peroxide fusion-HCl-HF extractions. Au, Pt and Pt determinations were by Fire Assay-acid dissolution method. Selected findings on the distribution of trace elements, HFSE and REE in stream sediment samples are presented in relation to the geology, known mineral occurrences, as well as other factors that affect the distribution of elements in the surface environment. A systematic approach to the interpretation of the elemental concentrations and distributions involved a range of statistical techniques (including correlation, cluster and factor analysis) to investigate the structure and trends within the data set, thus providing insights into the underlying geological, physical, geochemical and anthropogenic processes that are important in controlling the stream sediment geochemistry.

The role of ilmenite and Fe/Mn-oxides and oxy-hydroxides in controlling trace element stream sediment geochemistry is highlighted by strong Fe/Ti-trace element associations in the multivariate statistical analyses. Rare element associations including Th-U-HREE, Zr-Hf, as well as Sn-Ta-Nb indicate resistate heavy minerals in the stream sediments derived from potentially economic deposits of minerals in the area. The spatial distribution of REE-bearing pegmatitic systems is highlighted in the high-density stream sediments geochemical dataset of the Central Cell. Rare-metal pegmatites with Sn-W-coltan mineralisation and/or economic placer deposits derived from them are recognised in the Central Cell. In the South-western Cell, element associations Li-Ni-(Cr), and Pt-Cr for stream sediments derived from crystalline geological terrains are perhaps indicative of unknown basic/ultrabasic lithologies with potential for associated mineralisation. Gold is principally found in alluvial placer deposits; As and Sb concentration data are potentially useful for pathfinder follow-up exploration for primary hydrothermal Au mineralisation in schist lithologies. A range of elements, including U and some REE, are moderately enriched in Mesozoic to Recent sedimentary (terrestrial and marine) cover sequences as a result of regional reworking of well exposed crystalline lithologies, with potential for sediment-hosted mineralisation and economic alluvium. In the South-western Cell, anomalies of Au, Ta, Nb as well as the REE (e.g. La, Ce, Nd, Sm, Pr, Nd) and U, Th and Y are associated with stream sediments derived from metasedimentary and metavolcanic lithologies and migmatitic gneisses. In the Central Cell, high anomalies of a full range of light- and heavy-REE are associated with pegmatites, genetically associated with the known *Older Granites* of north-central Nigeria.

Compared to a range of other published regional stream sediment studies in Africa, Asia and Europe, these results from South-west and central Nigeria show comparatively high concentrations for REE, Y, U, Ta, Nb, Zr and Hf. In addition there are several anomalies for Au and Pt that need further investigation.