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Targeting Gold Deposits along a Regional Shear Zone: A Case Study from the Archean Golden Pride Deposit in Tanzania

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ABSTRACT

Exploring for gold deposits along regional shear zones can be challenging because of the presence of cover. A case study from the Archean Golden Pride deposit in Tanzania demonstrates how the utilization of short-wave infrared reflectance data combined with multi-element geochemistry can aid in locating the position of regional shear zones and the generation of targets along such shear zones.

INTRODUCTION

The Golden Pride Au deposit (Total Resource: ~3 Moz Au) is situated in the central part of the E-W striking Nzega Greenstone Belt in the Archean Lake Victoria Goldfields of Tanzania. The Golden Pride Au deposit is hosted in the immediate hanging-wall of the regional, ~150km long, steeply south-dipping Bulangamirwa Shear Zone within intensely deformed and altered meta-sedimentary rocks of the Nyanzian System (Borg, 1990).

The occurrence of this well-sized orebody along a regional-scale shear may infer the presence of additional Au occurrences under cover along the strike of the structure. However, identification of the Bulangamirwa Shear Zone outside of the immediate mine area is hampered by the presence of surficial cover sediments and a relatively poor signature in airborne magnetic data.

In order to better define the strike extent of the prospective structure alternative methods were required to 1) effectively delineate the position of the shear zone, and 2) generate 'vectors to ore' to define targets along the strike of the shear zone. To achieve these aims, a study on the alteration and geochemical signature of the Golden Pride deposit was carried out utilizing PIMA (Portable Infrared Mineral Analyser) and litho-geochemistry. The results of this study could then be applied to regional exploration.

METHODS

To define the alteration signature of the Golden Pride Au deposit, a total of ~15,000 samples from drilling were measured with PIMA (see Thompson et al., 1999 for a discussion on its application to exploration). In addition, a total of 152 samples from drill holes along two selected sections through the ore deposit were analysed using a full ICP-OES/MS multi-element (ME) suite. On the basis of the results of these studies, an air core (AC) program was designed along the strike of the Bulangamirwa Shear Zone on 1km-spaced fences centered on the interpreted position of the shear zone and collar locations approx. 80m apart. Each hole was drilled to blade refusal and an end-of-hole (EOH) sample of fresh rock was obtained. PIMA and ME analyses were carried out on the obtained samples, which were then interrogated in light of the results from fingerprinting the Golden Pride Au deposit.

FINGERPRINTING THE GOLDEN PRIDE AU DEPOSIT

PIMA analysis results from the Golden Pride Au deposit indicate:

1) Short wavelength micas are spatially associated with the Bulangamirwa Shear Zone;
2) High mica abundance can be used to map the presence of felsic porphyry units;

In "Proceedings of Exploration 07: Fifth Decennial International Conference on Mineral Exploration" edited by B. Milkereit, 2007, p. 953-956

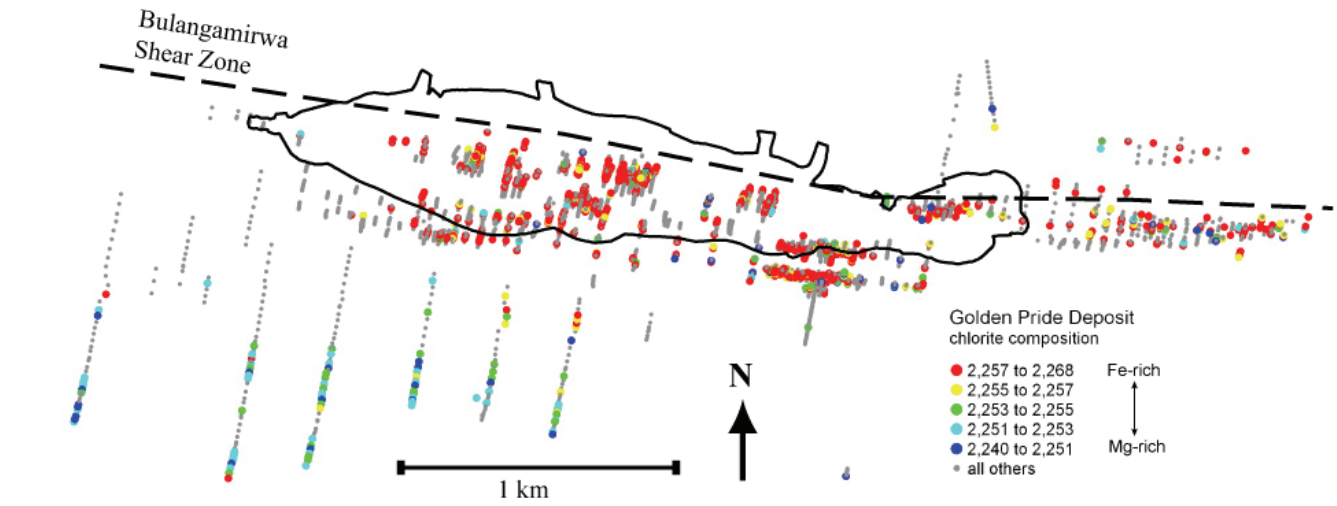

Figure 1: Alteration signature of the Golden Pride Au deposit (approx. outline of pit in black) showing contrast in chlorite composition associated with gold mineralization. Proximal to mineralization Fe-rich chlorite dominates while distal to mineralization Mg-rich chlorite dominates. The composition of chlorite was determined by measuring the shift in the chlorite 2250nm absorption feature for each sample.

3) There is no visible zonation in chlorite chemistry within the rocks associated with the Golden Pride Au deposit;
4) Biotite and chlorite alteration minerals in the samples close to the deposit are iron-rich. More distal, the chlorite mineralogy is more Mg-rich (Figure 1).

The ME results of rocks sampled as part of this study indicate that a strong relationship exists between a number of pathfinder elements (As, Li, Sb, W) and Au mineralization at the Golden Pride deposit (Figure 2).

In particular, Sb and Li haloes were found to exceed over 500m width, as a result of which the current study did not get out of the hydrothermal system. Importantly, W was identified as a proximal indicator mineral, producing restricted haloes around gold mineralization.

The signature of short wavelength micas, Fe-rich chlorites of the Golden Pride deposit and its close association with As and Sb can be interpreted to reflect an acid-reduced hydrothermal environment, where gold has a relatively low solubility as a bi-sulfide complex.

REGIONAL TARGETING

Based on results from PIMA analysis at the Golden Pride Au deposit, it was inferred that the Bulangamirwa Shear Zone could be identified along strike as a zone of short wavelength mica and long wavelength chlorite. Unfortunately, it was found that the majority of EOH samples collected from the AC drilling program did not penetrate to fresh rocks and therefore the results of this study were only partially beneficial.

On the basis that As and Sb generally have anomalous values in the vicinity of regional shear zones (as is generally accepted for the Yilgarn craton in Australia), As and Sb results from ME analysis of EOH samples from AC drilling were used to determine their proximity to the Bulangamirwa Shear Zone (Figure 3: top and centre). These results allowed a refined interpretation of the position of this shear zone along the portion of the Nzega Greenstone Belt covered by the AC program.

In addition to this, potential areas of gold mineralization could be defined from anomalous values of Li and W in close proximity to the Bulangamirwa Shear Zone (represented by high values of Sb and As) and a number of targets could be generated that can be drilled in follow-up programs (Figure 3: bottom).

CONCLUSIONS

PIMA and ME analysis has successfully enabled the identification of the characteristics of the Golden Pride Au deposit. The recognition of this footprint aided in delineation of the location of a regional shear zone and potential targets along that shear zone. The successful application of this technique around the Golden Pride Au deposit and along the Bulangamirwa Shear Zone demonstrates its strength and applicability in exploration for gold deposits in Tanzania and Archean greenstone belts elsewhere, in particular where gold deposits may be present under cover.

ACKNOWLEDGEMENTS

Resolute Mining Ltd. is gratefully acknowledged for allowing presentation of project results. JigSaw Geosciences is acknowledged for project work related to this paper.

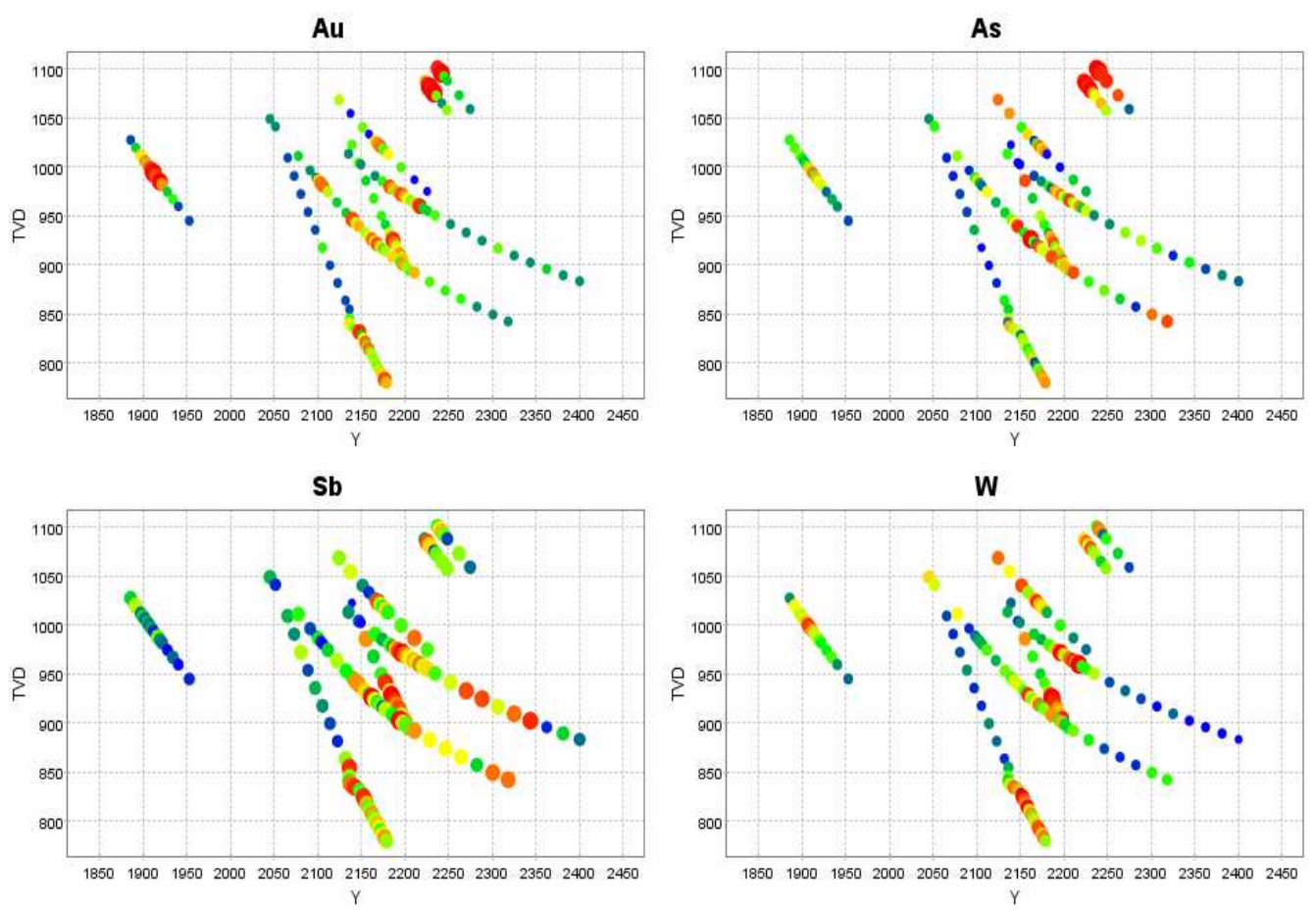

Figure 2: Pathfinder element signatures from representative section associated with Au mineralization (top left) at the Golden Pride deposit. Note that Sb has a wide dispersion around the ore zone, while W is only well defined within the ore zone. Values range from blue (low) to red (high) and represent relative abundances in ppm (i.e. values are not normalized against average crustal abundances). TVD = total vertical depth; Y = Grid Northing.

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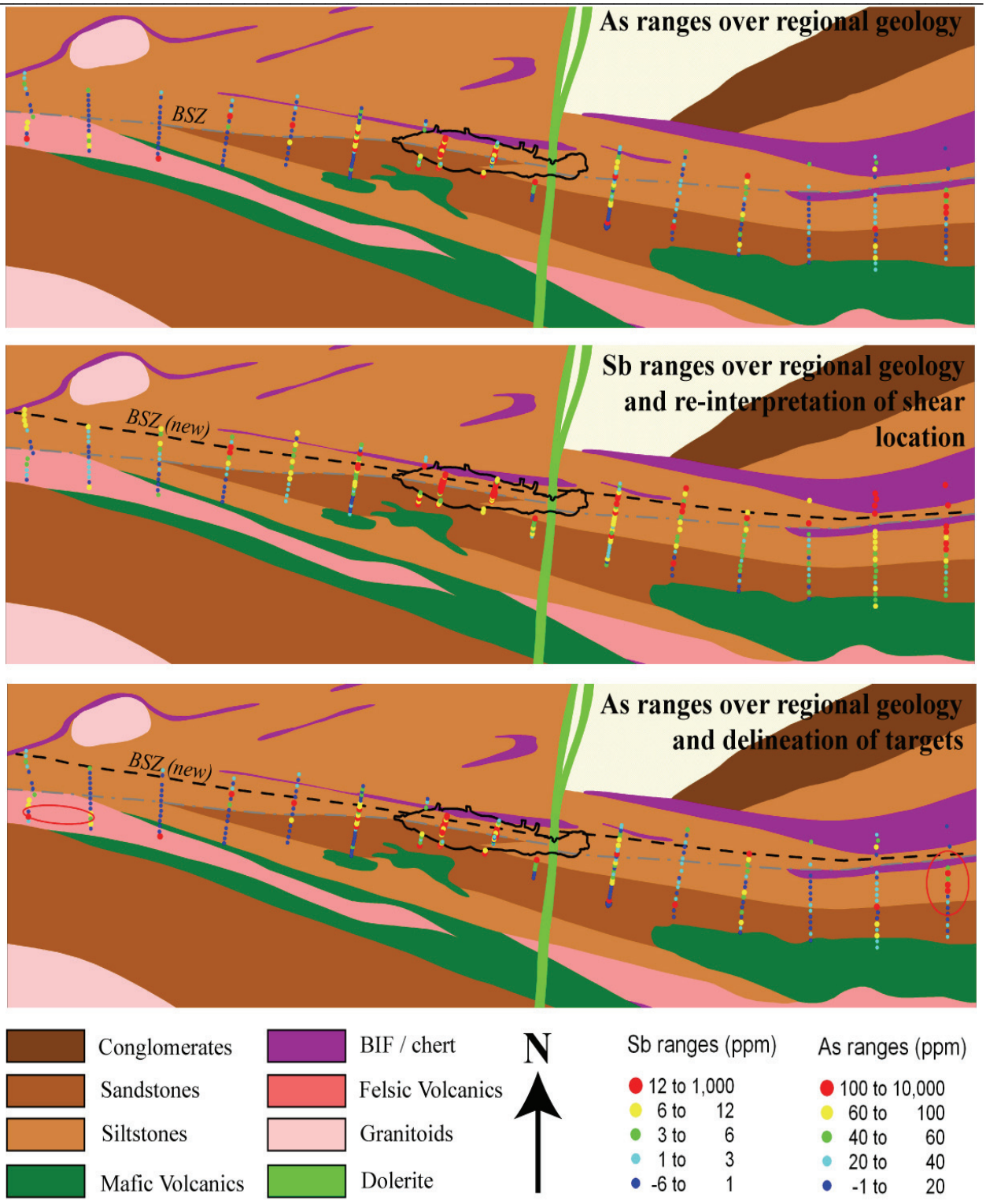

Figure 3: Location of AC holes across the Bulangamirwa Shear Zone (BSZ) with projected As ranges draped on regional geology (top). A combination of As and Sb ranges resulted in the re-interpretation of the location of the shear zone as indicated by black dashed line (middle) and where pathfinder elements are anomalously high, potential drill targets (red outlines) could be generated (bottom).