PARKINSON GOLD DEPOSIT, MURCHISON GOLDFIELDS, WESTERN AUSTRALIA

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LOCATION

The Parkinson Au Deposit is located 3 km NW of Mount Magnet and 560 km NNE of Perth at 28° 05'S, 117° 50'E; Kirkalocka (SH-50-03) 1: 250 000 map sheet.

DISCOVERY HISTORY

Gold was discovered in the Mt Magnet district in 1888, with lode mining commencing in 1891 and has continued almost uninterrupted to the present with more than 7 t of Au won from the district. Many of the individual workings are small, but 17 of the deposits have produced over 40 kg of Au. Mineralization in banded iron formations accounts for 80% of the production, with more than half from the Hill 50 deposit alone (Thompson *et al.,* 1990). However, 20% of the Au in the district occurs within quartz±carbonate±tourmaline veins as in the Parkinson Pit (subsequently renamed Star Pit) in the North Morning Star area (Wilson, 1990; Figure 1). The Parkinson mineralization was discovered during 1986 by Metana Minerals NL. This followed a programme of 10 x 6 m grid drilling in some relatively small leases, E of the Hill 50 Mine leases, which were acquired from prospectors in 1985. Mining commenced in 1987 with an initial resource of 3.1 Mt at 3.2 g/t Au to a depth of 100 m (*i.e.,* essentially the regolith resource) providing a minimum 5 year mine life (Wilson, 1990). Subsequently, the Parkinson Pit was amalgamated with the adjacent Hill 50 Pit and mining was extended into fresh rock.

PHYSICAL FEATURES AND ENVIRONMENT

The climate is semi-arid with long, hot, dry summers and short, cool winters. The mean annual rainfall is 240 mm. Although most rain falls during May-July, a few local thunderstorms or rain-bearing depressions may bring rain during January-March. The mean daily maximum and minimum temperatures are 38°C and 22°C in January and 19°C and 7°C in July. The mean annual evaporation is 2600 mm. The district vegetation is mulga, poverty bush and turpentine but, in the Parkinson Pit area, past mining activities have destroyed the indigenous species and saltbush now dominates.

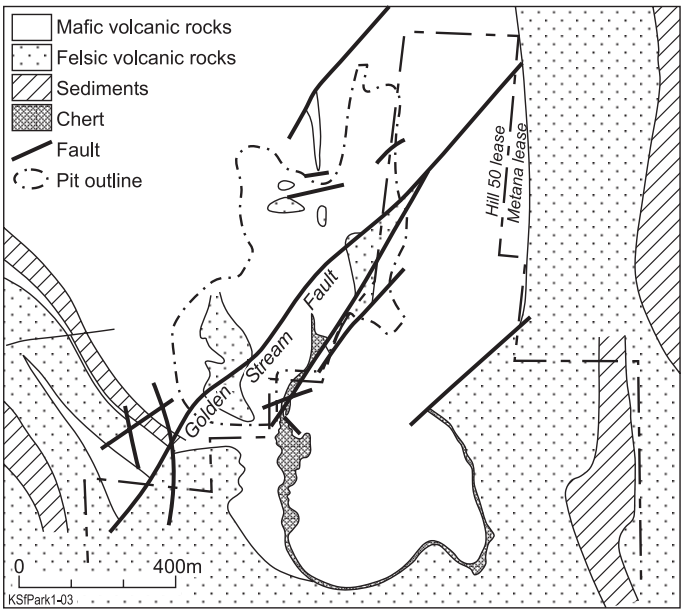

Figure 1. Geological plan, Parkinson pit area (modified from Wilson, 1990).

The Parkinson Deposit is located 3 km ESE of Hill 50 and 3 km N of Water Tank Hill, the dominant topographic features in a generally flat landscape covered by colluvium. Regolith profiles within the Parkinson Pit generally contain calcrete within the top 4 m, especially above mafic and ultramafic rocks, despite being >100 km N of the Menzies Line (Butt *et al.,* 1977). Soils are extensively disturbed by past mining activities.

GEOLOGICAL SETTING

The regional lithologies are ultramafic, mafic and felsic volcanic rocks with minor sediments, banded iron formation and chert. These form the southern end of the Mt Magnet Greenstone Belt that has been intruded by minor mafic and felsic rocks (Watkins *et al.,* 1986). The region has suffered multiple deformation, regional metamorphism and moderate to intense carbonation. The major structural element is the Boogardie Synform and the Parkinson deposit is on its eastern limb. Although the mine area consists of saprolite beneath a thin soil cover, much of the region occupying the Boogardie Synform to the SW lies beneath a variable thickness (to 20 m) of lateritic colluvium-alluvium (Robertson *et al.,* 2001). The zone is cut by a number of NNE striking faults, known collectively as the Boogardie breaks. One, the Golden Stream Fault, traverses the deposit (Figure 1). The Parkinson deposit is hosted by foliated mafic and felsic volcanic rocks with minor chert.

REGOLITH

Both mafic and felsic lithologies weather to saprolitic kaolinite-mica assemblages which are variably stained by Fe oxides. Although leaching of sulphides and carbonates occurs to 80 m near mineralization, weathering outside the pit is only to half that depth (Scott, 2001). Although complete lateritic weathering profiles occur elsewhere in the Mt Magnet Mining District (Robertson *et al.,* 2001), profiles at the Parkinson deposit lack ferruginous cappings. However, strongly ferruginous saprolite in the southern portion of the pit suggests that only minor stripping to the upper saprolite has occurred (Scott, 2001).

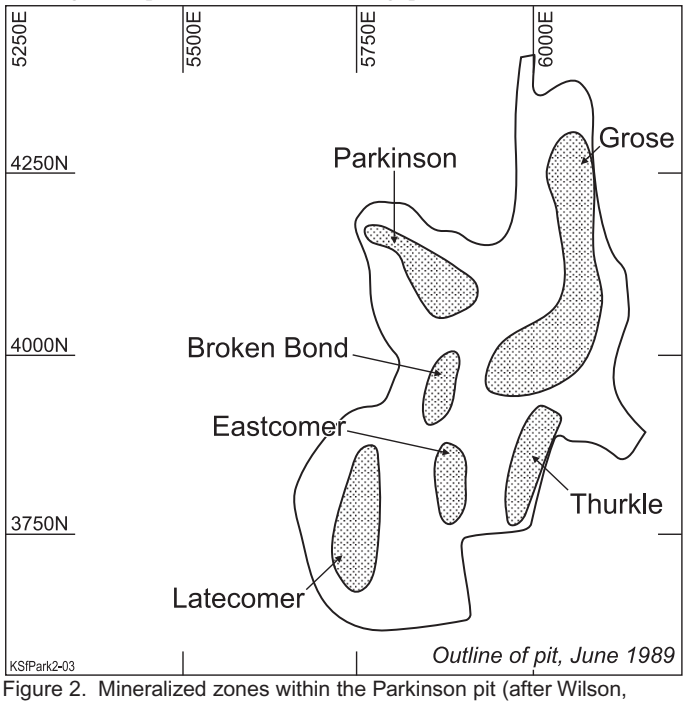

Figure 2. Mineralized zones within the Parkinson pit (after Wilson, 1990).

Although weathered felsic rocks are less ferruginous than mafic rocks, colour was unsatisfactory as a lithological indicator for logging (Wilson, 1990). The saprolite is covered by a metre of soil which contains pisoliths and calcrete.

MINERALIZATION

The dominant mafic volcanic rocks have been pervasively altered to carbonate-chlorite-sericite-quartz assemblages with some disseminated sulphides, and veined by quartz, carbonate and quartz-carbonate-tourmaline. This veining is partially related to mineralization (Wilson, 1990). Felsic volcanic rocks occur in the SW part of the pit and consist of quartz-sericite-chlorite-carbonate with some pre-metamorphic albite phenocrysts. Veining is not as pervasive in these rocks as in the mafic volcanic rocks.

	Mineralization	Proximal (about 10 m)	Barren (about 100 m)	Distal (about 400 m)
Leached saprolite	mu, kao	mu + parag, kao, (hem)	Parag + mu, kao	Kao, (minor mu)
Saprolite	mu, kao, goe, hem	mu + parag, kao, goe, (hem)	Parag + mu, kao, goe	Kao, goe, ab (minor mu)

Ab = albite goe = goethite hem = hematite kao = kaolinite mu = muscovite
parag = paragonite Brackets indicate intermittent development

Figure 3. Mineralogical variations in weathered mafic rocks relative to mineralization.

Gold is generally fine grained and associated with sulphides (pyrite, molybdenite, stibnite and pyrrhotite) in quartz-carbonate-tourmaline veins or pyritic veins. Specifically, the Au occurs in solid solution in pyrite and as rare, Ag-rich grains (Scott, 1990). The veins are generally thin (commonly <20 mm) but are surrounded by about 0.2 m of highly sericitized wall rock that also contains pyrite and Au. Where veins are concentrated, they form zones of economic mineralization. Six such zones occur in the Parkinson Pit (Figure 2). They dip steeply, are up to 50 m long, 2-20 m wide and up to 200 m deep (Wilson, 1990) and trend N, although the previously unworked Parkinson Zone trends NW (Figure 2). Gold grades are unaffected by weathering (Scott, 2001).

REGOLITH EXPRESSION

There is no outcrop over the deposit and the thin soil over it is contaminated by previous mining nearby, so the efficacy of soil geochemistry cannot be assessed reliably. However, the geochemistry of the saprolite reflects underlying mineralization and Scott (2001) recommended preferential sampling of ferruginous bands within it.

During weathering of the saprolite, Ag, As, Mo, Sb and W are largely incorporated into neo-formed Fe oxides whereas Au forms Ag-free grains. Arsenic forms a 100 m wide halo about the economic mineralization in the lower saprolite and is probably the most useful pathfinder. Other pathfinders show dispersion distances of about 10 m (see Summary Table). The upper saprolite (10-20 m) is leached and has less Fe than the lower saprolite, so pathfinder contents in the upper saprolite are low. Thus, As dispersion can only be seen for 10 m in the leached upper saprolite (see Summary Table).

In mafic rocks, there are systematic variations in mica abundance and type. Muscovite on its own is associated with mineralization; muscovite+paragonite occur proximal to mineralization (up to 100 m away); mica is absent distally. This relationship is maintained despite weathering (Figure 3).

Up to 4 m of calcrete occurs over the deposit, in both the disturbed soil and at the top of the leached saprolite. The Au content in the calcrete reflects the abundances in the underlying saprolite (Scott, 2001) with little lateral dispersion. The occurrence of pedogenic carbonate in the Parkinson Pit area, well N of the Menzies Line (Butt *et al.,* 1977; Lintern, 2001), is unusual and its potential as a regional sampling medium is probably limited (Scott, 2001; Robertson *et al.,* 2001).

ACKNOWLEDGEMENT

Staff of Metana Minerals NL during the late 1980's supplied samples, results and plans of the Parkinson deposit.

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SAMPLE MEDIA - SUMMARY TABLE

Sample medium	*Indicator elements*	*Analytical methods*	*Detection limits (ppm)*	*Background (ppm)*	*Maximum anomaly(ppm)*	*Dispersion distance (m)*
Primary mineralization	Au	FA(40)	0.010	0.150	28	<10
	Ag	OES	0.1	0.4	3	<10
	As	XRF	10	10	70	<10
	Mo	OES	0.3	1	4	<10
	Sb	OES	30	30	80	<10
	W	OES	10	<10	30	<10
Mineralization in mafic volcanic-derived saprolite	Au	FA(40)	0.01 0	0.04 0	12	10
	Ag	OES	0.1	<0.1	7	10
	As	XRF	10	35	250	100
	Mo	OES	0.3	2	20	?100
	Sb	OES	30	30	250	10
	W	OES	10	<10	240	100
Mineralization in mafic volcanic-derived leached saprolite	Au	FA(40)	0.010	0.015	17	10
	Ag	OES	0.1	<0.1	1	10
	As	XRF	10	30	70	<10
	Mo	OES	0.3	2	7	<10
	Sb	OES	30	30	70	<10
	W	OES	10	<10	25	<10
Calcrete/carbonate	Au	FA(40)	0.010	0.180	7	<10 (lat) 4 (vert)

FA(40) = Fire Assay on 40 g charge OES = Optical Emission Spectroscopy
XRF = Xray fluorescence