Visualizing the Multivariate Footprint of the World-class, Canadian Malartic Gold Deposit by Using Clustered Heat Maps

L Feltrin[1], M Bertelli[1], J McGaughey[2], W Morris[3], M Crocker[4], S Piercey[4], S Perrouty[1], R Linnen[1], G Olivo[5], P Lypaczewski[6], B Rivard[6], N Gaillard[7], N El Goumi[8] R Enkin[8], C Lafrenière-Bérubé[9], M Chouteau[9], M Lesher[10], F Bouchard[11]

[1]Western University, London, Ontario, lfeltrin@uwo.ca; [2]Mira Geoscience, Montréal, Québec; [3]School of Geography & Earth Sciences, McMaster University, Hamilton, Ontario; [4]Memorial University, St. John's, Newfoundland; [5]Queen's University, Kingston, Ontario; [6]University of Alberta, Edmonton, Alberta; [7]McGill University, Montréal, Québec; [8]GSC Paleomagnetism and Petrophysics Laboratory, Sidney, British Columbia;[9]École Polytechnique de Montréal, Montréal, Québec; [10]Laurentian University, Sudbury, Ontario; [11]Canadian Malartic Mine, Malartic, Québec

We present the first application of Clustered Heat Maps (CHMs) to a mineral exploration data set and discuss its usefulness in characterizing the footprint of the Canadian Malartic Au Deposit. We foresee the use of CHMs will find broader application in mineral exploration and other geoscientific disciplines given their ease of implementation and applicability. Geology is a science that has similar data visualization needs as genetics or biochemistry. Each subject requires visualization of complex data structures capable of revealing high-level processes, while providing insight on their possible causes. The primary benefit derived from the use of CHMs is their capacity of compacting large amounts of information in a two-dimensional image-based pixel space. A CHM offers an ingenious data display that simultaneously reveals row and column hierarchical cluster structure. CHMs obtained on p-XRF data at the Malartic deposit indicate the presence of natural clusters of specimens with high abundances of K, Si, Ca, Al and S. Some of these clusters represent hydrothermal alteration because of their association with Au mineralization. CHMs can facilitate the identification and separation of samples containing specimens that best represent either known or unknown hydrothermal alteration styles. Cluster size (granularity) may be an important parameter in this discrimination. Cluster granularity is a function of a minimum of two variables: (*a*) the volume of influence of a process generating a cluster; (*b*) sampling bias, as sample location may well be the cause of different cluster dimensions. Provided that *b* has negligible effects—for instance in cases where sampling is conducted on a regular grid—the granularity may be used as a threshold factor to discriminate processes that operate at different scales. Since the overall objective is to isolate clusters that could represent discrete (well-defined) or characteristic portions of the footprint of the Malartic ore system, CHM cluster results should be filtered in 3D geographic space to penalize sparse clusters. These likely represent regional-scale processes or other processes that are not sufficiently focused to be usable as exploration vectors. CMIC-NSERC Exploration Footprints Network Contribution 079.