CHATTERBOX SHEAR GOLD DEPOSITS, LAVERTON DISTRICT, WESTERN AUSTRALIA

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LOCATION

The Chatterbox Shear Au deposits, comprising Rumour, Whisper and Innuendo, are located approximately 8 km WSW of Laverton at 28°38'50"S 122°19'20"E; Laverton 1:250 000 sheet (SH51-02).

DISCOVERY HISTORY

The deposits were discovered in 1997 by the Metex - Delta Gold Laverton Exploration Joint Venture (LEJV). They occur over a strike length of some 5.5 km, beneath transported Quaternary and Permian cover of variable thickness, in an area having no historic workings. They were discovered by systematic RAB and air-core drilling of an anomalously low magnetic and gravity corridor, which defined the Chatterbox Shear Zone (CSZ; Figure 1) as a fundamental regional structure. Geochemical orientation emphasized the critical importance of geomorphological mapping and appropriate selection of analytical methods, particularly in areas of significant overburden.

PHYSICAL FEATURES AND ENVIRONMENT

The climate is semi-arid, with an irregular average annual rainfall of 230 mm, mainly in January-July. Winters are generally cool to mild, and relatively dry. Vegetation consists predominantly of *Acacia* spp, *Cassia* spp, *Brachychiton* spp, *Casuarina* spp and other drought-resistant shrubs and grasses. The deposits are down slope to the W of a prominent banded iron formation (BIF) ridge and associated colluvial slope. They are on a predominantly erosional plain with low hills and rises, that has a veneer of Recent alluvium or Tertiary sediments containing extensive ferruginous detritus (Figure 1).

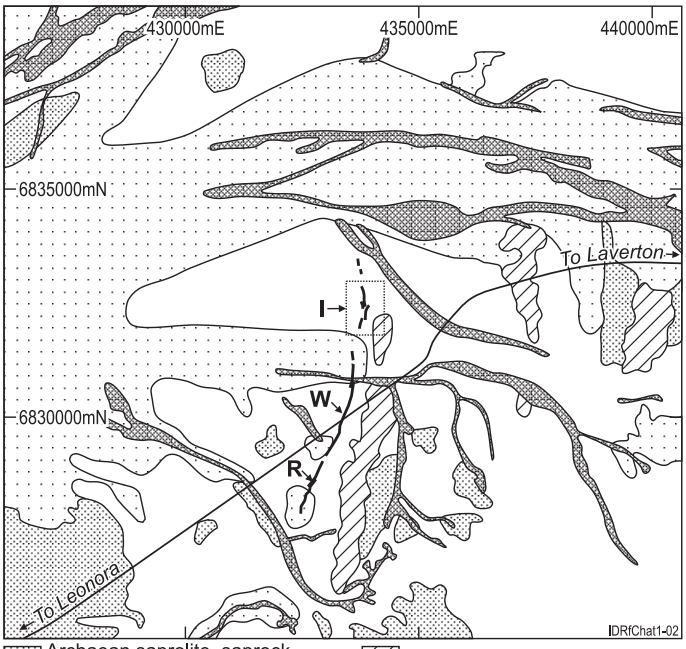

Figure 1. Regional regolith geology around the Chatterbox shear zone Au deposits - Innuendo (I), Whisper (W) and Rumour (R). The area shown in detail in Figure 2 at Innuendo is shown as a box.

GEOLOGICAL SETTING

Rumour, Whisper and Innuendo are located within the North Eastern Goldfields of the Archaean Yilgarn Craton. Three geological domains are recognized within the broader Laverton Archaean sequence; from W to E, these are the Margaret Domain, the Laverton Tectonic Zone, and the Burtville Domain. The deposits occur within the Margaret Domain, which also hosts the Mt Morgans, Jupiter, Lancefield and Wallaby gold deposits. This domain consists of predominantly tholeiitic basalts and ultramafic rocks, and subordinate metasedimentary rocks, including BIF, intruded by dolerites, syenites, granitoids and felsic porphyries. Structurally, the domain is dominated by the broad SE plunging Margaret Anticline; the CSZ is on the E limb of the anticline. The CSZ is a complex N-striking E-dipping ductile-brittle fault zone that can be traced geophysically over a length of at least 30 km, and is thought to have dominant E-block-down normal and dextral movement (Johnson and Ryall, 1999). The deposits are hosted by deeply weathered metacarbonates and felsic intrusives, with subordinate fine-grained sediments. The Laverton Tectonic Zone, which hosts the Granny Smith and Sunrise gold deposits, lies to the E.

REGOLITH

Rumour, Whisper and Innuendo are buried by transported Quaternary and Permian cover of variable thickness, immediately W of a pair of prominent BIF ridges (Figure 1). Despite the proximity to the ridges (300 m at Innuendo, gradually increasing to 750 m at Rumour) the colluvium contains no BIF fragments. The mineralization at Innuendo lies beneath a gentle W-sloping, predominantly erosional, plain, which grades to the S at Whisper and Rumour to a series of low hills and rises. The low hills, in particular, have an extensive ferruginous duricrust representing variably preserved lateritic profiles mainly on greenstone and some on granite (Jones, 1999). The duricrust is partly degraded and eroded, commonly overlain by a veneer of Recent alluvium or Tertiary sediments containing extensive ferruginous detritus. At Innuendo and Rumour, the duricrust varies in thickness from 2-15 m but, at Whisper, it is generally 2-5 m thick. Whisper is cut by a major W-trending active drainage and Rumour is cut by three smaller NW-trending active drainages. A number of Permian and Tertiary palaeochannels have interpreted flow directions to the W, draining into a large saucer-like basin. The Permian sediments are glacial and fluvioglacial deposits of the Paterson Formation, and consist predominantly of fine-grained claystones and siltstones with a few grits. Coarse tillite is generally absent, although a few basal sediments include cobbles. The palaeochannels feeding the basin W of the mineralization are of limited width and have steep canyon-like cross sections. The thickness of Permian sediments varies along the CSZ, being 0-5 m over much of Innuendo, 0-40 m over Whisper, and increasing to the S from 20 m to >50 m thick in some parts of Rumour. Where the Permian is thickest the characteristic topography is low, round hills of ferruginized fine-grained Permian sediments.

MINERALIZATION

The mineralization of the Chatterbox Shear occurs over a strike of some 5.5 km, within a package of metacarbonates, sediments and felsic intrusives, overlying an ultramafic horizon. The hanging wall is predominantly tholeiites and BIF. The intensely altered and deformed lithologies within the shear are extremely weathered, with depths to unoxidized material >150 m. The water-table is generally at 25 m. Precise definition and correlation of individual lithologies within the shear is rarely possible because intense weathering in the oxidized zone has largely obliterated original features. The bulk of the mineralization identified to date occurs within the oxide zone, and comprises a series of NNE- to N-trending moderately to steeply E-dipping and shallowly S-plunging, anastomosing lenses. There is a common association between mineralization and distinctive intense goethite-hematite-Mn oxide alteration, +/- quartz (carbonate) veining, brecciation textures (possibly due to hydrothermal collapse) and low temperature open space needle and dogtooth quartz crystal development. The combined Rumour, Whisper and Innuendo indicated and inferred resource consists of 5.9 Mt at 2.4 g/t Au (Johnson and Ryall, 1999). The mineralization in the oxide zone has a strong Au-As association. Mineralogical studies show that primary Au mineralization is associated with pervasive, weak, predominantly pyrite alteration. Rarely Au occurs as fine-grained inclusions within pyrite.

REGOLITH EXPRESSION

The mineralized environment at the CSZ presents a series of characteristics that requires diligent regolith mapping and careful selection of

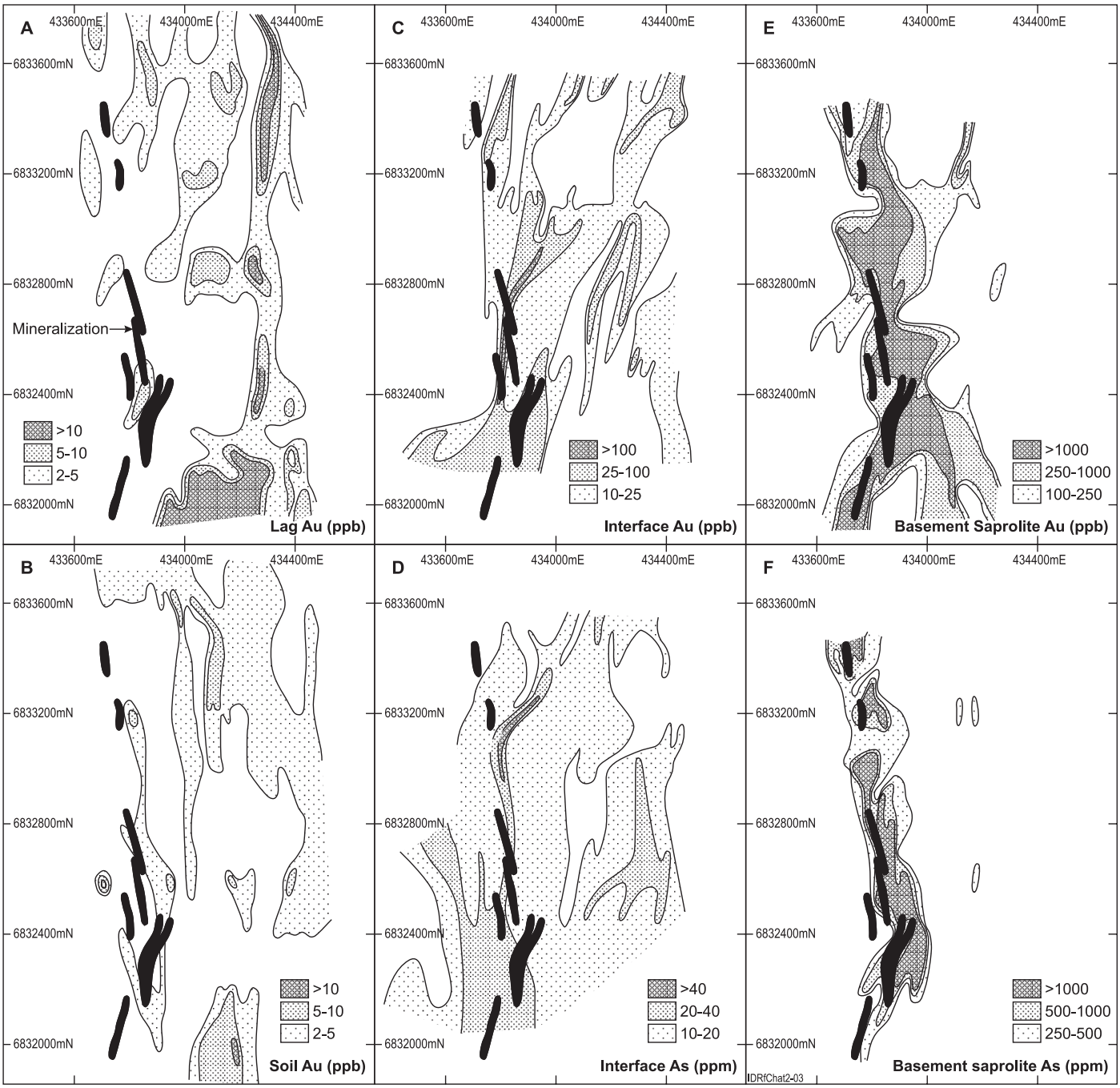

Figure 2. Innuendo deposit. Comparisons of sampling of lag (A), soil (B), interface (C) and basement saprolite (E) for Au; comparison between sampling interface (D) and basement saprolite (F) for As. See Figure 1 for location.

geochemical exploration techniques. Over a relatively restricted area, potential sampling media include, at surface, (i) active alluvial channel sediments, (ii) colluvium, (iii) variably lateritized Tertiary and Permian sediments and (iv) degraded ferruginous duricrusts; sample media at depth include (v) intensely leached saprolite to depths of at least 150 m in the oxide zone, and (vi) intensely altered saprock to bedrock in the unoxidized zone. Geochemical orientation work at Innuendo (Figure 2) highlights the care required in using geochemical procedures as a primary exploration tool in such an environment. At surface, ferruginous lag sampling (6-100 mm) by previous explorers failed to define any significant contrast against background, with the exception of an areally-restricted, two sample 7 ppb anomaly directly above the mineralization (Figure 2A). Soil sampling (<6.4 mm) of predominantly Recent sediments by previous explorers returned a subtle anomaly of 2 ppb Au against a background of 1 ppb, with a single spot high of 180 ppb, 100 m W of the mineralization (Figure 2B). Both the lag and soil sampling highlighted a significantly more anomalous zone to the E, at the BIF ridges. A modest resource, hosted by the BIF, of 277 000 t at 2.3 g/t was defined further S by WMC. However, the restricted area of the anomaly over the CSZ mineralization, and the poor anomaly to background contrast failed to highlight the CSZ as an attractive drill target. A subsequent restricted orientation study by the LEJV at Rumour on the <180 μm fraction has shown that although analysis by aqua regia and dilute HCl partial digestions of soil samples produce anomalous responses, the anomaly contrasts are small. Better contrasts of >x2 background (5.8 compared to 2 ppb) are obtained by analysis after concentrated HCl digestion (Rugless, 1998).

The LEJV investigated Innuendo with systematic vacuum drilling to sample the interface between the base of the lateritized Tertiary sediments, and the Archaean saprolite. A prominent Au anomaly in excess of 100 ppb (peak 240 ppb) with a corresponding As anomaly (peak value 42 ppm) was defined over the mineralization (Figures 2C and 2D). Dispersion trains demonstrate the strong geochemical influence of the N-trending CSZ, and the subordinate influence of NE-trending cross-faults. Although this technique worked very well at Innuendo, it is critically dependent on precise recognition of the material being sampled. Experience in the W Laverton area suggests that Tertiary sediments display high Au and low As backgrounds, whereas Permian sediments display low Au and higher As backgrounds. At Innuendo, the interface sampled was the Tertiary-Archaean boundary. Where significant Permian sediments occur, distinction between lateritized Tertiary and lateritized Permian material is generally difficult.

Gold and As geochemistry from RAB, air-core, RC and diamond drill-

ing to saprolite displays the strong Au-As association (Figures 2E and 2F). Silver, Sb, Mo and W display a weaker association of varying degrees within the saprolite. There is no evidence of any significant sub-horizontal remobilization of Au within the saprolite. The characteristic lateral zones of supergene enrichment, commonly observed within the southern Yilgarn, where saline acid groundwaters allow the mobilization of Au through the formation of halide complexes, are absent. This is consistent with the geochemistry of groundwater at CSZ, which is neutral (pH 7.5-8) and of low salinity (0.09-0.11% TDS). Recent drilling of the unoxidized zone has revealed, for the first time, the presence of metacarbonates as the primary host to mineralization. Preliminary data from mineralized intervals in the unoxidized zone suggests two geochemical associations: -

1) Au- As, Ag, Cu, Zn, Sb, W, (Mo) in high Fe-Mn zones and

2) Au- (As, Ag, Zn, Mo, Bi, W) in high Ca zones.

In summary, considerable effort by the LEJV has been directed at identifying geochemical techniques with the ability to assess areas obscured by cover quickly, at relatively low cost. Historically, regional lag sampling has been successful over residual materials (Beasley Creek (Robertson and Carver, 2003) and North Gladiator) but appears to have been completely ineffective over areas of significant transported overburden. To date, interface sampling with Au and As analysis has proved to be the most effective technique, but particular attention to identification and sampling of the correct interface (Tertiary-Archaean) is required. In areas of Permian cover in particular, conventional soil or lag sampling has been shown to produce ambiguous results, or at best, very low anomaly to background contrasts. It has not been possible to drill the Permian-Archaean contact systematically due to significant water in the Permian. However, there is some evidence for dispersion along the contact but little is known of its scale. Some Au has been found within basal grit and cobble sediments, suggesting nugget or placer dispersion. In general, conventional fine fraction soil sampling with a partial concentrated HCl digest and low level analysis appears to be effective in areas with <30 m of cover, with Au occurring in association with As in particular. In areas where cover is >30 m, no single technique has yet been shown to produce definitive results.

REFERENCES

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SAMPLE MEDIA SUMMARY TABLE

Sample Medium	Indicator elements	Analytical methods	Detection Limits (ppm)	Background (ppm)	Threshold (ppm)	Maximum Anomaly (ppm)	Dispersion Distance (m)
Supergene mineralization	Au As	FA XRF	0.010 2	0.010 20	0.100 100	53.820 13380	300 250
Colluvium-basement interface	Au As	AAS AAS	0.001 5	0.003 10	0.010 20	0.240 42	<25 50
Lag	Au	AAS	0.001	0.001	0.002	0.007	80
Soil	Au	AAS	0.001	0.001	0.002	0.180	80