REDEEMER AU DEPOSIT, AGNEW DISTRICT, WESTERN AUSTRALIA

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LOCATION

The Redeemer deposit is approximately 1.5 km SSW of Agnew at 28°08'S, 120°48'E (Figure 1); Leonora 1:250 000 map sheet (SH51–01).

DISCOVERY HISTORY

The deposit was discovered in April 1985 by WMC Resources by drilling a Au soil anomaly (<6 mm fraction) associated with the projected southern extensions of the Emu Shear (Oates, 1985). The deposit was one of several discovered by WMC Resources in the mid 1980s. These discoveries followed the development by the company of a sensitive (1 ppb), cost-effective analytical method for Au, using an aqua regia digest, organic extraction and a carbon furnace AAS finish (Robbins, 1995).

The total production from 1988-2002 was 11.31 Mt at 3.89 g/t (1.411 million oz). From 1988-1991, 2.09 Mt at 3.53 g/t (0.238 million oz) was produced from open pits and, from 1990-2002, 9.2 Mt at 3.97 g/t (1.176 million ounces) from underground (Goldfields Ltd). Redeemer has been on care and maintenance since 2002. Resources of 3.16 Mt at 4.4 g/t remain.

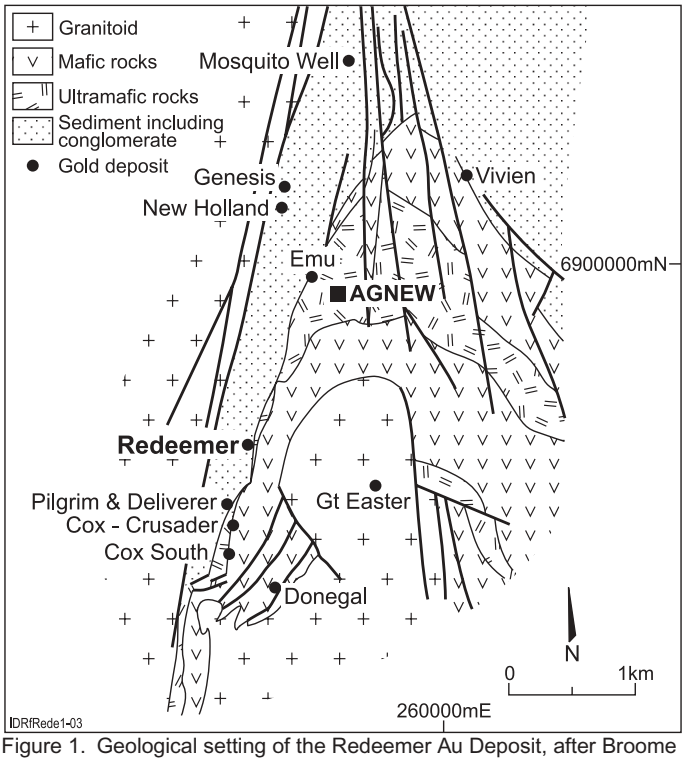

Figure 1. Geological setting of the Redeemer Au Deposit, after Broome et al., 1998.

PHYSICAL FEATURES AND ENVIRONMENT

The deposit is located on a gentle slope. A major drainage trends N and is located to the W of the deposit. The climate is semi-arid, with an annual rainfall of 200 mm, and the mean daily minimum and maximum temperatures are 22-38ºC in January and 4-19ºC in July. The vegetation is sparse and dominated by *Acacia* spp., and other shrubs.

GEOLOGICAL SETTING

The Redeemer deposit lies within the N sector of the Norseman-Wiluna greenstone belt (Figure 1). From E to W, the stratigraphy of the W limb of the Lawlers antiform consists of greenstone (layered gabbro, basalt and komatiites) unconformably overlain by sediments of the Scotty Creek Formation. The basal part of the Scotty Creek sediments (Figure 2) is a foliated conglomerate of flattened ultramafic, mafic and minor

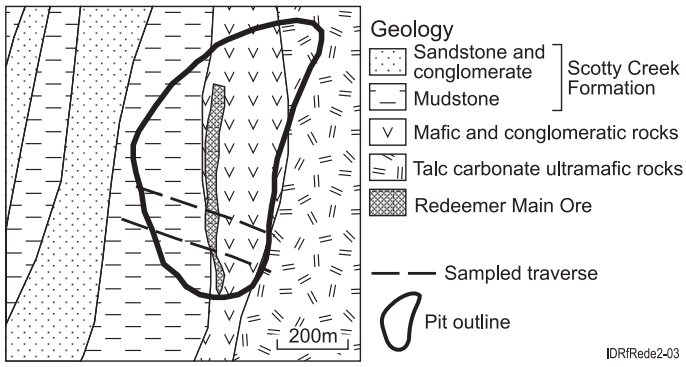

Figure 2. Local geology around the Redeemer pit.

felsic clasts in a chlorite-talc-actinolite matrix. This is overlain by 50 m of mafic conglomerate which, in turn, is overlain by a thick sequence of greywacke, arkose and siltstone (Dugdale, 1992). The unconformable contact between the greenstones and the Scotty Creek sediments is sheared.

REGOLITH

The deposit lies beneath a lag-strewn surface. There is minor subcrop of saprolite and ferruginous saprolite, and Permian tillite and gravel of presumed Tertiary age (Figure 3) conceal part of the deposit. The depth of the weathering front in the Archaean basement is about 50 m over the ultramafic rocks and about 25 m over the mafic conglomerates. The tillite is up to 25 m thick and consists of glacially-rounded granite boulders at the base, weathered to saprock, overlain by clays. It has steep margins that, in places, are undercut. In RC drill spoil, the pale clays of the tillite were misinterpreted as upper saprolite. The position of the tillite coincides with what was previously thought to be a near-surface Au depleted zone over much of the deposit. The Tertiary channel is 5 m thick and contains a mixture of cobbles, ferruginous nodules, quartz and fresh mafic rocks. Fresh clasts clearly indicate negligible post-depositional weathering of the Tertiary sediments. No detailed logging of the regolith in drill cuttings is available.

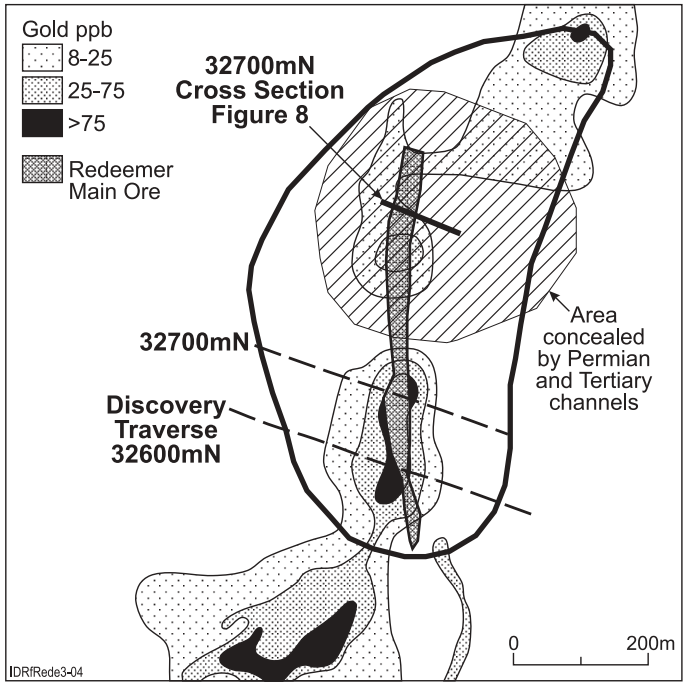

Figure 3. The Redeemer pit showing mineralization, overlying area if Permian and Tertiary cover, contoured Au in soil and two traverses, including the discovery traverse.

MINERALIZATION

The stratabound mineralization is hosted by a thick mafic conglomerate unit near the base of the Scotty Creek Formation (Figure 2). Five zones of mineralization have been defined (Broome *et al.,* 1998): -

Redeemer Main: The major ore source is poor in veining and sulphides (<0.1%) but has biotite and actinolite alteration. The Au occurs as fine (<100 μm) grains interstitial to coarse actinolite and biotite. A number of Bi-Te sulphides, chalcopyrite, molybdenite and scheelite occur within the ore zones. Gold grades are generally 4-5 g/t.

West Lode: This zone has a similar mineralogy to Redeemer Main but biotite alteration is less intense and numerous quartz-carbonate veins occur throughout the mafic conglomerate.

North Pipe: This high-grade shoot is located E of the Redeemer Fault and West Lode, on the hanging wall contact between the mafic and ultramafic conglomerates. The Au is associated with quartz-carbonate veins and coarse arsenopyrite.

Zones 2 and 3: These more typical, small, quartz vein-associated zones within the intermediate conglomerate units to the W of Redeemer Main have weak biotite-actinolite alteration and coarse arsenopyrite.

REGOLITH EXPRESSION

Surface geochemistry

The discovery soil survey used the <6 mm fraction on a 400 x 40 m pattern with follow-up at 100 x 20 m. Analysis was for both Au and As. The Redeemer Au anomaly is one of a number found by the survey (Figure 4A). The two southern anomalies represent the Cox-Crusader (S) (see Mazzucchelli, this volume) and the Deliverer deposits; the large northern anomaly is the Emu deposit. The anomaly 500 m NE of Redeemer is not associated with economic mineralization.

Regionally, the 8 ppb contour defines a 1200 x 200 m anomaly that is broader to the N and S due to masking by tillite and Tertiary fluvial gravels in its central section. The discovery traverse (32600mN; Figure 3), with peak values of 104 and 108 ppb Au in 20 m spaced samples, lies at the N end of a 400 x 50 m zone outlined by the 25 ppb Au contour.

The deposit has an extensive regional As anomaly (Figure 4B) which is spatially correlated to the ultramafic unit to the E of the ore body. The spatial relationship between the Au and As is best seen in traverse 32600mN (Figure 5). The narrow Au peak lies within a broad 300 m wide As plateau (~100 ppm). Although As is a clear regional mineralization indicator, it does not directly indicate the Redeemer Main ore position.

Subsequent to the discovery, orientation lag sampling (2-6 mm fraction) was compared statistically to 82 sites that had also been soil sampled.

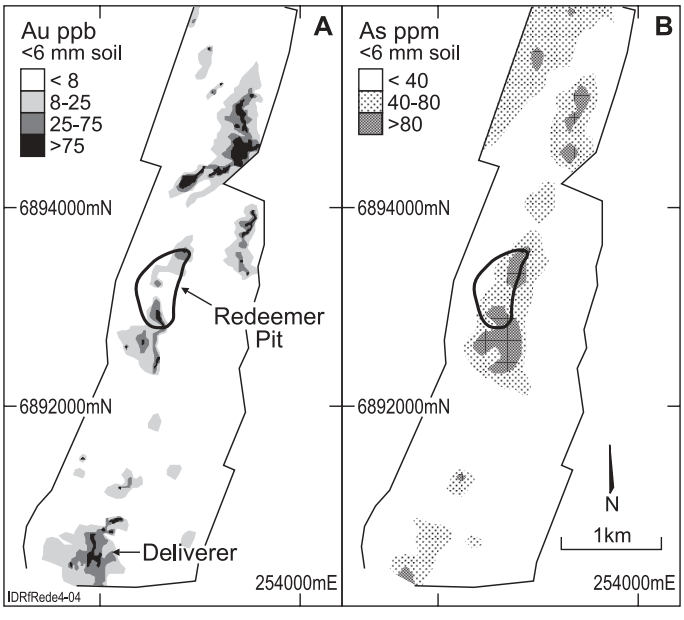

Figure 4. Distribution in regional soil sampling (200x20 m) of Au (A) and As (B).

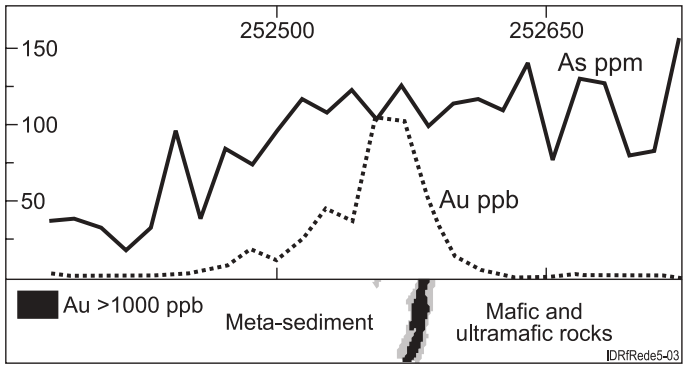

Figure 5. Gold and As soil profiles along the 32600mN discovery traverse.

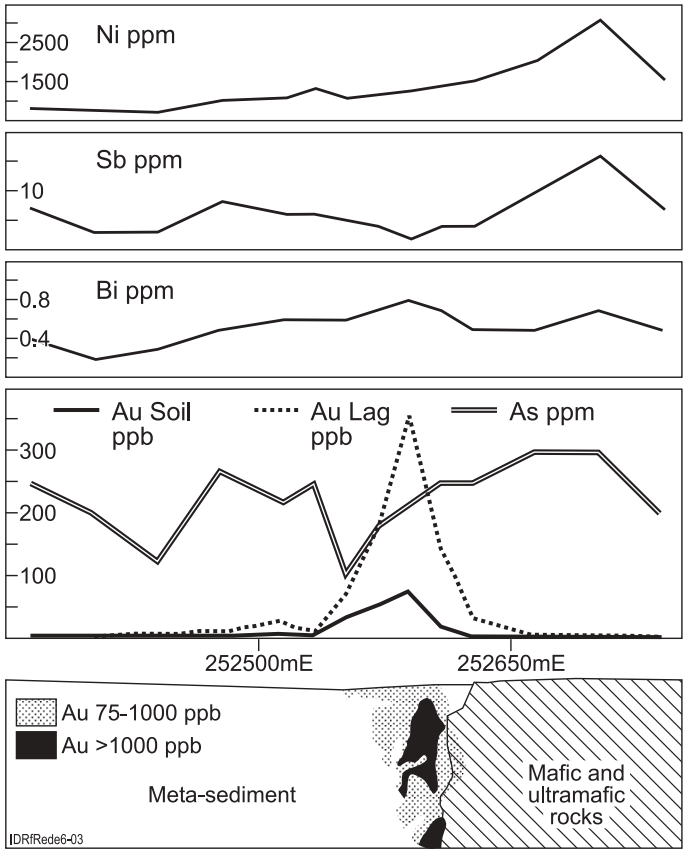

Figure 6. Soil and lag orientation profiles on 32700mN.

Both sample media have similar Au backgrounds (4-5 ppb, as indicated by the 50th percentiles) but the lag has a significantly greater 97.5th percentile, yielding twice the contrast. This is evident in Figure 6 where the Au peaks are generally 2-3 times greater in the lag. The As abundances are significantly greater (3-4 times) across the full length of the lag traverse. The contrast for As is modest for both media and only marginally greater in the lag. Soil is an effective sample medium but lag is superior to the <6 mm soil because the As and Au are preferentially hosted by lateritic material which dominates the 2-6 mm lag fraction. Incorporated aeolian sand has diluted the <6 mm soil signatures.

Additional elements determined on the lag confirmed correlation of As and Sb with Ni (ultramafic rocks). There is a broad, low contrast Bi peak (Figure 6) associated with the Au as would be expected from the geochemistry and mineralogy of the Redeemer Main mineralization.

Regolith drilling

The expression of the Redeemer ore system in the residual regolith was studied using a subset of the available drilling. Figure 7 presents two interpretations of these data. In Figure 7A, the maximum Au value in each of the holes indicates the Redeemer system outlined by a polygon of 800 x 200 m in size above 250 ppb. Figure 7B shows the percentage of assays in a hole above this 250 ppb threshold. This parameter highlights thick, mineralized sections that are likely to

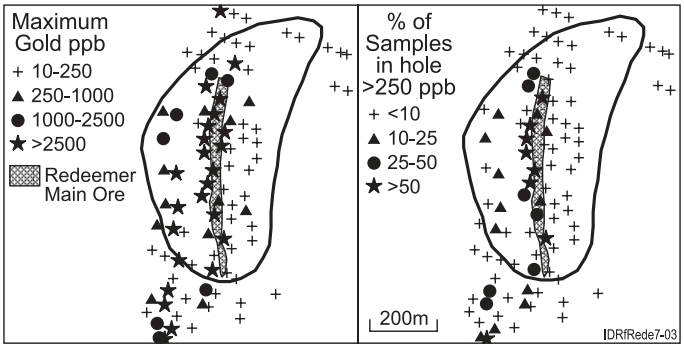

Figure 7. Plan view of gold in regolith drilling based on available 50x50m spaced drill holes.

correlate with major ore positions. The tight eastern linear cluster of the >50% 250 ppb results shows the position of Redeemer Main. The trend of weaker responses shown as filled triangles that lie about 150 m W of Redeemer Main is a reflection of the Zones 2 and 3. It should be noted that these zones have similar maximum Au abundances to Redeemer Main but the significant regolith intersections are much narrower.

These drilling data indicate that, if the deposit was concealed, it would be readily located by a 400 x 200 m drill pattern and would be unlikely to be missed at an 800 x 200 m spacing with holes drilled to refusal.

Permian and Tertiary sediments

Baker (1991) investigated dispersion in the Permian channel on section 32960 mN. A sampling grid of 10 x 2 m was generated by combining drilled and pit wall samples. Figure 8 shows the Au and Bi distributions in the weathered Archaean bedrock. The upper part of the Permian channel is strongly weathered, the lower part only weakly. There is a close correlation between Au and Bi distributions in the fresh rock and regolith over the mineralization in the mafic conglomerate. Gold and Bi show the same relationship on the W side of the Permian channel adjacent to the ore-bearing mafic conglomerate where ore has been mechanically incorporated into the channel. In the near surface, the mafic conglomerate is depleted in Au relative to Bi. The relationship is similar for the base of the Tertiary. Gold is dispersed from the weathered mafic conglomerate into the Tertiary channel. This dispersion is not associated with any obvious weathering in the channel and is likely to be mechanical.

DISPERSION MODEL

TBA

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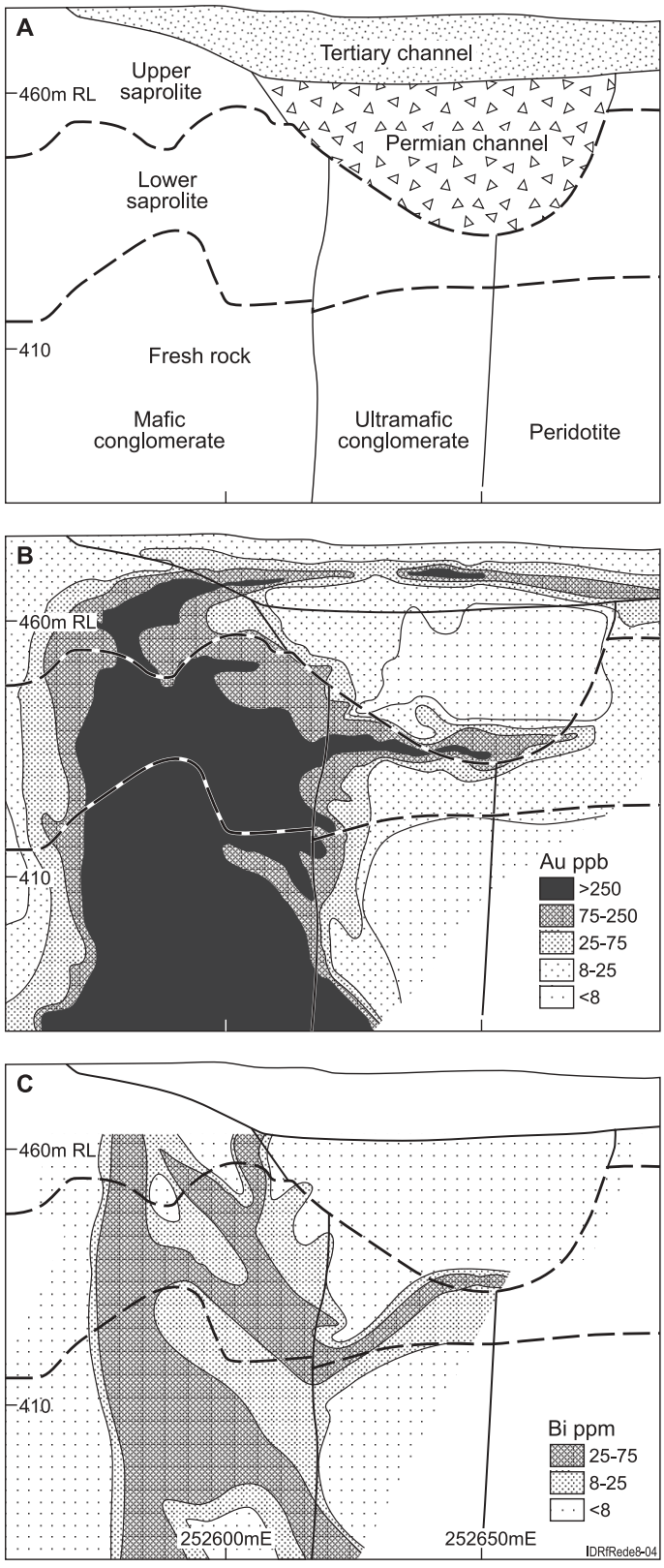

Figure 8. Geology of section 32960 mN (A) with Au (B) and Bi (C) distributions from the basement into the Permian and Tertiary sediments.

SAMPLE MEDIA — SUMMARY TABLE

Sample medium	Indicator elements	Analytical methods	Detection Limits (ppm)	Background (ppm)	Threshold (ppm)	Max anomaly (ppm)	Dispersion distance (m)
<6 mm	Au	GFAA	.001	.002	.025	.108	400x50m
Soil	Au	GFAA	.001	.002	.008	.108	1200x200m
	As	AA	1	15	50	128	2000x250m
2-6 mm	Au	GFAA	.001	.002	.025		100m
Lag	Bi	AA	.1	.2	.5		300m
Regolith	Au	AA	.020	<0.020	.250		800x200m
RC							