Data mining – a powerful tool for exploring under cover in mature districts

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The past twenty years have seen some remarkable advances in mineral exploration technology. Surprisingly, the discovery rate of new economic mineral deposits has not kept pace with these advances. A common explanation for this is that the easy pickings have gone and deposits are becoming much harder to find. This is true. But perhaps what this really means is that we need to change our thinking and to make better use of the tools and data at our disposal.

A consequence of many of these new technological advances is an explosion in the volume of data being collected. This volume of data is almost overwhelming to the human interpreter who is trying to spot subtle patterns that may be indicative of a mineral deposit. Other sciences such as genomics have encountered similar situations of giant data bases, and the new statistical techniques of data mining and data visualization have emerged to meet the challenge. One approach that has proved effective is supervised learning. This depends on training a system to distinguish meaningful patterns by showing it a number of examples. Once trained, the system can be applied in a predictive sense to recognize similar patterns.

To illustrate the benefits that data mining can provide to mineral targeting in mature districts, two examples will be presented. The first is from the Quesnellia terrane in Central BC, a classic belt of alkalic porphyries hosting copper-gold mineralization. Between the known deposits of Mt Polley to the south and Mt Milligan to the north is a broad swath of glacial till cover, which conceals the geology and any further possible economic deposits. In this area there are stream and lake sediment geochemical surveys comprising over 7100 42-element samples, totaling 300,000 assays. A data mining study of this geochemistry was successfully applied to infer the bedrock geology under the glacial till. Subsequent field checking of previously missed outcrops and recent drill holes produced a 75% success rate in matching the predicted geology.

The second example is from an area in the Eastern Goldfields of Western Australia. This is a belt of Archean greenstone geology with a rich history of profitable gold mining going back over 100 years. The challenge facing the exploration team in this mature district is to wade through the gigabytes of multidisciplinary data collected over the years and to make a new economic gold discovery in an area that is largely covered by regolith. The size of this area is approximately the same as the country of Uruguay. At a regional level, therefore, this is essentially a 2D study. As we shall see, however, the techniques described here are equally applicable at 3D in the mine environment.