JUNCTION GOLD DEPOSIT, ST IVES DISTRICT, WESTERN AUSTRALIA

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LOCATION

The Junction Gold Deposit is 35 km SE of Kambalda at 31º29'10"S, 121º50'10"E; Widgiemooltha 1:250 000 map sheet (SH51-14).

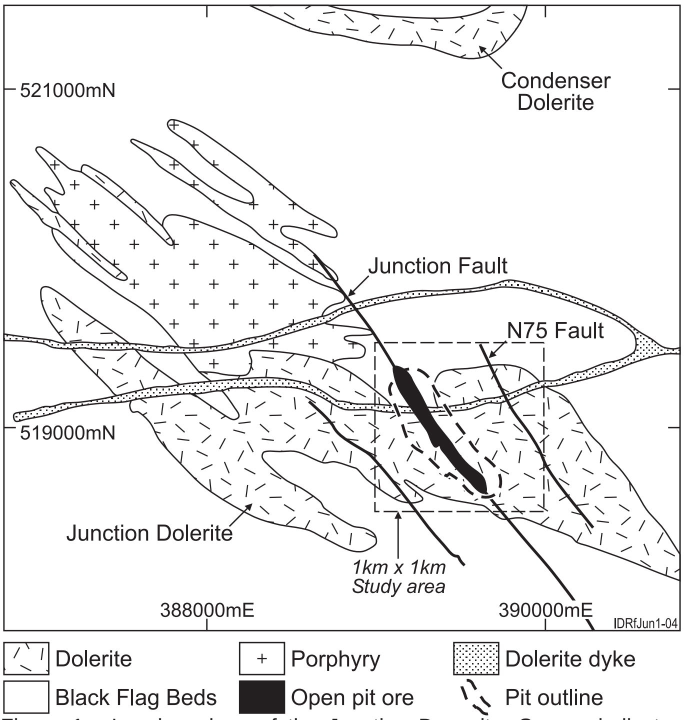

Figure 1. Local geology of the Junction Deposit. Square indicates detailed areas of Figures 4, 6 and 7.

DISCOVERY HISTORY

Prospectors first explored the area from 1910-1920 but no significant Au mineralization was discovered and only a few shallow pits and costeans near the Junction mineralization remain as evidence of their activity. There is also a prominent, shallow, costean (pre 1925) E of the Junction Fault, over the N75 Fault (Figure 1), which hosts the smaller N75 orebody (Balkau 1989). WMC Resources Ltd tested a large, conspicuous magnetic anomaly at Junction in 1966 in the course of systematic Ni exploration. The first drillhole showed that doleritic rather than ultramafic rocks caused the anomaly. There was only limited exploration in the area for another nearly twenty years. In 1983, four percussion holes were drilled along an EW traverse to test bedrock lithologies. One intersected the base of weathering and terminated in barren dolerite 20 m W of what is now known to be supergene mineralization associated with the Junction Fault. Based on this drilling, the weathered profile was incorrectly interpreted as transported material and it was concluded that the Junction area was totally concealed by some 30 m of sand and clay. This discouraged application of soil geochemistry and delayed discovery.

An orientation soil survey was proposed for the Junction area in late 1985, using a sensitive (1 ppb detection limit) and cost-effective analytical method for Au developed in the WMC laboratory (Robbins, 1985). Soil was sampled at 40 m intervals on three traverses 400 m apart, highlighting strongly anomalous Au concentrations on line 519000 mN, coincident with the Junction magnetic anomaly. Follow-up sampling on lines 100 m apart was completed in October 1985 and by March 1986 a significant Au anomaly had been defined (Figure 2). The soil anomaly was tested by three E-W traverses of percussion drilling 120 m apart in April 1986. The discovery of Junction was first indicated by intersections of 11 m at 5.6 g/t Au (TD1378; 32-43 m) and 5 m at 3.8 g/t Au (TD1379; 50-55 m).

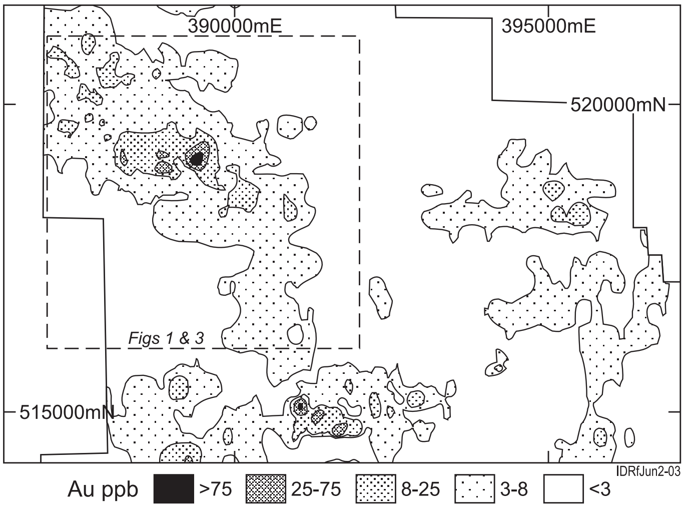

Figure 2. Regional soil Au geochemistry (<2 mm). Square indicates areas of Figures 1 and 3.

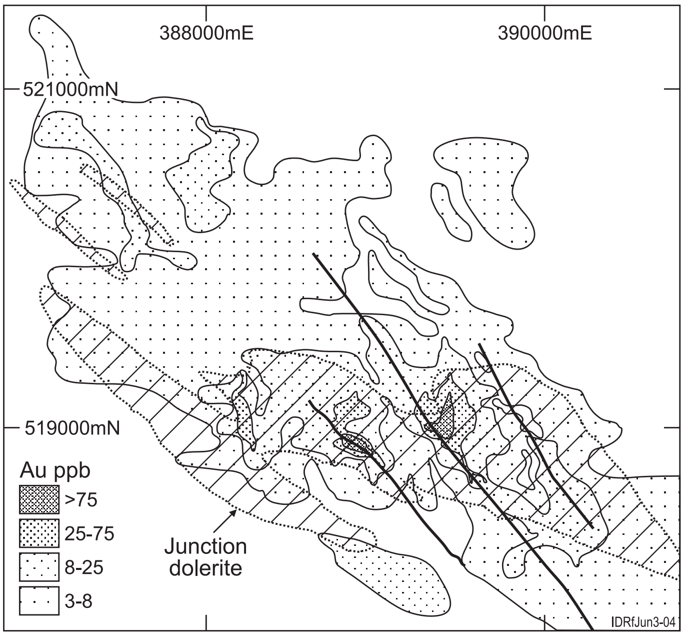

Figure 3. Local soil geochemistry.

PHYSICAL FEATURES AND ENVIRONMENT

The area is flat and featureless, with calcareous soil and minimal bedrock exposure, and is semi-arid. The 1-3 m deep soils over the deposit are generally residual but have alluvial and aeolian components. They have developed from saprolite and local transported overburden. The area has a mean annual rainfall of about 270 mm (Kalgoorlie). Most rain occurs in winter from cold fronts with a few localized heavy summer thunderstorms. Mean daily temperatures range from 18 to 34°C (January) and 5 to 17°C (July). The Junction area has open woodland dominated by salmon gum (*Eucalyptus salmonophloia*), other *Eucalyptus* spp., and shrubs including *Eremophila*, *Atriplex* and *Maireana* spp..

GEOLOGICAL SETTING

Junction is in the Norseman-Wiluna greenstone belt. It is a typical structurally controlled quartz vein Au deposit, hosted by the Junction Dolerite, a 450 m thick differentiated mafic sill, which occupies a similar stratigraphic position to the Golden Mile Dolerite. The Junction Dolerite lies within the Black Flag Beds (Figure 1), N of the Tramways Thrust, an early D1 event (Archibald, 1985), and 3.5 km SW of the younger D4 Lefroy Fault. Chilled dolerite margins and locally discordant contacts with the Black Flag host rocks indicate it was intruded approximately 200-300 m above the unconformable contact between the Paringa Basalt and Black Flag Beds (Balkau, 1989). The Junction Dolerite and overlying Black Flag Beds dip gently to the N. Two E-trending, nearly vertically dipping Proterozoic dolerite dykes are the youngest intrusives and post-date the Au mineralization. Four zones have been recognised in the Junction Dolerite.

Zone 1: (100-120 m) - medium grained equigranular pyroxene cumulate, dominated by equant amphiboles after orthopyroxene. The Junction and N75 faults are well developed here as wide mylonite zones, but rarely carry significant sulphides or Au mineralization.

Zone 2: (120-150 m) - characterized by a significant increase in the amount of fine-grained interstitial albite in a dominantly amphibole (after pyroxene) porphyritic dolerite. It is a good host for Au mineralization along the Junction and N75 faults.

Zone 3: (50-80 m) - medium grained with granophyre making up to 25%. This unit also typically contains up to 10-15% magnetite. Zone 3 is the best host for Au mineralization.

Zone 4: (100-130 m) - medium to coarse grained dolerite.

Most major fault structures in the Junction Dolerite are NW oriented, moderately E dipping mylonite zones. They post-date felsic porphyry intrusives and have minor displacements. Structures with documented displacement, Junction Fault and N75 Fault, are oblique reverse faults with an average displacement of approximately 50 m with the eastern block moving up and to the NW. North of the Junction Dolerite, D4 structures are poorly developed, and occur as semi-ductile to brittle zones within the Black Flag Beds. No significant Au mineralization has been encountered within the Black Flag Beds.

MINERALIZATION

The majority of the Au mineralization (90% of Au) is confined between two pitch lines, which represent the intersection of the Junction Fault with the upper and lower contacts of the Junction Dolerite. The plunge of the ore surface is approximately 20º N. The highest grades are generally within Zone 3 and the lowest grades within Zone 1. The Black Flag Beds are typically barren. The main ore zone mineralogy is quartz-albite-dolomite-biotite-chlorite-pyrrhotite (or pyrite), and the alteration halo is dominated by chlorite. Gold is closely associated with sulphides near the biotite-albite-altered margins of quartz carbonate veins. To the end of June 2003, 8.6 Mt tonnes of ore had been mined for 1.8 Moz Au (open pit grade 3.9 g/t; underground grade 6.9 g/t), leaving reserves of 150 000 oz (Goldfields Ltd pers. comm).

REGOLITH

The depth of weathering is about 50 m. The regolith within the pit includes 1-3 m of residual soil, or thin alluvium and aeolian sand, with a well-developed stone line at the base. A 1-2 m thick ferruginous zone of lateritic residuum is underlain by mixed mottled and clay zones from 1-20 m thick, and 10-20 m of saprolite. Quartz veins associated with the Junction Fault continue through the weathered profile to the base of the soil. Two NE-trending palaeochannels (Figure 4) about 15 m in thickness are well exposed in the eastern wall of the open pit, overlying the saprolitic regolith below the peak of the soil anomaly. The channels have only been mapped in the pit area and are thought to drain N, extending for at least 300 m. They were recognised during excavation of the pit (Clarke 1988) and are difficult to distinguish in near-surface drill cuttings. The upper 4 m of the channels are carbonate bearing clays with associated anomalous gold (100's of ppb). The more compact carbonate-free clays in the lower part of the channel have low gold contents (<100 ppb).

REGOLITH EXPRESSION

Weathered bedrock

To examine the signature of Junction in weathered bedrock, a sub-set of drilling data was created using 167 holes on 50 m centres. The

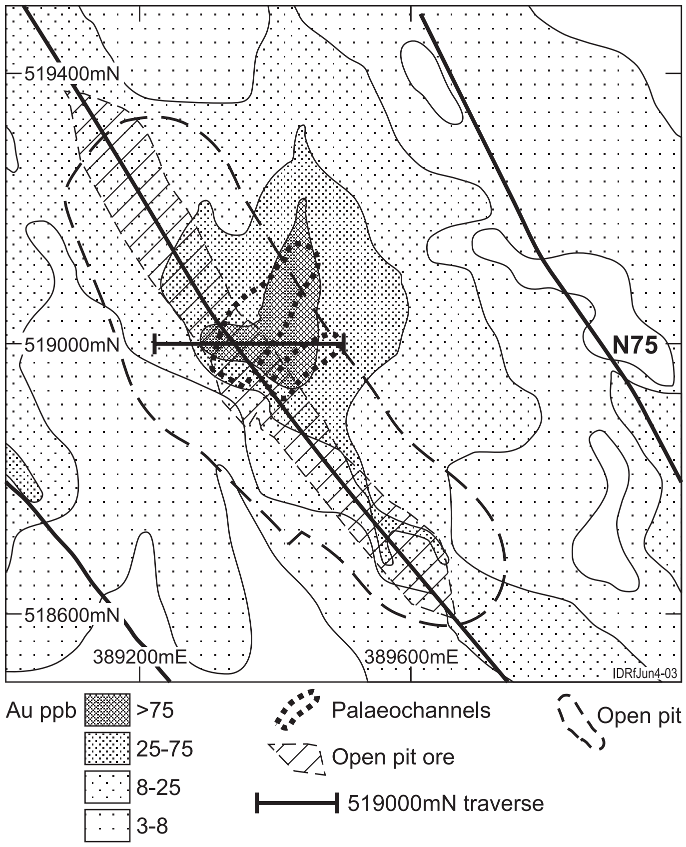

Figure 4. Relationship between detailed soil Au geochemistry, ore and palaeochannels.

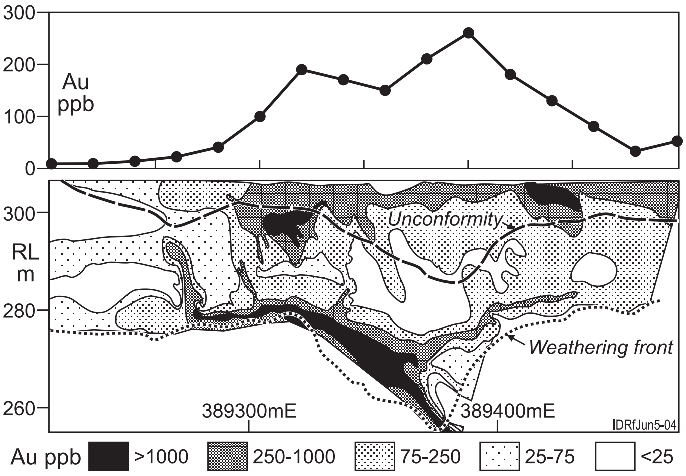

Figure 5. Gold geochemistry in <6 mm soils and regolith along 519 000mN. Regolith drilling spaced at 20 m intervals.

maximum Au concentration in each hole above 1000 ppb outlines the ore zone, but there are some holes well away from the ore zone with Au at these levels. Using a 250 ppb Au threshold, which is significant in reconnaissance drilling, over half of the Junction study area is anomalous, reflecting the wide lateral dispersion of Au in the base of the regolith in the Kambalda region. An alternative interpretive parameter is the percentage of samples in a hole over a specified threshold. Proximity to mineralization is marked by both stacking of Au anomalies in the regolith and deeper weathering, leading to thick sections of highly anomalous Au in the weathered profile. There has been broad dispersion of Au in the basal saprolite (100's of metres) by hypersaline action rather than a regolith expression of a broad primary halo. It is difficult to quantify the extent of the dispersion on the W side of the deposit due to the flat dip (20º) of the mineralization. Using a 250 ppb threshold, although there is noise in the data, the higher values cluster close to the ore and many distal responses are downgraded. The weathered bedrock anomaly over Junction is 1000 x 160 m in size (63 holes). The probability of intersecting Au concentrations above specified concentrations in individual holes within this anomaly polygon is:

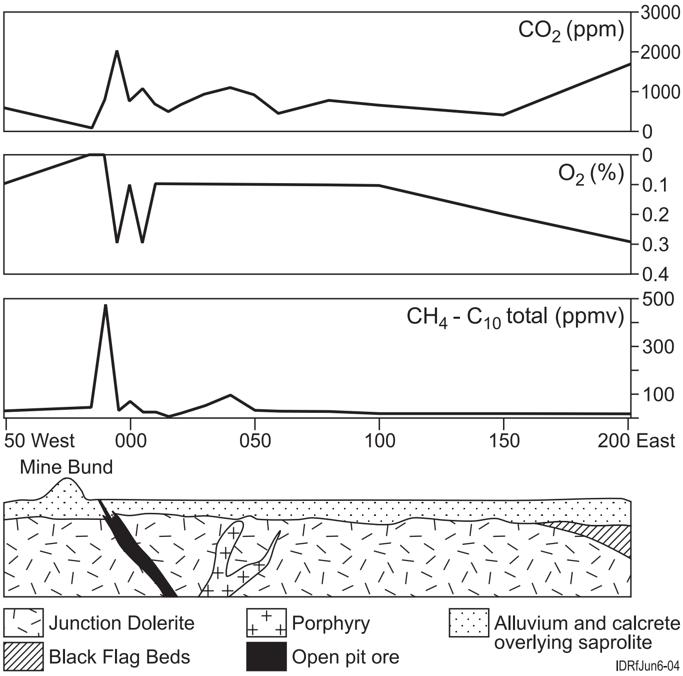

Figure 6. Soil gas geochemistry across the Junction deposit after Polito et al,. (2002).

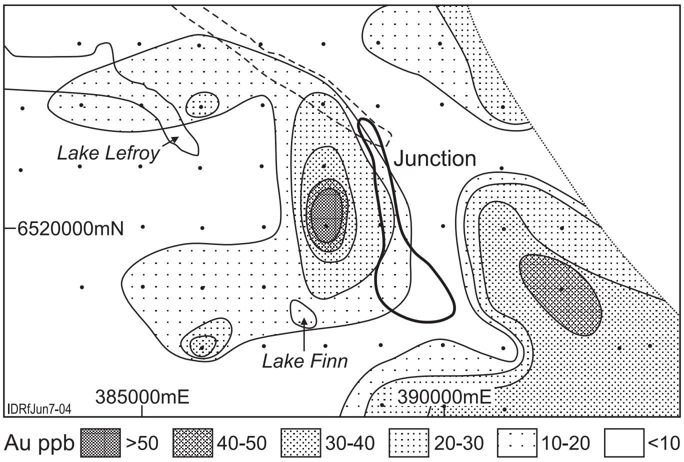

Figure 7. Gold in groundwater after Carey et al., (2003).

Au (ppb)	>2500	>1000	>250
Probability	0.32	0.57	0.89

This indicates that a drilling density of 800 x 100 m would generate at least one >1000 ppb intersection related to the Junction deposit. Data for other elements is very limited. From a suite of 68 fresh and weathered drilled samples, Mo (>20 ppm) and Bi (>0.65 ppm) are clearly anomalous and Cu (>180 ppm) is weakly anomalous.

Soil

Regionally (Figure 2), Junction is in an extensive area (5x2 km) of elevated Au background (>3 ppb) which trends NW. The soil data are shown in more detail in Figure 3. At a threshold of 8 ppb Au, there is a strong correlation between the soil geochemistry and the location of the Junction Dolerite; at a 25 ppb Au threshold, there is a clear relationship between structures, such as the Junction fault, and the soil geochemical peaks. The peak of the Junction anomaly has a NE trend. In detail (Figure 4), there is a close correlation between the extent and orientation of the >75 ppb Au response in soils and the location of the palaeochannels. Mining consistently located >1 g/t Au mineralization within the upper cemented and lateritized alluvial sediments of the palaeochannel, although no Au was recovered from the lower, clay-rich part of the channel. Gold has clearly migrated from the weathered lodes into the palaeochannel during sedimentation. The soil profile on 519000 mN (Figure 5) shows the relationship between the Au responses in the palaeochannel and in the soil. The contoured regolith section (Figure 5) shows the gently dipping ore in the lower saprolite and the lateral dispersion along the basal part of the weathered profile, which enlarges the regolith footprint of the deposit.

Soil gas

Strong, broadly coincident CO_2-O_2-light hydrocarbon anomalies were detected by Polito *et al.*, (2002) through cover sediments above known mineralization (Figure 6). Only aberrations in CO_2-O_2 (without light hydrocarbons) occurred above barren carbonate and sulphide mineralization. CO_2 and O_2 were measured in the field by a soil probe, penetrating 0.9 m, using portable gas analysers; light hydrocarbons were collected onto activated carbon at 0.25 m depth and analysed in the laboratory by gas chromatography. Sample spacings along two traverses ranged from 5 m directly above mineralization to 50 m , 200 m away from mineralization. Oxidation of alteration assemblages and release of gases contained in fluid inclusions were considered to be the sources of these anomalies.

Groundwater

Groundwater samples were collected from specially drilled PVC-cased holes on a 1000 x 1000 m grid (Carey *et al.*, 2003) over an extensive area (70 km^2). In the Junction area, the mineralization is indicated by a 3 x 4 km Au anomaly (12 samples) with a threshold of 10 ppt and a peak of 52 ppt (Figure 7). The anomaly is offset to the W of Junction, consistent with the direction of water flow across the deposit. The hydrogeochemical Au signature was best developed within a few metres of the water-table. Deeper waters locally consist of hypersaline brines, from the nearby playas, moving counter to the regional groundwater flow. No other elements, apart from Au, showed strong spatial correlations with the deposit.

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SAMPLE MEDIA – SUMMARY TABLE

Sample medium	Indicator elements	Analytical methods	Detection limits (ppm)	Background (ppm)	Threshold (ppm)	Max anomaly (ppm)_	Dispersion distance (m)
Soil (<6mm)	Au	GFAA	.001	.002	.003	.260	5000x2000
	Au	GFAA	.001	.002	.008	.260	1800x400
	Au	GFAA	.001	.002	.025	.260	400x200
Regolith drilling	Au	GFAA	.001	.025	1.0		
Soil gas	CH_4-C_{10}	GC	10 ppbv	15 ppmv	40 ppmv	470 ppmv	10-20
Ground-water	Au	ICP-MS	0.000005	0.000005	0.00001	0.000052	4000x300

GFAA - graphite furnace AAS after aqua regia dissolution of Au