MOUNT ISA Cu and Pb-Zn-Ag DEPOSITS, NW QUEENSLAND AUSTRALIA

E.L. Conaghan, K.W. Hannan, J. Tolman

1Mount Isa Mines Exploration Pty Ltd., P.O. Box 1042 Brisbane, QLD 4001
2Mount Isa Mines Ltd., Mount Isa, QLD 4825

LOCATION

The Mount Isa Cu and the Mount Isa, Hilton and George Fisher (formerly Hilton North) Pb-Zn-Ag deposits are located W of the Leichhardt River between 20°44’ and 20°34’ S at 139°29’E (Figure 1); Mount Isa (SF 54-01) 1:250 000 sheet.

DISCOVERY HISTORY

Lead-Ag mineralization was discovered by John Campbell Miles in 1923 when cerrusite was identified in the prominent gossanous ridges above the Mount Isa lodes. Systematic exploration began in 1927 with a 5-year, 11 000 m surface diamond drilling programme. During that time, the Black Star, Rio Grande, Black Rock Pb deposits, and the 650 and Black Rock Cu deposits were discovered.

High-grade Cu mineralization does not persist to the surface, although dark gossans amongst the mine infrastructure (Figure 2) indicate its former occurrence. Copper was first reported in 1927 in an intersection of 15 m at 17% secondary Cu from a diamond drillhole targeting Ag-Pb-Zn mineralization in the Black Rock area. Three years later, the 650 primary Cu orebody was located, again by a drillhole that targeted primary Zn and Pb, but which, instead, intersected Cu ore as chalcopyrite, including an interval of 8.8 m @ 8.5% Cu. These intersections were largely ignored until a need for Cu during World War II prompted development of primary Cu. The Black Rock Cu orebodies were drilled between 1937 and 1946. Continued drilling and underground development led to the discoveries of the nearby 500 and larger 1100 orebodies during the late 1950’s. The 1100 orebody was discovered in 1954 by a drillhole intersection of 202 m at 2.2% Cu. The high-grade Enterprise Cu orebodies were discovered in the mid 1960’s by deep diamond drilling above the N-dipping basement contact.

The Hilton and the later defined George Fisher deposits were first recognized in 1947 when S.R. Carter identified cerrusite in the ironstone ridges N along strike from Mount Isa (Figure 1). In 1948, systematic drilling intersected economic mineralization, although production did not commence until 1987 at Hilton and 2000 at George Fisher.

PHYSICAL FEATURES AND ENVIRONMENT

The Mount Isa area has a semi-arid climate with an average annual rainfall of 450 mm, 45% of which falls during January and February, and an average temperature range of 17 to 32 °C. High evapo-transpiration rates result in a water deficit for most of the year. The natural vegetation is dominantly spinifex (Tedra pungens) and Snappy Gums (Eucalyptus pulverulenta).
'ribs' along elongate, low hills that rise 5-25 m above the alluvial flats.

Sisions of ore lodes or pyrite lenses and form 1-5 m high strike-parallel

the mines, silicified and ferruginous gossans are the surface expres-

ions of spatially separate Zn-Ag and Cu oxide-carbonate assemblages
developed above the BOCO whereas secondary Cu sulphide, particu-
larly chalcocite, have accumulated in a transitional zone below and

within about 30 m of the BOCO (Smith, 1966, and see below). Detailed

investigations of the weathering profiles are in Scott and Taylor (1982),
Herlihy (1994) and Yamaguchi (2001).

Beyond the mine environs, outcrops in the Mount Isa district are weakly
to moderately weathered to saprock. In valleys, saprolite extends to an
average depth of 30 m.

Weathering history and age of the regolith

The ferruginous and siliceous gossans are effectively the remnants of
middle to upper saprolite that developed locally from the intense acid
leaching of former sulphide lodes. Manganese oxide coatings, rich in
Pb, Zn and Ba, from the Mount Isa Mine gossan are dated at 15-21 Ma
by \(^{40}\)Ar/\(^{39}\)Ar and K-Ar techniques (Vasconcelos, 1998). This range of
dates fits within a wider band of Tertiary ages determined for Mn oxide
minerals from other prospects and deposits in the Mount Isa region
(Vasconcelos, 1998). Therefore, supergene enrichment, leaching and
gossan development over the Mount Isa base metal deposits probably
occurred during the same wet periods of the Miocene that contributed
to the widespread silcrete and laterite, which survive today as eroded
relicts on mesas and isolated Cambrian and Mesozoic plateaux.
Evidently, Phanerozoic sediments had already been eroded from the vicin-
ity of Mount Isa, allowing large quantities of meteoric water into the ore
sequence by the early Tertiary.

MINERALIZATION

The pre-mining, combined Pb-Zn-Ag resources of Mount Isa, Hilton
and George Fisher are estimated to have been 223 Mt at 6.2% Pb, 9.2%
Zn and 118 ppm Ag. Primary Pb-Zn-Ag ore contains galena, sphalerite,
pyrite, pyrrhotite and freibergite. A similar estimate for the original Cu
resource at Mount Isa Mine is 248 Mt at 3.3%. The sulphide mineral
assemblage in primary Cu ore consists of chalcopyrite (the only signifi-
cant Cu-bearing mineral), pyrite, pyrrhotite and minor cobaltite (Table
1).

As indicated above, supergene resources are both mineralogically and
spatially more complex than the primary ore. The relationships between
oxide, transitional and primary zones are illustrated in Figure 3; their
respective mineralogies are listed in Table 1. Above the BOCO, the
Urquhart Shale is lighter but below it is invariably grey. Figure 3 illus-
trates this important transition at an average depth of about 70 m, but
extending to much greater depths in areas of structurally enhanced
permeability. The transition zone is of incipiently oxidized primary sul-

Figure 3. Geological cross-section through the northern area of the
Mount Isa Mine (mine grid 36 550mN) displaying simplified relationships
between mineralization, structure, weathering and alteration.


REGOLITH EXPRESSION

The distributions of bedrock Cu, Pb and Zn in near surface drill hole samples from the vicinity of Mount Isa Mine are summarized in Figure 4. Most of the samples were collected during the 1980s from saprolite and supergene minerals in the Urquhart Shales, Mt. Isa, Northwest Queensland. B.Sc. Hons. Thesis, The University of Queensland, 87pp. (Unpublished).

REFERENCES

