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Regional GIS based exploration targeting studies in data poor environments: A case study of gold prospectivity mapping in Nigeria

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West Africa has emerged as a significant gold producer, with the Archean and Paleoproterozoic rocks (e.g. Birimian and Tarkwaian) from within the West African Craton being the most prospective. The largest gold production in this region is from Ghana, Burkina Faso and Mali. However, Nigeria has had little modern exploration for gold and the basement geology is poorly understood, despite northern Nigeria having rocks of a similar age and composition to the major gold provinces in West Africa. Throughout the country numerous artisanal workings have targeted alluvial gold as well as mineralisation within the Proterozoic basement rocks.

Nigeria is composed of Archean to Early Phanerozoic rocks, which are located between the West African and Congo Cratons. They are often referred to as the Pan-African Shield which were metamorphosed during the Pan-African orogeny at Ca. 600 Ma [1]. At this time a predominant north-south foliation was developed along with the emplacement of granites in the region with metamorphic grades ranging from greenschist to amphibolite facies.

Gold mineralisation is largely concentrated along tightly folded north-south striking "schist belts" in Northern Nigeria. The belts are comprised of gneiss, schist, phyllite, quartzite, banded iron formations (BIF), amphibolite and granite. The schist belts are variably metamorphosed. Metamorphism is regarded as being related to Late Neoproterozoic "Pan-African" orogenic events (ca. 600 Ma) as is the gold mineralisation [1]

SRK conducted a regional Weights of Evidence (WoE) prospectivity analysis over northern Nigeria covering a total area of 280,000 km². The aim of this study was to identify geological controls on gold mineralisation and to highlight areas considered prospective. SRK used Spatial Data Modelling tools in ArcGIS [2]. The geology was based on Nigerian Geological Survey mapping at 1:2 million scale, SRK developed a structural and geological frame work from regional geophysical data to allow more detailed analysis of regional structures. A training dataset incorporating 139 gold occurrences was collated from literature and site investigations and largely consisted of artisanal hard rock mining.

The data was interrogated using WoE methods [3] with the strength of this correlation based on the presence or absence of mineralisation with a positive correlation being assigned a positive weighting (W+) and poor correlation resulting in a negative weighting (W-). The strength of that correlation is measured by the addition of the absolute values of these two features is noted as a contrast. From this analysis gold mineralisation was found to have a strong correlation to within 20 km of regional NE striking faults. Mylonites, schists and biotite granites were found to be the

best host rocks with gold mineralisation most likely found within 5km of the contact between the schists and the granites.

References:

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