CENTURY Zn-Pb-Ag DEPOSIT, NORTHWEST QUEENSLAND

P.D. Agnew
Rio Tinto Exploration Pty Limited, 1 Research Ave, Bundoora, VIC 3083

LOCATION

The Century Deposit is located approximately 250 km NNW of Mt Isa in NW Queensland (Figure 1) at 18º43’33.11”S, 138º36’3.04”E: Lawn Hill 1:250 000 map sheet (SE54-09).

DISCOVERY HISTORY

The deposit was found in 1990 by CRA Exploration Pty Limited by drilling a soil geochemical anomaly on a regional gravity - magnetic - soil geochemistry traverse. An earlier conceptual study had identified the Lawn Hill area to have potential for base metal discoveries, with a prominent domal annulus of Cambrian limestone thought to be particularly prospective. Two 20 km long traverses were soil sampled across the dome, with one passing beneath its SW margin where it crossed the Termite Range Fault. There was a prominent Zn-Pb soil anomaly near the SW end of this traverse. This was directly over the surface projection of the Century orebody, concealed beneath barren Proterozoic hangingwall sediments and the unconformably overlying Cambrian limestone. Subsequent infill soil sampling confirmed the anomaly over the Cambrian limestone near the unconformity as well as over a strongly leached, laminated Proterozoic siltstone outcrop, lacking gossan. Rock chip samples, collected earlier from this outcrop, contain 1-2% Pb and Zn and up to 30 ppm Ag. The outcrop was an exposed section of the Century mineralization, later named Discovery Hill, but strong leaching and the lack of gossanous iron oxides led to a subdued geochemical and visual expression of the low sulphur mineralization. Geochemical anomalies on the nearby Cambrian limestone could have been from Cambrian carbonate-hosted Pb and Zn, which was not considered an attractive exploration target. However, the presence of anomalous Proterozoic outcrop near the unconformity on Discovery Hill and comparable soil results from Watsons Lode, a nearby, small, high-grade, discordant Pb-Zn deposit, led to drilling of the soil anomaly. The discovery hole was collared on Proterozoic hanging wall sediments near the anomalous Cambrian unconformity and intersected 27 m at 6.3% Zn. The sulphides are so fine grained that mineralization was not readily visible in the drill chips but panning revealed some galena.

PHYSICAL FEATURES AND ENVIRONMENT

The deposit is located in moderately incised, undulating rocky terrain flanked by flat depositional plains. The climate is semi-arid with an average annual rainfall of approximately 400-500 mm falling mostly in the monsoonal summer months. Temperatures range from 25-37ºC in January and 10-25ºC in July. Vegetation is sparse, consisting mainly of Eucalyptus and Acacia shrubs with spinifex (Triodia spp.) and ephemeral grasses. Zinc weed (Polyarpia spp.) is conspicuous on the outcropping leached mineralization.

GEOLOGICAL SETTING

The Century Zn-Pb-Ag deposit lies in the Western Fold Belt of the Mt Isa Inlier, in laminated siltstone of the Lawn Hill Formation. This is the youngest member of the Proterozoic McNamara Group, 5-10 km of fine grained clastic sediments and minor volcanic rocks that host the Mount Isa, Hilton, Hilton North and Lady Loretta base metal deposits. The geology of the deposit has been described in detail by Waltho et al., (1993) and Broadbent et al., (2002). The mineralization is largely concealed beneath Cambrian limestone and dolomite of the Georgina Basin, which forms a prominent 15 km diameter doughnut-shaped outlier 10 km E of the current main erosional margin of the Georgina Basin. Century lies adjacent to a major NW trending structure, the Termite...
with minor, Cambrian limestone consists of residual skeletal soils on rocky outcrops Proterozoic hangingwall sandstone and siltstone. Regolith on the beneath 50-150 m of Cambrian limestone and up to 200 m of barren
All of the northern block of the Century mineralization lies concealed
block, mineralization outcrops on Discovery Hill.
The Cambrian unconformity. At the western extremity of the southern
limestone, exposes the hangingwall sediments with isolated remnants of
under the Cambrian limestone. The southern block, largely stripped of
preservation of the mineralization, (Ord et al., 2002). Normal movement
Pandoras Fault, a small E-trending splay from the Termite Range Fault, breaks the Century deposit into two major blocks, the northern
downthrown block preserves the mineralization and the unconformity
among the Cambrian limestone. The southern block, largely stripped of
weathering of the stratigraphy (Ord et al., 2002). The unconformity-
covered slopes or are covered by adjacent colluvial-alluvial plains with
extensive black soils (Figure 2).
The southern block is also partly covered by Cambrian limestone and
barren hangingwall sediments that either outcrop on gentle scree-
covered slopes or are covered by adjacent colluvial-alluvial plains with
extensive black soils (Figure 2).
The Cambrian unconformity, which truncates the Century host stratigraphy, is a partly preserved regolith surface. It is gently
undulating over Century but, locally, it is severely disturbed by post-
Cambrian faulting. Massive to friable manganiferous ironstone rubble and minor outcrop at the Cambrian unconformity occur as isolated
pods around the 15 km diameter limestone annulus. This unconformity-
related manganiferous ironstone appears to have been derived from
increased fluid flow along the permeable unconformity during lateritic
weathering, suggesting the unconformity may be a geochemical
migration pathway.

Lateritic residuum is scarce in the Century area, but less resistant
lithologies such as siltstones have been leached and bleached, with
some ferruginous saprolite. Proterozoic quartz-rich sandstone and
Cambrian limestone are relatively fresh at the surface. Gossans occur
over sulphides, particularly pyrite, in Proterozoic rocks.

MINERALIZATION
Century contains an estimated in situ mineral resource of 167 Mt at
8.2% Zn, 1.2% Pb and 33 g/t Ag, (Kelso et al., 2001). Mineralization
consists of fine-grained sphalerite, with minor galena and pyrite, in
fine bedding laminae in a black shale up to 5 m thick, within a 50
m thick mineralized sequence. Mineralization is stratabound but, in
detail, grade variations and Pb-Zn zonation patterns subtly transgress
the stratigraphy (Ord et al., 2002). The surface projection of the
orebody covers approximately 1.4 km², separated by faulting into
two major blocks and a third small block to the E. The orebody is
fault-bounded on all sides and has been eroded both at the Cambrian
unconformity and the present surface.

REGOLITH EXPRESSION

Stream sediments
Regional stream sediment sampling and extensive regional soil sampling
after the discovery, including multi-media, partial and total digestion
orientation traverses, have built a clear picture of the geochemical
dispersion from Century, (Agnew, 1997). Century has a 7 x 2.5 km
regionally prominent <180 µm stream sediment Zn-Pb-Cd anomaly
(>99th percentile; 3512 samples). Tailings, shed from nearby discordant
lode workings at Silver King, contribute significantly to this anomaly,
but there are two highly anomalous 300 m² catchments (with 700 and
570 ppm Zn) which drain directly from Cambrian limestone over the
mineralization and Discovery Hill, respectively.

Manganese, Zn, Pb and Cd are regionally anomalous in stream
sediments around the large Cambrian limestone annulus that, in part,
conceals the Century orebody. This is due to high lithochemical
backgrounds in the carbonates, particularly from the brecciated basal units at the unconformity. Although Zn in catchments draining Century
is significantly greater than elsewhere on the limestones, lower Zn-Pb
stream sediment anomalies provide spurious targets unless the high
background is taken into account.

Soil
The original reconnaissance line of 100 m-spaced soil samples collected
over Century (Figure 3) yielded a prominent Zn anomaly comprising 17
consecutive samples at between 350 ppm and 6050 ppm, including
6 consecutive samples (covering 600 m) averaging 2800 ppm. These
highly anomalous samples were from Cambrian limestone between the
N and S ore blocks, near the surface projection of Pandoras fault. Lead
data were more erratic and gave a spiky anomaly (120-280 ppm)
coincident with the peak of the Zn anomaly (Figure 3). The location of the
Zn anomaly on the Cambrian limestone initially diminished its

Figure 3 Zinc and Pb profiles in <180 µm soils along the original
CRAE reconnaissance traverse which crossed the Century deposit.
Surface projection of Century mineralization shown as a bar. Location of
traverse given in Figure 2.

Figure 4 Multi-media geochemical orientation soil and high iron lag Zn
profiles over Century Zn-Pb-Ag deposit. Regolith and landform domains
are labelled on the top profile. Location of Pandoras Fault shown as a
black arrow, (Agnew 1997). Location of traverse given in Figure 2;
coordinates refer to a local grid.
significance, as minor Pb-Zn mineralization in the Cambrian limestone is common and was not considered a worthwhile target.

The Century mineralization shows a regionally prominent 2 x 1 km Zn anomaly (>99th percentile; 19200 samples) in <350 µm soils immediately over the orebody. Peaks of 7200 and 7000 ppm Zn occur on the Cambrian unconformity directly above Century and on the hanging wall over the southern mineralized block, respectively. Cadmium and Pb are also anomalous (>99th percentile; 19200 samples) with peaks of 34 ppm Cd and 5300 ppm Pb. More obvious Pb anomalies occur just S of the deposit on discordant lode mineralization. Anomalous Mn and P also occur with the Zn-Cd-Pb anomaly but are not prominent regionally.

Soils on Cambrian Thorntonia Limestone and carbonates of the Border Waterhole Formation have background Zn and Pb levels an order of magnitude greater than any other lithologies in the region. As with stream sediments, recognition of the high lithochemical backgrounds in soil is important in order to distinguish responses due to mineralization. Statistical correction for sample site lithology was achieved by calculation of standard scores for each subset of samples collected on the same geological unit. This effectively compensated for the high Zn and Pb background in the Cambrian carbonates without detracting from the anomaly over Century. Enzyme leach <180 µm soils give very high contrast anomalies through barren Proterozoic rocks over the S ore block but do not detect mineralization through limestone cover.

**Lag**

Ferruginous lag is also effective in detecting Century through carbonate cover, but is more expensive to collect and prepare than soil. Lag is swept from deflation surfaces, generally near termite mounds where termites have brought coarse material to the surface. The 1-2 mm fraction is separated in a heavy liquid (SG 2.96) to recover both the magnetic and non-magnetic ferruginous fractions (Agnew, 1994). There are spurious anomalies in ferruginous lag on black soil plains due to scavenging by Mn minerals but it gives a clear response over Century, even highlighting the gap between the N and S ore blocks (Figure 4).

A comparison of media (total mixed-acid (HF-HClO₄-HCl-HNO₃) digestion soil, ferruginous lag and enzyme leach soil) is shown on Figure 4 (Agnew, 1997). This orientation traverse clearly shows the peak Zn results in soils and ferruginous lag lie on the projection of Pandoras Outcrop and float around the Century mineralization. Adjacent orientation lines confirm this pattern.

**Outcrop and float**

Grab samples of manganiferous ironstone float and outcrop around the limestone annullus contain high Zn (1%), Pb (1700 ppm) and Cd (50 ppm) with very little Ag (<0.5 ppm). However, near Century, Zn, Pb and Cd increase sharply (up to 7.3% Zn, 6.8% Pb and 170 ppm Cd) and Ag is highly anomalous (2-48 ppm). Manganese oxides outcrop much more abundantly on the Cambrian unconformity near Century. Anomaly patterns over the orebody suggest that the primary controls on geochemical dispersion from Century are: -

i) Physical dispersion from leached mineralized outcrop on Discovery Hill where anomalies occur in all elements in rock chips, residual soils and stream sediments.

ii) Hydromorphic dispersion along the Cambrian unconformity during lateritic weathering. This is associated with precipitation of manganiferous ironstones which carry highly anomalous Zn, Pb, Cd and Ag immediately overlying and adjacent to Century.

iii) Hydromorphic dispersion up Pandoras Fault generating anomalous soils on the Cambrian limestone overlying the orebody. This and other small structures, which are probably numerous, appear to provide conduits for dispersion from the orebody and the Cambrian unconformity, through the overlying limestone. There is also likely to be a contribution from minor Pb-Zn mineralization in the Cambrian carbonates themselves, however the abundances of Pb and Zn in soils on limestone overlying Century are an order of magnitude greater than those regionally on the Cambrian limestone.

**REFERENCES**


