

Atom Probe Tomography of Carlin Type Gold Mineralization

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Introduction

Carlin-type gold deposits accounts for ~6% of the worldwide gold production and are characterized by “invisible” gold hosted in sulphide minerals (Cline et al., 2005). Carlin-type gold tends to be contained as a trace element dispersed within pyrite and arsenopyrite (Reich et al., 2005). Despite decades of research questions still remain concerning the transport and deposition mechanisms of the gold bearing fluids. This study used a combination of high-resolution electron probe microanalysis (EPMA) and atom probe tomography (APT) to visualize the occurrence of gold within arsenian-pyrite from the Turquoise Ridge deposit (North-Central Nevada).

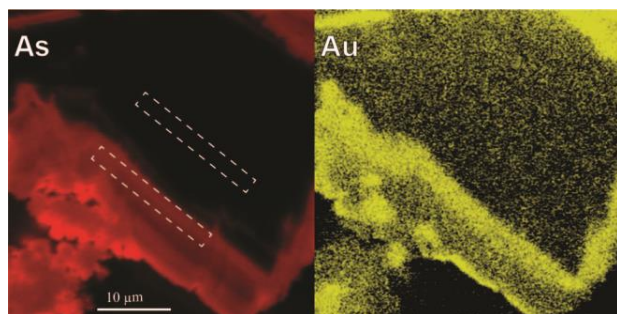


Figure 1: As and Au maps of arsenian pyrite. Dashed boxes show regions for two FIB liftouts from which the APT specimens were prepared. Images acquired on a CAMECA SX-5-FE.

Discussion

EPMA mapping of the As-rich pyrite shows an As & Au poor core and an outer, oscillatory zoned rim enriched in As & Au. The textures suggest two possible scenarios; (i) two, compositionally different, fluid pulses; (ii) the evolution of a single fluid that becomes progressively saturated in As & Au as a result of pyrite deposition. APT work (on a CAMECA LEAP 5000) will show if there are significant differences in key trace element (e.g. Cl, K) contents and reveal their 3-D distribution between the core and rim. The aim is to deduce which process is dominant, and to shed light on the fluid evolution and deposition mechanisms.

References

- Cline, J.S., et al., 2005, Carlin-Type Gold Deposits in Nevada: Critical Geologic Characteristics and Viable Models: Economic Geology, .100th Anniversary Volume, p. 451–484.
- Reich, M., et al., 2005, Solubility of gold in arsenian pyrite: *Geochimica et Cosmochimica Acta*, . 69, , p. 2781–2796.