

Walter Herrmann Geoscience Pty Ltd

ABN: 89 074 201 371
57 Webberley Road FORTHSDIE TAS 7310 AUSTRALIA
mobile: 0429 956 587
email: wherrmann@iprimus.com.au

Copperfield – a brief review

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Walter Herrmann

INTRODUCTION

As I was passing through the Northern Territory this week on other business, Thundelarra's exploration manager, Costica Vieru, requested me to 'have a look' at the Copperfield prospect in Thundelarra's exploration license EL 29523, 'Mt McLachlan', near Pine Creek.

This cursory review is based on a half-day field inspection of the historic mine workings and nearby lode extensions at Copperfield, and appraisal of some monthly exploration progress reports summarizing soil geochemical and rock chip 'prospecting' surveys undertaken in mid 2013, by Harry Mees for Thundelarra.

COPPERFIELD PROSPECT DESCRIPTION

The Copperfield prospect is situated 6 kilometres southwest of Pine Creek. It was one of the first mineral discoveries in the district, with reports of copper mining at Copperfield Creek as early as 1872.

The mine workings consist/ed of at least 15 shafts up to 40 metres deep and an open cut, of which some are still open, and which produced ~3450 tonnes of (presumably hand-picked) oxidized and supergene ore grading ~25% Cu between 1875 and 1917 (Ahmad et al., 1993).

Ahmad et al. (op. cit.) described the geologic setting as follows:

'The workings lie within slightly hornfelsed meta-greywackes and phyllites of the Burrell Creek Formation, about 2.5 km southeast of the contact with the Tabletop Granite. The copper sulfides and carbonates are found within a conformable quartz-filled breccia zone which strikes 335° and dips 50-60° west. At the surface, the width of the lode averages about 1 m, and can be traced for about 200 m along strike. Pyrite and chalcopyrite are the main primary ore minerals which are coarse-grained and are present

as breccia fill with lesser chalcocite. Covellite and bomite are common minerals in the supergene zone, while malachite and azurite are present in the oxidized near-surface ore.'

In 1967 United Uranium NL (UUNL) estimated the 'remaining probable ore' at 90,000 tonnes grading 6.1% Cu and 185 g/t Ag. However, an early 1970's exploration program including IP/resistivity, geochemical, and mapping surveys and drilling by UUNL produced 'discouraging' results (Ahmad et al., 1993).

Another small open cut and shaft are developed on a WNW trending quartz-breccia lode of similar character, located south of the Jindare Road and about 500 m southwest of the main workings. These may relate to the second phase of production of 'several hundred tones of ore grading 12-26% Cu' referred to by Ahmad et al. (1993).

RECENT EXPLORATION

In 2011 Thundelarra carried out soil geochemical sampling programs over extensions to the two main lodes at the Copperfield prospect, and over another NNW trending lode 3 km to the southwest (Figure 1). Several RC drill holes tested the main lodes near 803600E 8465300N and 803550E 8464600N, presumably for Cu ± Au, but the results were inconclusive or insufficient to justify follow up drilling (C.Vieru, A.Ashe, pers. comm., July 2014).

During March 2013 Thundelarra investigated the Cu ± Au potential of the Peel prospect, 1½ kilometers southwest of Copperfield (Mees, 2013a). Earlier exploration for gold, including soil and rock chip sampling and eight RC drill holes, by Collotran Holdings in the late 1990s, had achieved a best result of 2 m @ 0.13 g/t Au. Mees (op. cit.) concluded it had 'little potential as a gold prospect'.

In the following months Mees made reconnaissance traverses in the broader Copperfield area, mainly focused on discovering gold-bearing quartz reefs. Field checking on reports of anomalous gold rock chip results by previous explorers, were 'largely unsuccessful' (Mees, 2013b).

He also turned up another copper prospect, which he named 'Copperfield 3'. It encompassed some 'malachite stained and pervasively mineralized quartz boulders derived from a 3m x 8m shallow pit' surrounded by quartz float. A soil geochemical survey around that area produced 'rather disappointing' results with a moderately anomalous 'bullseye' up to 120 ppm Cu centred on the old working against very low background, and Au values around 1 ppb (Mees, 2013c).

However, traversing of the area east of Copperfield located several additional veins; of which some produced gold assays of up to 2 g/t from 'selective' rock chip sampling (Mees, 2013c). Nevertheless, he concluded that these and other veins were unlikely to be potentially economic gold deposits because of

- their narrow widths, 0.1 to 2 metres,
- discontinuous short strike lengths, 5 to 200 metres, and
- low grades, which are anyway enhanced by supergene enrichment at surface.

Furthermore, he suggested that future exploration for these types of quartz vein hosted gold (\pm copper?) deposits, which lack broad geophysical and soil geochemical expressions, would have to be limited to geological mapping and prospecting – techniques that were fairly extensively applied by previous explorers, but without much success in EL29523

EXPLORATION POTENTIAL

Under the metallogenic classification of mineral deposits in the Pine Creek Orogen the Copperfield deposit is classed as a 'Cu-Quartz vein' deposit, whereas most of the other quartz veins in the area may be considered as (weakly mineralized) 'Au-Quartz veins' (Ahmad et al., 1993).

Ferenczi & Sweet (2005) described the Cu-Quartz veins as being

'characterized by northwesterly or north-northwesterly trending sulfide bearing quartz veins in metasedimentary rocks (mainly Burrell Creek Formation). The quartz veins are in the range 0.2-2.5 m in thickness and are typically white, coarse grained and locally brecciated¹. Fluid inclusion and stable isotope studies on the copper-bearing quartz veins in PINE CREEK suggest that the fluids responsible for the generation of the base metal bearing veins were derived from granitoids after the carapace fracturing stage, and that precipitation of sulfides occurred due to an increase in pH accompanying CO₂ loss (Ahmad et al., 1993).'

The value of mineral production and resources in the Pine Creek 1:250,000 sheet area is vastly dominated by gold (Ahmad et al., 1993, Table 7, p.43). Recorded production of gold up to about 1993, probably largely won from Au-Quartz veins, was 29,516 kg, whereas total copper production was 3,529 tonnes, of which almost half reportedly came from the Cu-Quartz vein deposits at Copperfield (~960 t Cu) and Mount Ellison (~660 t Cu). At today's copper price², production from those two foremost Cu-Quartz vein deposits would total about \$12 million. Even UUNL's 1967 estimate of 'remaining probable ore' at Copperfield (which seems to have been invalidated by their subsequent drilling program) would have an in-ground value today of only about \$42 million.

Although the copper grades seem attractive, base metal deposits of this scale are well below the economic radar in modern times. Ahmad et al. (op. cit.) noted that although there are more than sixty copper occurrences in the PINE CREEK area, most were 'economically insignificant' and none were in production.

Mount Diamond, with a delineated resource of 211,000 tonnes @ 5.6% Cu to a depth of 100 m, is the largest known, and best non-economic example of a Cu-Quartz vein deposit in the Pine Creek Orogen (Ferenczi and Sweet, 2005). Underground mining by UUNL in 1970–1973 produced 51,000 t of ore grading around 5% Cu and 73 g/t Ag. Taylor (1973) commented on the deposit's high grade shoots separated by sharp transitions to low grade or barren quartz, which had contributed to reductions in reserves and increased ore dilution. Mineralized zones at Mount Diamond are known to exist at about 200 metres below surface, and there is an estimated resource of 150,000 tonnes @ 5% Cu remaining in the deposit above 100 metres depth (Ferenczi and Sweet, 2005). That remaining resource has a present day in-ground value of \$57 million. That it remains in the ground, and moreover that UUNL (with an already established sulfide flotation mill nearby at Moline) could not profitably extract it forty years ago, demonstrate the modern non-viability of this type of narrow vein deposit.

On that empirical basis, I consider the Cu-Quartz veins in the Pine Creek Orogen, and probably everywhere else in Australia, to be not worth exploring for. They fall into my category of exploration 'red-herrings'. They might have strong surface geochemical and gossanous expressions, and patchy high grades that entice costly exploration and drilling, but ultimately will be sub-economic - because they are too small.

The potential of the Au-Quartz veins is another matter. EL 29523, which lies just west of and partly overlaps the Pine Creek Shear Zone with its prominent Pine Creek Goldfield, may have potential for undiscovered auriferous reefs. This gold potential was doubtless the objective for the reconnaissance traversing and sampling undertaken by Harry Mees in 2013.

¹ Exactly applicable to the Copperfield lodes.

² London Metals Exchange Cu cash price on 10/07/2014: ~ AU\$7,600/t

However, as Harry Mees noted, that is not a new idea. And there has been extensive and locally intensive gold exploration including drilling, over parts of EL 29523, as summarized by Bajwah (2014).

Harry Mees concluded that because the Au-Quartz vein type deposits are not reliably detected by soil geochemical or geophysical methods, future exploration for them would have to be based on 'geological traversing to map out potentially mineralized structures'. In that, I assume he meant mapping and sampling exposed quartz reefs, as well as identifying favourable structures, such as anticlines, faults and en-echelon shear veins in the metasedimentary host rocks, which are the major structural controls on deposits in the Pine Creek Goldfield.

That approach, of course, has been well tried by the previous explorers, including the prospectors of more than a century ago. Considering EL 29523's proximity to the Pine Creek Goldfield, it is highly unlikely that any major reefs or favourable structures have been overlooked in the areas of reasonable outcrop. There may be such features still hidden in areas of alluvial cover or poor outcrop but they represent very difficult exploration targets because of their lack of geophysical response and dubious geochemical expression.

Maybe detailed seismic surveys could identify buried structures, and C-horizon auger soil sampling may detect subtle Au-As geochemical haloes? Nevertheless, I suspect it would require a lot of persistence, and a lot of blind drilling, fraught with the high risk of near misses of discontinuous veins with nuggety gold distribution. And to make sense of host rock structures under covered areas would require costly diamond core drilling; RC drilling would be useless for that.

Despite that I have no detailed knowledge of the Pine Creek Goldfield, I consider that EL 29523 has only moderate potential, combined with a low or very low findability factor, for new discoveries of Au-Quartz vein type deposits.

CONCLUSION

EL 29523 has moderate potential for Cu-Quartz vein deposits of Copperfield type, but Thundelarra should waste no more energy and funds exploring for such sub economic deposits.

The area has moderate potential for existence of potentially economic Au-Quartz vein deposits in areas of poor outcrop or alluvial cover. However, their low to very low findability factor, and lack of success in previous exploration programs, combine to indicate a low prospectivity.

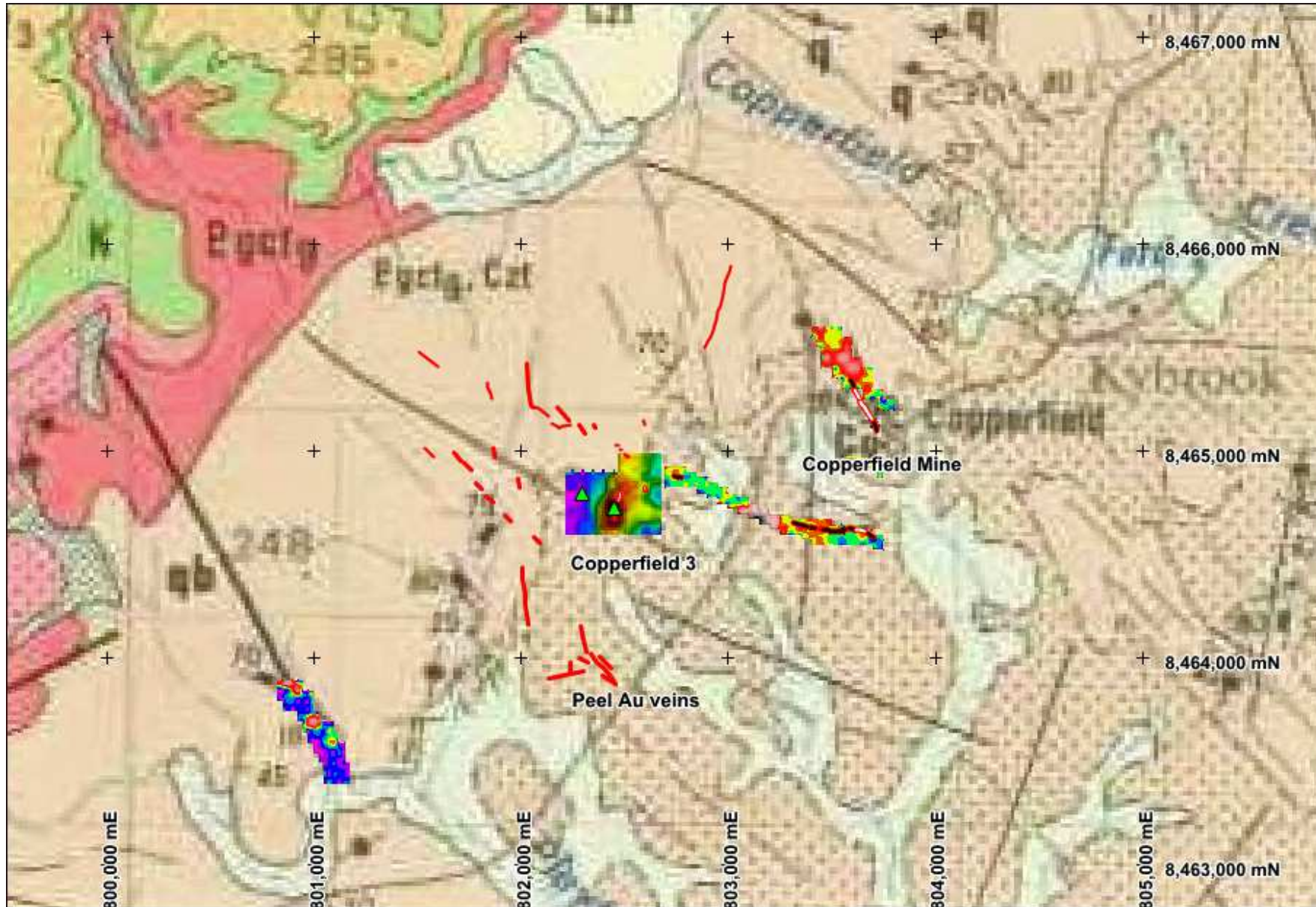


Figure 1 Copperfield location diagram showing prospects, mapped quartz veins (red lines), and soil geochemical surveys overlaid on NTGS' 1:100K geological map of Pine Creek. Scale ~1:25,000. (There is clearly a projection error between the exploration data and NTGS 100K geologic map – but I haven't troubled to sort it out for this district scale diagram.)

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