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Copper and Gold Mineralisation in the Flinders Ranges

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Extended Abstract

The range of rocks and tectonic settings occurring in South Australia, dating from the Achaean to the Holocene, lead to a variety of mineral associations of economic importance, such as metals (copper, gold, lead, zinc, nickel, silver, Platinum Group Elements), minerals (uranium-bearing phases, jade, talc, barite), fossil fuel (petroleum and coal) as well as water resources. The biggest mineral deposit is the giant copper-uranium-gold-silver-REE deposit at Olympic Dam, west of Lake Torrens, located at the eastern edge of the Gawler craton (Drexel et al., 1993).

In the Flinders Ranges there are numerous examples of mineralisation, including copper, lead, zinc and uranium. Mineral exploration played a dominant role in the settlement history: in particular copper mining enhanced the development of the northern section of the Ranges. Pastoral development in the area started around 1850, and was soon followed by prospectors being encouraged by the discovery earlier on of the rich Burra deposit south of the Flinders Ranges [1] . In the Ranges themselves, the first copper mineral outcrops were found at Spring Creek near Port Augusta in 1853 and Blinman to the north of Wilpena in 1861 (e.g. Barker et al., 1995; Coats and Blissett, 1971a, and others). These discoveries were followed by tens of other outcrops, resulting in several mining operations to be started. However, the lack of transport and of water, as well as the overall poor ore grade caused all mining operations to struggle and eventually shut down, with only the two first mines ever being economic, at Blinman and Spring Creek.

The occurrence of copper-bearing rocks was first recognized by the presence of bright green and blue copper carbonate minerals, Malachite ($Cu_2(CO_3)(OH)_2$) and Azurite ($Cu_3(CO_3)_2(OH)_2$). This led to the building of a smelter in Blinman, and an afflux of mining workers coming to the Flinders Ranges to try their luck. However, except for Blinman and Sliding Rocks (SE of Leigh Creek), none of the mines opened was profitable. Transport issues, poor communication, reoccurring periods of drought made the mining of poor ore grades a hopeless endeavour. The very low price of copper at the end of the 19th century caused almost every single mine to shut down (Barker et al., 1995; Davies et al., 1996).

Gold is almost absent from the Flinders Ranges. Two founds in the 1890s caused mini-gold rushes, as short-lived as they were sudden. Some alluvial gold has been reported several times, but in no quantities that would be even remotely economic (Davies et al., 1996).

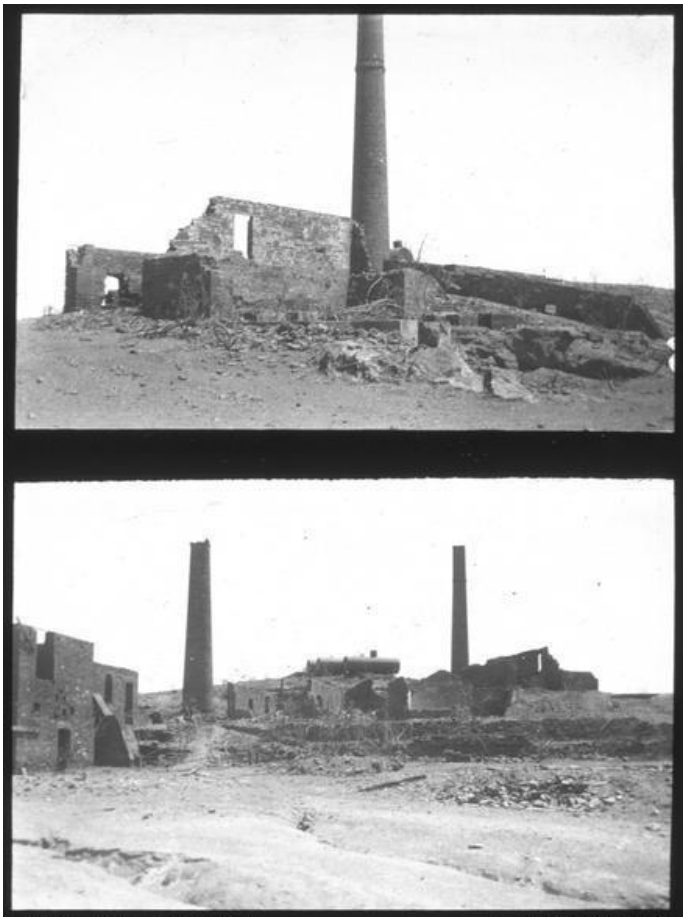
Copper mineralisation

Copper ore mainly occurs at the surface as malachite and azurite as a weathering products of underlying copper sulfides such as chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), as well as copper oxides (tenorite, CuO, and cuprite, Cu_2O), located in thin veins in fault zones and tension fractures. The origin of these fractures is diverse. The main copper occurrences are associated with the formation of a diapir, as is the case for the Blinman deposit, or with fluid circulation associated with granite intrusions, which is the case in the deposits in the Mt. Painter region (e.g. Yudnamutana). (Barker et al., 1995; Davies et al., 1996).

The Blinman Deposit (after Coats (1964): Blinman Mine was the most successful mining operation undertaken in the Flinders Ranges and was intermittently active between 1863 and 1907 (Barker et al., 1995). Some 200 000t ore were mined, with copper contents ranging from 3-30%, leading to a recovery of approximately 9700t of copper. Figure 1 shows a picture of the Blinman smelter in 1930, 20 years after its final closure.

[1]For locations see this page.

Figure 1. Photo of the Blinman mine



The remnant of the Blinman mine in 1930. Photo by J. Flynn [2] .

The Blinman Diapir consists of fragments of a variety of rock types thought to belong to the Willouran Series deposited during the late proterozoic sedimentary sequences in the Adelaide Syncline. It contains sedimentary rocks, breccias, altered basalts, dolerites, gneisses and granites. Unfortunately the source of the mineralisation is not certain, as not many recent studies have been undertaken. However, it seems certain that mineralisation was associated with the fault system related to diaprism: at the rim of the diapir, mineralisation is found in veins close to contact with the core complex. Within the core complex, it appears that the copper may have originated from the volcanics within the Willouran Series, and was later remobilized in an alteration or metamorphism event.

Mt Painter Region after Coats and Blissett (1971a)

The numerous small copper occurrences in the Mt Painter Inlier region lie along the margin of the Mt Painter block, within the metamorphic aureole of the Adelaide System around the basement. They are associated with the stage of epithermal activity following the intrusion of granites in the lower Ordovician, during the Delamerian Orogeny. The intrusions are believed to be anatectic, produced by the melting of rocks of the Mount Painter Complex. Ore elements were remobilized by the exsolution of a fluid capable of transporting volatile phases and precipitated in faults zones.

At Yudnamutana, there appears to be the remnants of a supergene surface enrichment that happened during an erosional episode in the Tertiary. Like most of the ore bodies in the Mt Painter region, the copper phases are oxidized; This is inferred to be related to the lowering of the water table after block faulting during the late Tertiary.

Even though no single deposit has yet proven to be economic enough to justify large mining operations within the Flinders Ranges, the amount of small deposits and the improved exploration techniques still cultivate the belief that the Flinders Ranges hold considerable mineral potential.

[2] http://nla.gov.au/nla.pic-an24206280

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