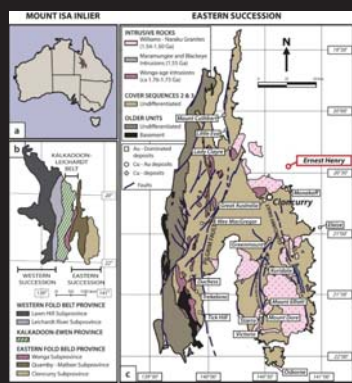


FOOL'S GOLD?

THE ASSOCIATION BETWEEN PYRITE AND GOLD AT ERNEST HENRY MINE, QLD, AUSTRALIA

James Hewett¹, Richard Lilly¹

¹Department of Earth Science, University of Adelaide, North Terrace, Adelaide, SA, Australia.



Regional geology of the Eastern Succession and study location of Ernest Henry Mine adapted from Mark et al., (2006).

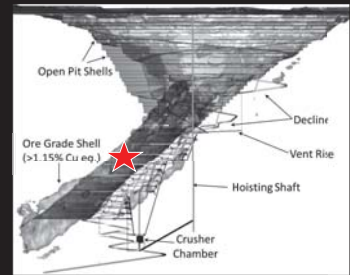
INTRODUCTION

- The Ernest Henry iron oxide copper gold deposit is located 35 km NE of the township of Cloncurry in NW QLD.
- It is the most significant Cu-Au deposit in the Cloncurry Mineral System.
- The pipe-like Ernest Henry ore body is hosted in brecciated and K-feldspar altered Mount Fort Constantine Intermediate Volcanics (~1740Ma; Mark et al., 2006) and dips ~45° towards the SSE.
- The pipe-like ore body is structurally bounded by sub-parallel shear zones and is ~250m thick, ~300m wide with a down-plunge length of over 1000m and is open at depth.
- The ore assemblage is dominated by magnetite, chalcopyrite, pyrite, carbonate, quartz and apatite.
- Currently an underground sub-level cave operation with a 2016 underground resource of 87.1Mt @ 1.18% Cu, 0.60 g/t Au.
- 78% Au recovery - CAN WE IMPROVE THIS?**

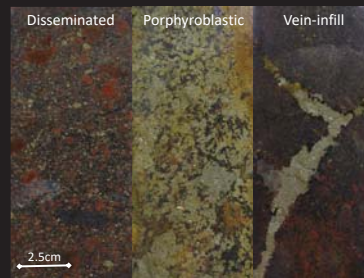
Where is the Au...?

SAMPLING

- 22 Samples selected from 3 cores at ~700m depth within the deposit.
- Samples selected on pyrite texture.
- SEM-EDS and MLA (Mineral Liberation Analysis) have been used to identify and image gold grains.
- LA-ICP-MS has been used to discriminate trace elements associated to Au.



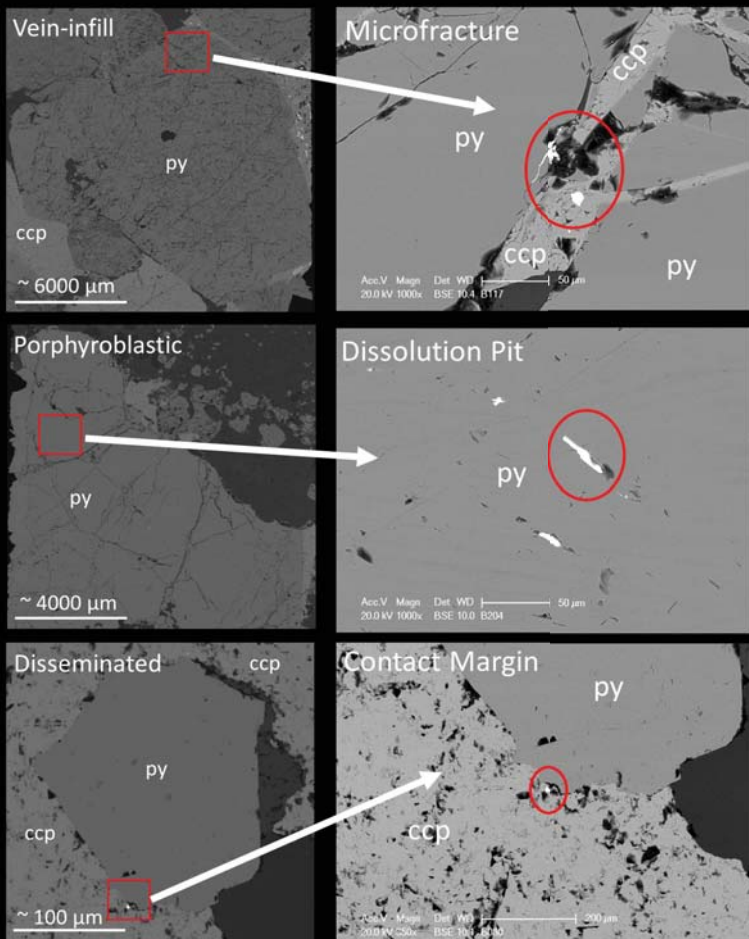
Ernest Henry Mine open pit and underground resource model. The red star represents sample locations.



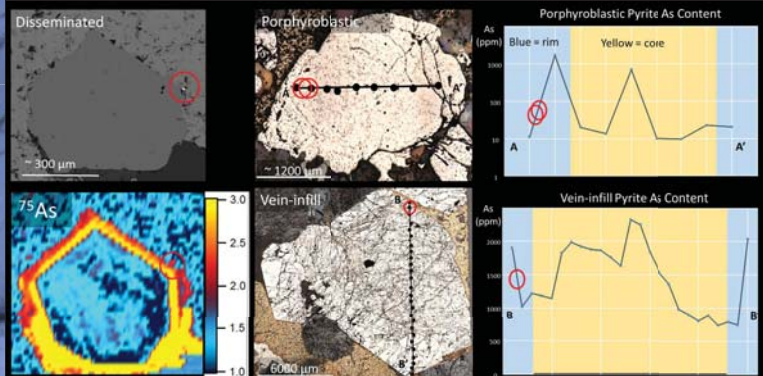
- 3 pyrite textures sampled.
- All pyrite interpreted as pre-dating the main stage chalcopyrite (Cu) mineralisation.
- Au enters system with chalcopyrite.

Half core: The three types of pyrite sampled. Description of pyrite textures were adapted from Foster et al. (2007).

SEM OBSERVATIONS: WHERE IS THE GOLD?



LA-ICP-MS OBSERVATIONS: ARSENIC AND GOLD



- Majority (72%) of Au is associated with Vein-infill pyrite.
- Majority (69%) of Au is in pyrite microfractures with chalcopyrite infill.
- Average diameter and length of Au grains were 4 μm and 13 μm.
- Au associated with As-rich rim.
- Au is NOT associated with high As concentration BUT a steep As gradient.

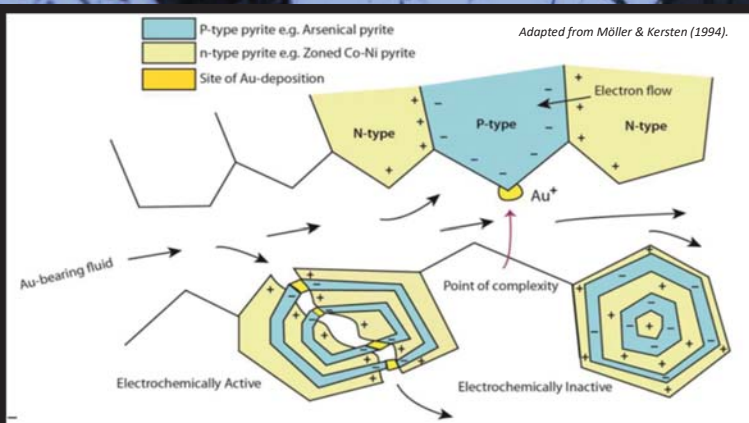
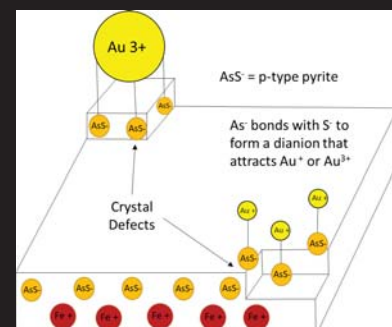
WHY IS THE GOLD HERE?

Physical Control:

- Microfractures = crystal surface defects
- Surface defects release As^{S-} anions
- Release of As^{S-} anions facilitate Au precipitation

Chemical Control:

- As substitutes for S = p-type pyrite
- Co/Ni substitutes for Fe = n-type pyrite
- P-type pyrite attracts the Au complexes from the fluid.



Adapted from Möller & Kersten (1994).