GOLD AND BASE METAL EXPLORATION STUDIES BASED ON MINERALOGICAL AND GEOCHEMICAL CHARACTERISATION OF STREAM SEDIMENTS FROM NORTH PAKISTAN

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I certify that all the material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other university.

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Abstract

North Pakistan represents a highly favourable area for a variety of mineral deposit types, including arc-related porphyry Cu, Au and Mo and arc and back-arc epithermal precious metal deposits (Sweatman et al., 1995; PMDC, 2001). However, few deposits have been discovered in the area, mainly due to its remote nature and inaccessibility, and because of a lack of exploration tools for high altitude terrains. From stream sediment sampling campaigns by local and international organizations, including a large dataset provided by the Pakistan Mineral Development Corporation (PMDC), a significant amount of geochemical data now exists for the region. This data has been incorporated into an Arc-GIS 9.2 database, along with stream catchment and geological information, and detail of all known areas of mineralisation. From this, spatial catchment maps together with multi-element geochemical associations have been studied to delineate areas showing anomalous values for Au and base metals. The two most prospective areas were found to be the Shyok Suture Zone and northern Kohistan, with the dominant control on mineralisation being structural rather than lithological. These areas were targeted for detailed stream sediment sampling and mineralogical and geochemical analysis. From studies of Au and Au pathfinder elements in different size fractions of the stream sediments and heavy mineral concentrates (HMC), the catchments of Teru, Asheriat and Pakora (in order of decreasing rank) were identified as most prospective.

Morphological and geochemical analyses of native Au grains from panned concentrates has given an indication of proximity to bedrock source (<10 km) and the possible styles of mineralisation in these catchments; porphyry Cu-type in Asheriat and Pb-Sb quartz veins in Teru and Pakora. Automated mineralogical analysis of the stream sediments (<180 μm fraction) and HMC (<180 μm), using a QEMSCAN® system, confirmed this interpretation. The effectiveness of the developed methodologies for exploration in remote and high altitude terrains of North Pakistan is discussed, and recommendations made for future exploration.

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