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Mineral predictive mapping (MPM) in selected target areas in DR Congo using hybrid approach: Combination of knowledge-driven genetic models and data-driven artificial neural networks (ANN)

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In DR Congo, in the frame of the PROMINES project, funded by the World Bank, mineral predictive models have been compiled for the areas of Katanga Sud, Katanga Nord, Katanga Sakania and Equateur Quest. The prediction models are based on the airborne geomagnetic and radiometry data produced by NRG/PGW; geological and structural data, stream sediment geochemistry and field observation data by BGRM/IGS/GEOCOFF; own field observations (in Katanga South); as well as review of publications and archived historical documentation, especially in zones where neither field observations nor geochemistry were available, such as Katanga Nord and some parts of the Equateur region. For predictivity mapping, a hybrid approach was used: Potentially mineralisation-controlling factors were identified in knowledge-driven genetic exploration models, followed by data-driven artificial neural network (ANN) predictive modelling. The results were checked against available other data (e.g. presence of artisanal mining sites and other mineral indications in the field / on the aerial images).
In the first step, the mineral occurrences have been classified into various genetic types, controlling parameters were defined and retrieved from the available datasets. For copper-cobalt mineralization, the main types in the three working zones of the Katanga region are: a) Ecailles (imbricated blocks) of the Roan group, b) mineralisation related to thrust faults, c) concealed stratiform deposits of Kamoa-Kakula type, d) the rims of pre-Kibaran domes. For tin mineralisation, a separate model was created. Gold mineralisations were distinguished between Kibaran and pre-Kibaran age. For the zone of Equateur, Gold was modelled separately. For these genetic types, different prediction models were created.
Secondly, for each mineralisation type, known mineral occurrences were compiled into sets of training points/ areas for ANN modelling. Controlling factors (e.g. thrusts, anticlines, synclines) were retrieved from geological maps, processed as buffer zones / distances and introduced to the model as input data sets. Within the ANN, the importance of each controlling parameter was determined and defined as weights. Based on the predicted potential for similar mineralisation, targets were identified for the different types of copper, gold and tin in the respective working areas. These reconnaissance targets have been ranked for priority and follow-up steps for their exploration were recommended.