



THE UNIVERSITY OF Western Australia



INTRODUCTION

The Problem

The Bridge River-Bralorne district forms a zoned mineral district with Au±W in the southwest zone, Sb±Pb,Zn,Ag,Au in a central zone, and Hg±Sb,Au in the northeast zone.

Do these three mineral zones represent one, two or three discreet mineralizing events?

Are the Sb and Hg occurrences related to epithermal mineralization? What models best explain the zonation?

What exploration model should I use to explore for gold in the Sb and Hg occurrences?

How deep do I go? Which ones are the best gold targets?

There are significant amounts of existing geochemistry of the veins of this district but it has not been compiled and applied to exploration. This project is compiling and obtaining new information on the fluid chemistry and temperatures and metallogeny of this important district in order to reconstruct the vertical dimensions of the uppoer portions of the Bridge River hydrothermal system.

Additionally, existing age dating of mineralization at Bralorne and district is imprecise and difficult to relate to either magmatic, structural, thermal or tectonic events with confidence. This project will provide numerous accurate and precise age determinations of several styles of mineralization and of several magmatic phases, in order to construct a robust exploration model.

PROJECT BACKGROUND

The Bralorne-Bridge River mineral district in southwestern British Columbia hosts a large range of epigenetic mineral deposit types, but the region is dominated by the Bralorne-Pioneer orogenic vein system that generated more than 4.1 million ounces of gold from high-grade ores (0.58 opt) between 1897 and 1971 (Church 1996). However, although orogenic gold deposits typically form district scale camps with numerous producers, only a small amount of gold was produced from three other small deposits (Wayside, Congress, Minto). In addition, much of the broader district is dominated by ores that are characterized by gold-poor antimony or mercury mineralization. Many of these small occurrences are recognized as being small, highlevel, potentially epithermal occurrences. Most of the suggested deposit models for this region support significant differences between the goldrich and gold-poor occurrences. This has discouraged aggressive exploration in much of the area except for those veins immediately adjacent to Bralorne-Pioneer system.

An alternative interpretation may be that the stibnite and mercury systems are simply the upper (epizonal) portions of orogenic gold systems (such as Donlin Creek) and that the entire district representative of one large hydrothermal event that should be explored more aggressively for gold resources.

Geochronology is one method to determine if such a model is possible, and is the line of research herein pursued.



Regional scale map of the broader Bralorne-Bridge River mineral district which contains more than 60 mineral occurrences. Mineral occurrences are broadly zoned with gold-dominated veins in the west, stibnite-dominated veins in the central region, and mercury associated mineralization further east

MODELS EXPLAINING ZONATION



observations and data with the mineral occurrences that relates the different metallogenic belts to different structural belts, with mineralization forming in response to different structural events.



Distance from CPC (km) Utilizing available geochrononology Woodsworth et al. 1977 suggested that the district-wide variations in the styles of mineralization, and their progressive easterly younging trend, can be accounted for with increasing distance from the progressive flux of heat and fluids from the Coast Plutonic Complex.

Several authors have attributed the formation of mineralization to specific magmatic rocks or events. For example the close association of albitite dykes, which locally occupy the same structures s the veins, and are often intensely altered, are therefore considered to be closely, and genetically related to mineralization (Cairnes 1938; Leitch et al.

Most specically, the close proximity c Bendor batholith suite intrusions to the Bralorne-Pioneer gold veins have been considered compelling evidence for a direct association. However, the regional metal zonations are not aligned with respect to the batholiths.

Epizonal Orogenic Sb and Hg in the Bridge River-Bralorne District: A Basis for District Zonation and New Exploration Models Craig JR Hart^a, Erin E. Marsh^b, and Richard J Goldfarb^b,

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MAGMATIC MODEL

Bralorne Style Au



Bralorne - 51B









VEIN and FLUID GEOCHEMISTRY Bridge River Sb±Au,Ag,Pb



Mary Mac Sb







LOOK! Co2 in Sb veins!! 0----

h = 225-235 °C

CARBON DIOXIDE

Yippee!!! CO2 in stibnite veins Why is this important? This tells us that these epithermal looking systems actually result from deep fluids where CO2 was under considerable pressure and acquired at depths greater than typical epithermal systems which lack CO2. Carbon dioxide can therefore be a confident indicator to differentiate small epithermal prospects from potentially large. epizonal orogenic deposits like Donlin Creek

Upper Reliance



Mercury deposits in progress







Congress



TEMPERATURES

Gold veins in teh Bralorne-Bridge River show axonsistent temperature zonation with depth that indicates a geothermal gradietn of apporox. 35°C/km.

Plugging in the temperature sof fomation can be used to establish an upper continuum for the epithzonal portions of an orogenic system









CONCLUSIONS

Quartz veins from Sb-rich and Hg-rich mineral occurrences have oxygen isotopic ratios that indicate formation from either a magmatic or a metamorphic fluid

These fluid sources are dissimilar to those formed from meteoric fluids that are characteristic of epithermal gold systems indicating that the Sb- and Hg rich veins are unlikely to represent "epithermal" occurrences

The oxygen isotopic signature of the Sb-rich and Hg-rich veins is similar to that from the Bralorne-Pioneer gold veins, indicating a similar, either magmatic or metamorphic fluid source

The carbon isotopic signature is too light to consider a magmatic fluid source

Clathrate, that is CO2 liquids, are observed in fluid inclusions in the Sb-rich veins indicating that a CO2-H2O liquid was responsible for vein deposition

Clathrate and CO2 are characteristic features of orogenic gold deposits, specifically of the Bralorne-Pioneer gold vein system, and indicate a further link of the Sb and Hg systems with deep fluids and orogenic gold systems

The Sb-rich and Hg-rich represent high-level, lower temperature, epizonal portions of orogenic gold systems and are not epithermal gold deposits

District scale zonation can be accounted for as differential levels of exposure of a single system, if the system formed during a single event

Our geochronological data indicates that the Bralorne-Pioneer gold system was emplaced at ca. 67 Ma, we are currently attempting to date mineralization from the Sb and Hg gold systems in order to show a similar timing and a single, district scale mineralizing event.

Two analyses from two different veins located approximately 15 km apart yield nearly identical ages for mineralization within the Bralorne-Pioneer system to approximately 67 Ma.



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