Managing uncertainty in exploration targeting

T. Campbell McCUAIG [1*], Alok PORWAL [2], Aurore JOLY [3] and Arianne FORD [3]

[1]Centre for Exploration Targeting, and ARC Centre for Excellence for Core to Crust Fluid Systems, University of Western Australia, Crawley, WA 6009, Australia
[2]Indian Institute of Technology, Powai, Mumbai, India
[3]Centre for Exploration Targeting, University of Western Australia, Crawley, WA 6009, Australia

[*] campbell.mccuaig@uwa.edu.au

Mineral exploration is one of the best examples of a business run by judgement under conditions of extreme uncertainty. A study of manual targeting exercises over several groups, on several continents has revealed that targets derived by human-data interaction are fraught with systemic uncertainties dominated by the mineralisation model used (reflecting the preferences/experience of the explorer), how this is translated to a targeting model, and the inability to systematically apply the targeting model over geoscience datasets. Targets generated tend to show some clustering between groups, usually towards areas of outcrop or known mineralisation (a problem when the best opportunities are likely under cover), but very different spreads in ranking. The stochastic uncertainties of the data are important but secondary to these systemic uncertainties.

Automated prospectivity analysis methods applied in GIS, although affected by systemic uncertainties in the selection of predictor maps, can partially mitigate the biases of human data interaction but in turn are severely affected by the stochastic uncertainties.

Examples from several terranes are used to illustrate that a combination of manual and automated approaches can best manage these uncertainties and enhance the confidence of mineral exploration targets. Keys to applying this approach are: (1) creation of appropriate derived datasets and predictor maps to overcome stochastic uncertainty in areas of cover or poor quality data, (2) a mineral systems approach in generating targeting models, (3) application of manual targeting, followed by automated knowledge- and data-driven approaches in GIS, and (4) final refinement of manual targeting for final target decisions.