ELOISE Cu-Au DEPOSIT, CLONCURRY DISTRICT, QUEENSLAND

I.D.M. Robertson and Li Shu

CRC LEME, CSIRO Exploration and Mining, Perth, Western Australia

LOCATION

The Eloise Cu-Au Deposit is approximately 60 km SE of Cloncurry at 20°57′30″S, 140°58′40″E (Figure 1); Cloncurry SF54-02 1:250 000 sheet.

Figure 1. Location map of the Eloise Mine in relation to outcropping Proterozoic rocks and the Eromanga Basin.

DISCOVERY HISTORY

Eloise was discovered by regional and local aeromagnetic, ground magnetic and electromagnetic surveys and subsequent drilling by BHP Minerals Exploration (Brescianini et al., 1992; Skrzeczynski, 1993).

PHYSICAL FEATURES AND ENVIRONMENT

The mine is situated on rolling plains underlain by sediments of the Eromanga Basin. The plains consist of alluvial river terraces and fluvial plains, where grasses flourish.

The climate is tropical, monsoonal and semi-arid, with an erratic annual summer rainfall of about 380 mm. Sparse bushes of eucalypt and spiky hummocks of spinifex cover much of the Proterozoic, whereas the N and E parts have been cleared for grazing, particularly the black soil plains, where grasses flourish.

GEOLOGICAL SETTING

Eloise lies on the margin of the Eromanga basin, close to the exposed part of the Eastern Fold Belt of the Mt Isa Inlier (Figure 1). The inlier runs predominantly N-S and consists mainly of folded and eroded Proterozoic metasediments and metabasalts of the Soldiers Cap Group. Mineralization in these rocks occurs along major faults and shears.

The exposed Proterozoic is sporadically capped with remnant, flat-lying, late Jurassic to early Cretaceous fluvial sediments (Gilbert River Formation), mainly in the headwaters of the Fullarton, Cloncurry and Burstard rivers.

The Eloise deposit is buried under 50-70 m of Cretaceous sediments of the Monto Formation, mainly in the headwaters of the Fullarton, Cloncurry and Burstard rivers.

MINERALIZATION

Eloise has an indicated reserve of 3.2 Mt at 5.8% Cu, 1.5 g/t Au and 19 g/t Ag. It is hosted by greenschist-metamorphosed metasediments and metamorphic rocks with major retrograde shears in which early hornblende-biotite-quartz assemblages occur. They were overprinted by chlorite-muscovite-pyrophyllite-chalcopyrite-calcrete-magnetite and, later, by calcite-chlorite-quartz + pyrite assemblages during subsequent brittle deformation (Baker, 1994).

REGOLITH EXPRESSION

To date, exploration in the Eromanga and Carpentaria basins has been by investigation of geophysical targets by drilling. The Mesozoic cover has presented a considerable challenge. Li Shu and Robertson

© CRC LEME 2003 Eloise Page 1
(1997) determined the linked geomorphic and sedimentary histories of this region and, using this framework, investigated opportunities for using geochemistry in this difficult environment. The most promising geochemical target is the Proterozoic-Cretaceous unconformity, marked by a thin, discontinuous layer of gravelly sand and conglomerate, sealed in by a thick mass of semi-pelitic to pelitic sediments. The basal, high-energy sediments developed on and from the basement might be expected to retain dispersions from any parts of the Eloise deposit that were exposed in Cretaceous times.

**Palaeotopography**

The palaeotopography of this unconformity was obtained from mine and broad-scale (>1 km) water bore drilling (Figure 3). The Eromanga Basin deepens to the NE. The gradient of the unconformity, close to the mine (Figure 3A), is slight (1:1250) but there appears to be a much steeper slope (1:100) about 3 km NE, suggesting a scarp (Figure 3B).

Near the mine, coarse, high-energy Cretaceous sediments are anomalous in Cu (75 ppm), Au (90 ppb) As (125 ppm) and, weakly, in Sb (0.7 ppm) at or very close to the unconformity in diamond drillholes ENG1 and ENG2 (Figure 4). There are no anomalies in the decline or in the upper parts of the Cretaceous stratigraphy (Figure 4).

Three km from the mine, there is a small Cu anomaly (80 ppm) at the upper surface of the basal sandstone in diamond drillhole 1TT about 2.5 m above the unconformity. There are very weak Au anomalies in 2TT (57 ppb at the sandstone base and 26 ppb in a thin conglomerate 0.3 m above the unconformity). Arsenic and Sb anomalies (102 and 1.5 ppm respectively) also occur in drillhole 4BTT in sandstones and conglomerates 1.3 m above the unconformity.

**Conclusions**

The degree of weathering below the unconformity is minimal so weathering-related dispersion in the basement is also minimal. There is no dispersion into the upper parts of the Cretaceous sediments. Here, thick Cretaceous cover at Eloise presents an effective barrier to geochemical exploration.

Apart from the mineralization itself, the most promising geochemical target at Eloise is the Proterozoic-Cretaceous unconformity. This is a thin and probably discontinuous layer of high-energy sediments developed on, and from erosion of, the basement. It appears to retain a down-slope mechanical or hydromorphic dispersion from the Eloise mineralisation that was detected in some of the drilling. Dispersion may extend about 100 m from the mineralization from or mineralized faults (Figure 5B). Drilling 3 km distant from the mine also indicated some anomalies, notably just above the unconformity, at sites located directly down-slope from Eloise. Early sediments infilling the area down-slope are anomalous (Figure 5A).

Sampling to detect down-slope mechanical dispersion of Cu, Au, As and Sb in coarse sediments at the Proterozoic-Mesozoic unconformity seems a valid prospecting method in areas of unweathered or slightly weathered Mesozoic cover. It could be used conveniently and cheaply in conjunction with drilling of magnetic basement targets to detect a near miss. The palaeotopography governs the direction of dispersion and needs to be thoroughly understood.

**REFERENCES**


**Figure 4.** Geochemistry of the decline below the concrete casing, the geotechnical drilling and water bore drilling (boreholes 1TT, 2TT and 3TT).

<table>
<thead>
<tr>
<th>Sample medium</th>
<th>Indicator elements</th>
<th>Analytical methods</th>
<th>Detection limits (ppm)</th>
<th>Background (ppm)</th>
<th>Threshold (ppm)</th>
<th>Max anomaly (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse, basal, high-energy sediments</td>
<td>Cu, Au, As, Sb</td>
<td>Au, As, Sb by INAA Cu by XRF</td>
<td>Au &lt;5 ppb As &lt;5 ppb Sb 0.2 ppm Cu 10 ppm</td>
<td>Au 15 ppb As 20 ppm Sb 0.35 ppm Cu 30 ppm</td>
<td>Au 150 ppb As 125 ppm Sb 1.4 ppm Cu 160 ppm</td>
<td>Cu 30 ppm</td>
</tr>
</tbody>
</table>

**Figure 5.** Model of mechanical dispersion along the Proterozoic-Mesozoic unconformity and into the basal Mesozoic high-energy sediments at Eloise Mine.