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Developing An Atlas Of Gold Compositions For British Columbia: A New Tool For The Exploration Community

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Detrital gold particles can greatly aid mineral exploration campaigns because they are broadly dispersed and create large footprints around lode gold deposits. In areas of complex geology, such as central BC, there may be gold particles from several different potential sources in surface sediments. Consequently, despite exhibiting the chemical and physical durability essential for an indicator mineral, gold particles have traditionally found limited application in this regard. This project has elevated particulate gold to the status of a source-specific indicator using a new approach based on compositional signatures. Natural gold is almost invariably an alloy, and gold particles commonly contain inclusions of other minerals that may be representative of the source. This project, underwritten by Geoscience BC, has established generic compositional signatures of gold from different styles of mineralization and has developed a methodology for interpretation of new data relevant to all scales of exploration activity. Populations of gold particles from a single locality may be classified by their microchemical signature; i.e., the alloy composition (Au, Ag, Cu, Hg, Pd) correlated on a particle-by-particle basis with the mineral inclusions revealed in polished section. This microchemical signature is directly related to the deposit style, but it is only of use to the exploration community if a sufficiently large compositional template is freely available. This project is developing a new, publicly available reference database of detrital gold particle microchemistry to encourage and aid exploration in BC. The provincial database describes 13,999 gold particles from 327 localities covering all major auriferous regions. Alloy compositions were generated by electron probe microanalysis and mineral species present as inclusions were identified using the scanning electron microscope. In addition, trace element compositions of 922 particles have been collected using laser-ablation inductively coupled plasma mass spectrometry. Gold formed in porphyry, epithermal, skarn, and orogenic mineralization is represented, and diagnostic compositional characteristics for each have been identified. Hitherto, new datasets have been interrogated to yield geological interpretations regarding gold provenance by domain experts who can draw upon extensive prior experience. The aim of the project is to empower individual researchers and explorationists to immediately benefit from analysis of gold particles collected during their own routine reconnaissance. Using Exploratory Data Analysis, we have developed a framework and methodology to facilitate classification of new gold data using the new gold Atlas. The training dataset for this approach was curated by researchers with expertise in both the metallogeny of BC and the microchemical signatures of gold formed in different deposit styles. Therefore, use of the classification algorithm will replicate data set interrogation as if performed by experienced researchers. A key deliverable of this project will be the detailed description and workflow of the algorithm, such as Linear Discriminant Analysis, used to classify new data. In this way, the project will generate a new tool immediately available to exploration in BC, but with the potential to expand efficiently to both the Canadian and Alaskan Cordillera. Subsequent workers will engage with the project outcomes according to the workflow in the figure below.

Workflow for Utilization of Data Base Post- Project

Detrital gold grains recovered during exploration



Alloy compositions analysed by Emp (or LA-ICP-MS) and inclusion suites by SEM

Either



Manual correlation of new data with relevant information in Atlas data base



Atlas Data Base



Linear Discriminant Analysis to identify related populations within Atlas data base



Or



Users Manual



- Can we identify the source style of mineralization of the new sample populations?
- Does this new knowledge inform exploration targeting?
- Are the new samples comparable to others from the same area?
- Does this result extend the range of mineralization?



Informed Exploration Program