

Occurrence of Gold in the Cross Mine, Boulder County, Colorado, USA

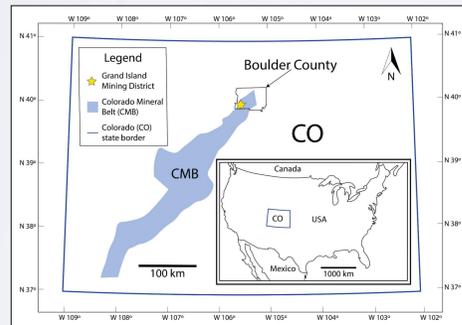
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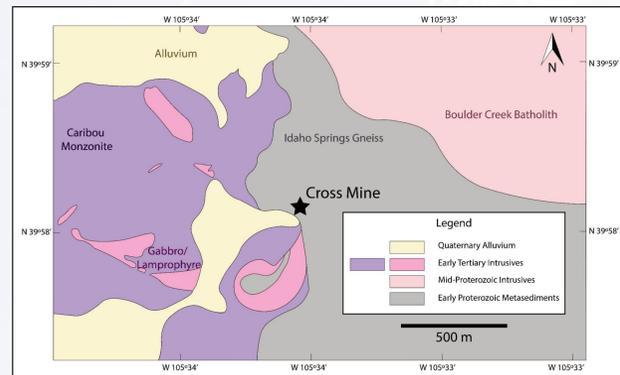
1. Overview of Purpose

- Aim:** To improve our understanding of the occurrence and distribution of Au and Ag in the Cross deposit, and the formation of the magmatic-hydrothermal system to aid in future exploration efforts and studies.



- The Grand Island mining district represents a **magmatic-hydrothermal system** with various alteration mineral assemblages that are distributed in well-defined zones (Melfos et al., 2020; Langston-Stewart, 2021)

- Identifying the **hydrothermal alteration zones** in such a system can be influential in a reconnaissance survey like this (Melfos et al., 2020).



- Thus, we also investigated if the alteration haloes can aid in exploration to vector towards the gold.

2. Methods

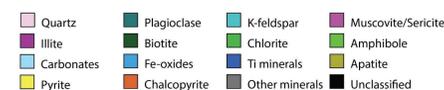
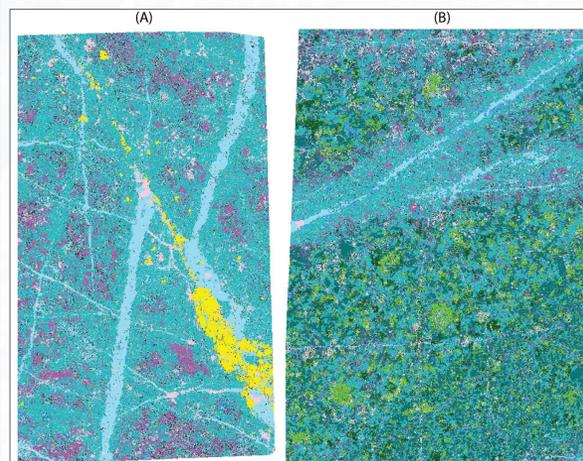
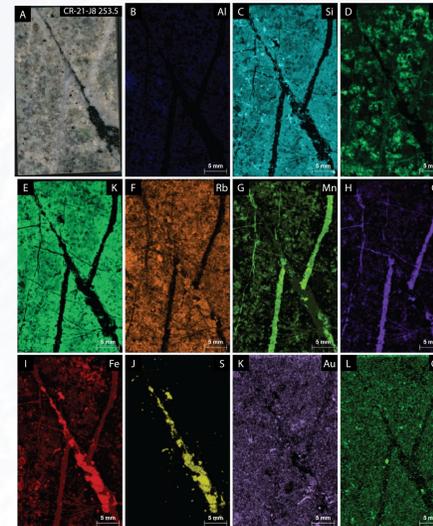
- We collected drill core samples from the **Cross Mine** which were optically investigated, and further analyzed a subset of **six samples**.



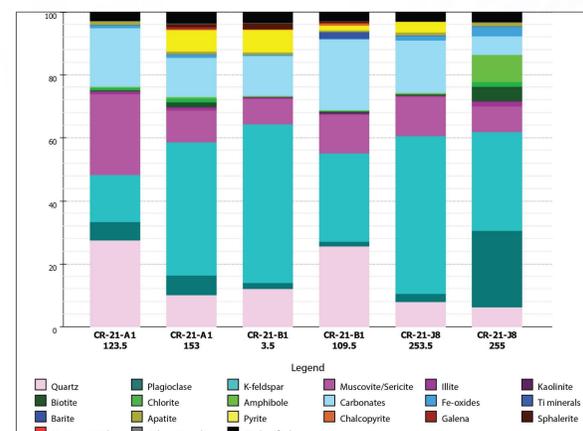
- pXRF** and **mapping μ XRF** were used to evaluate the location and distribution of ore minerals prior to sample preparation
- Prepared “thick” sections.
- SEM-based **automated mineralogy**
- FE-SEM BSE** (Field Emission-Scanning Electron Microscopy backscattered electron) imaging and **EDS** (energy dispersive x-ray spectrometry) analysis

3. Results

- The **host rock** is abundant in Si and Al, with minor Sr, common minerals: K-feldspar, plagioclase, quartz, muscovite, amphibole, biotite, and chlorite.
- Alteration haloes are abundant in K.
- Two main veins types:
 - Carbonate veins**, rich in Mn and also contain Fe-oxides and barite.
 - Quartz-pyrite veins**, which contain electrum and native Ag.
 - Au and minor Co occur in the quartz-pyrite veins.

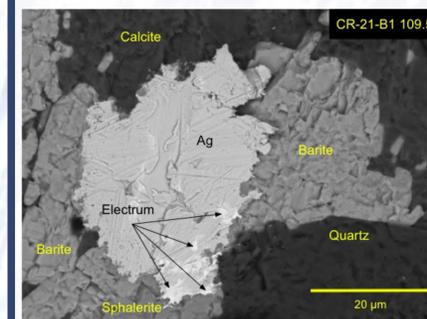
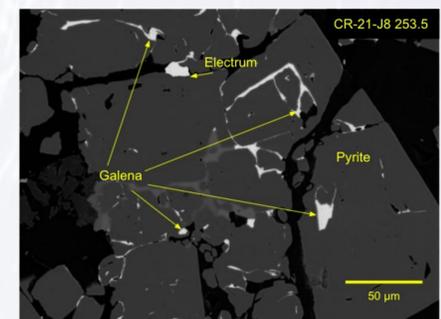


- In all samples, electrum is primarily associated with pyrite and subordinately with muscovite/sericite, K-feldspar, and carbonates, as well as galena and sphalerite. Only two samples had detectable electrum that contributed to their mass and volume percent—CR-21-B1 3.5 (0.1%) and CR-21-B1 109.5 (0.2%).



4. Discussion/Conclusion

- Electrum** and Au-bearing **native Ag** occur in quartz-pyrite veins that are associated with **potassic alteration**.
- Based on cross-cutting relationships, quartz-pyrite veins formed after the carbonate veins.



- Similar deposits to the Cross deposit:
 - Toromocho porphyry Cu-Mo deposit**, Morococha district, Peru (Catchpole et al., 2015).
 - Porphyry-related polymetallic Au-Ag vein deposits**, Central City mining district, CO, USA (Alford et al., 2020).

- This project was a reconnaissance survey, **part of a much larger study** that will seek to establish a better understanding of mineralogy of magmatic-hydrothermal veins, the precious metal zonation within the district, and associated alteration mineral assemblages to develop a conceptual model of the deposit and the Grand Island mining district in general (Langston-Stewart, 2021).

5. Acknowledgements

- A special thanks to all my co-authors.
- This work was conducted within the NSF I/UCRC Center for Advanced Subsurface Earth Models (CASERM) which is a joint industry-university center between the Colorado School of Mines and Virginia Tech.
- This material is based upon work supported by the National Science Foundation under Grant No. 1724794. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation

6. References

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