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Granite-related rare earth elements prospectivity mapping of the Bushveld Complex, South Africa

A.Y. Billay

Council for Geoscience, South Africa
Email: ybillay@geoscience.org.za

The acid-phase Bushveld Complex is known for its poly-metallic mineralization, in particular tin and fluorite but also a range of minor metals including REE, Pb-Zn-Ag and Mo (Crocker et al., 1988 [1], 2001 [2]; Robb et al., 2000 [3]; Baillie and Robb, 2004 [4]) and possibly Fe mineralization through upgrading of BIFs. In this study, granite-related rare earth elements (REEs) potential of the Bushveld region was revisited by synthesising regional soil data analysed using X-ray fluorescence (XRF) spectrometer.

The study involves compilation of existing litho-geochemical, ore material and mineral chemistry data to establish possible indicators of REEs mineralization and their background concentration levels to aid in anomaly identification. For the purpose of uni-element mapping, box and whiskers plots were used to establish the threshold values for anomaly recognition. This was followed by production of overlay and ternary maps of selected indicator elements, principal component analysis and ternary maps of relevant principal components.

The results of this study indicate the following:

1. The ternary plots of Rb, Sr, Ba and Zr broadly outline areas of more differentiated granites and hence prospective areas for Sn, F (+ REEs) and Pb-Zn-Ag types of mineralization.
2. Y, Th, U and Nb anomalies delineate fluorite (+REEs) potential areas within the broader Rb Zn and Pb anomalies are associated with different types of mineralization including tin, fluorite and Zn-Pb-Ag). Zn and Pb anomalies that do not coincide with either Y and/or Sn anomalies represent potential prospective areas for Zn-Pb-Ag type mineralization.

The Following conclusion can be drawn from this study:

1. Rb is a good indicator of the degree of differentiation of the granites and hence a good indicator of possible poly-metallic mineralization on a regional scale, whereas on a deposit scale Y is the better indicator of fluorite (+REEs) mineralization.
2. As the mineral prospectivity mapping was based on low density soil data, future follow-up work over the REEs prospective areas should start with areas with highest prospectivity (for a metal (s)) and eventually proceed to the low prospectivity areas.

References:

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