

PEAK HILL Au DEPOSIT, PEAK HILL, NSW

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LOCATION

The Peak Hill gold deposit is just E of the township of Peak Hill (Figure 1) in central western New South Wales at 32°43'22"S, 148°11'42"E; Narramine 1:250 000 map sheet (SI55-03).

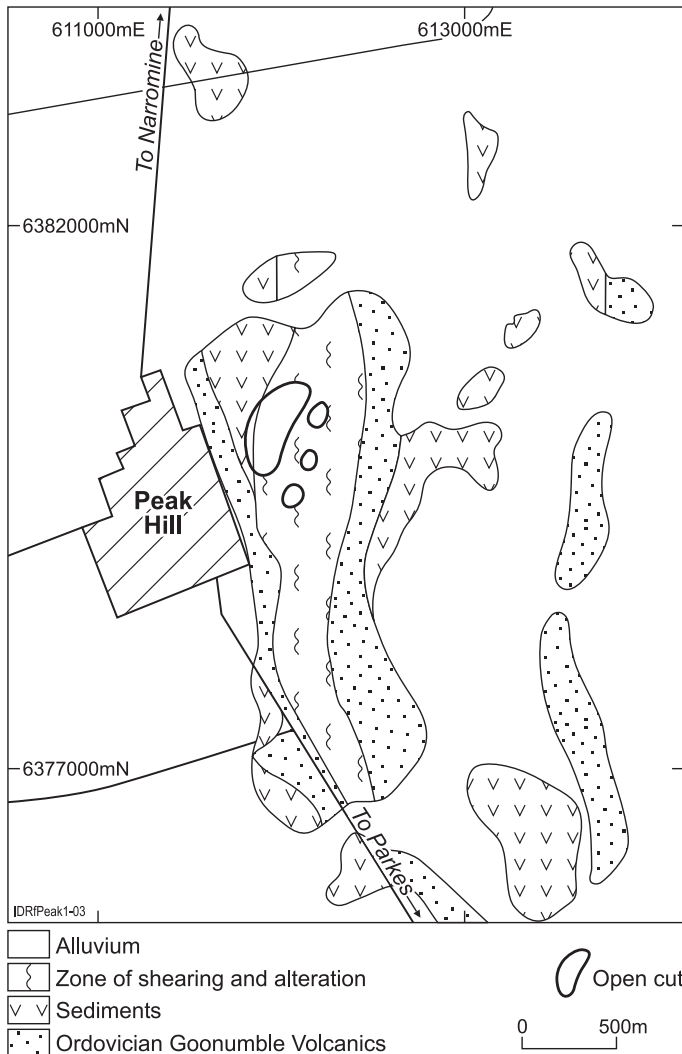


Figure 1. Geology of the Peak Hill area based on mapping by the Geological Survey of NSW.

DISCOVERY HISTORY

Alluvial gold was discovered in 1889 in drainage channels on the slopes of a prominent hill. Mining of outcropping lode was commenced the following year. A substantial hard rock mine, both open cut and underground, operated from 1904-1917 and produced over 60 000 oz Au (Alkane Exploration Pty Ltd, 2001). From 1964 onwards, a number of companies explored the deposit. Alkane Exploration NL drilled out the deposit in the 1990s and commenced mining in 1996. Operations in the main open cut ceased in 2001 but continue in two satellite pits.

PHYSICAL FEATURES AND ENVIRONMENT

The deposit is located on a prominent hill some 80 m above surrounding residual soil and alluvium plains. There is some remnant natural vegetation on the hill, mainly cypress pine (*Callitris spp*) and ironbark (*Eucalyptus sideroxylon*), but surrounding areas have been extensively cleared for agriculture. The climate is semi-arid with summer temperatures 18-33°C and in winter 5-15°C. Average annual rainfall is 550 mm pa, distributed through the year but with a slight peak in summer.

GEOLOGICAL SETTING

Andesitic lavas and volcanogenic sediments of the Late Ordovician

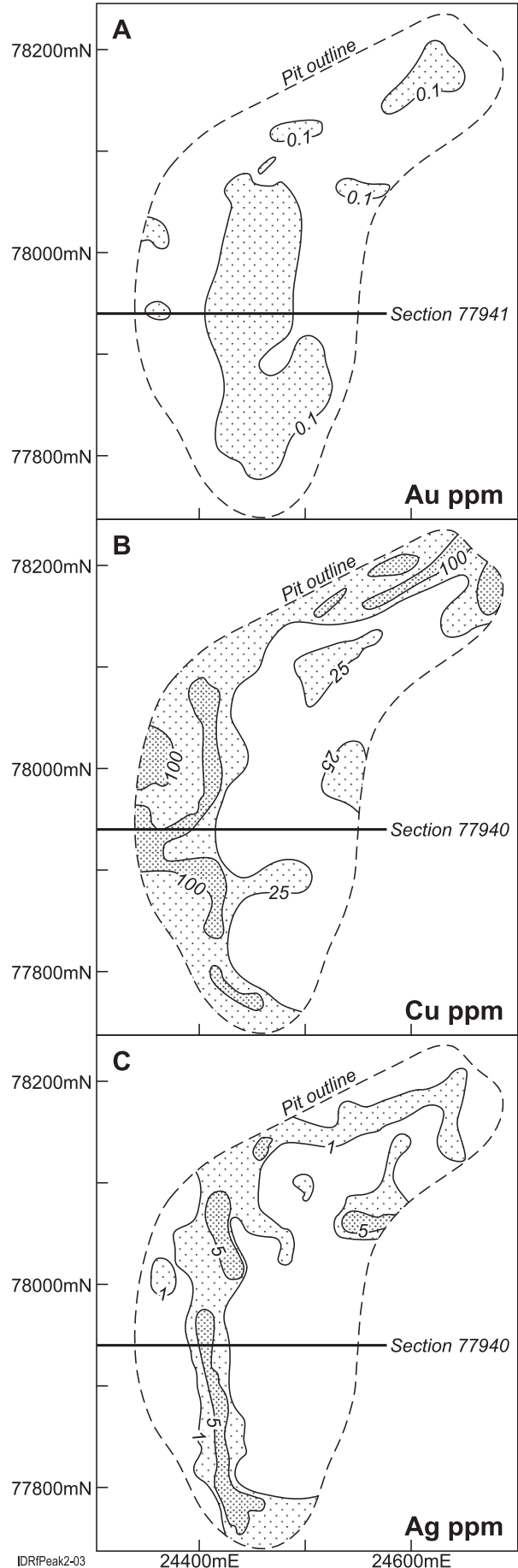


Figure 2 Plans of the main open cut showing distribution of Au (A), Cu (B) and Ag (C). Analyses are from grade control drilling. Mine grid is in metres.

Goonumbla Volcanics host the Peak Hill deposit (Figure 1). At Peak Hill, these rocks occur in a high strain zone between the Parkes Thrust to the W and the Narromine-Tumut Fault to the E (Sherwin 1996). Strong shearing, brecciation and hydrothermal alteration has largely destroyed primary rock textures. An extensive advanced argillic core of pyrophyllite alteration grades out through kaolinite-alunite, sericite and illite-montmorillonite assemblages. Silicification is also prominent.

Aeromagnetic data show a magnetic low underlying Peak Hill that suggests intrusions at depth. The mineralization is generally interpreted as porphyry related. Allibone (1998) suggests the mineralization is related to a regional shear zone but does not rule out a link to a porphyry system. High pyrite concentrations, a Cu sulphide assemblage dominated by enargite and tennantite and extensive advanced argillic alteration characterizes the Peak Hill deposit as a high-sulphidation porphyry system.

REGOLITH

Locally, the regolith comprises mostly thin, skeletal soil over saprolite and saprock. Saprolite is difficult to recognize because complete destruction of original rock fabric is common, in large part, by hypogene alteration. Siliceous gossans and soft, powdery, pyrophyllite-rich material are typical of the upper parts of the oxidized ore. Oxidation has extended to >90 m. The redox boundary between oxidized and unoxidized rock is very irregular due to peaks, tongues and residual pods of primary sulphides extending into overlying oxidized material. High sulphide contents and structures promote oxidation, influencing the topography of the redox surface.

MINERALIZATION

Primary mineralization

The recent Au mining has been in the oxidized zone. Beneath this, primary mineralization comprises Au, Cu sulphides and pyrite associated with extensive advanced argillic alteration and silicification in a steeply plunging lenticular zone. Pyrite contents commonly exceed 15% and barite is a prominent accessory mineral. Gold is mainly free with a low Ag content (0-4%) and occurs with minor calaverite (Au telluride). Tennantite and enargite are the dominant primary Cu minerals with lesser chalcopyrite. A preliminary resource estimate is 11.27 Mt at 1.29 g/t Au and 0.11% Cu.

Weathered mineralization

The main oxide orebody was some 300 m long, 50 m wide and extended from the surface to 90 m. It contains both of primary and secondary Au grains. Residual primary Au grains have cores with up to 4% Ag and Ag-depleted margins about 5 μ m thick. However, most grains are Ag poor and could be secondary. Some Au occurs as fracture fillings in botryoidal goethite and is clearly secondary.

Copper has been almost completely removed from the oxide zone. Primary grades commonly are 0.2-0.6% Cu but grades in the oxide zone are mostly less than 25 ppm (Fig. 1). Secondary Cu sulphates, carbonates, phosphates, arsenates and silicates, that might normally be associated with this type of copper deposit, are absent. Minor ferrian turquoise ((CuFe)Al₆(PO₄)₄(OH)₈.5H₂O) was noted from the open cut, well W of the ore zone. Mining was commenced on a reserve of 1.8 Mt at 2.0 g/t Au.

Supergene enrichment

The distribution of Au in the oxide zone, compared to primary mineralization, suggests some mobilization and possible supergene enrichment during weathering. This includes greater widths of ore in the upper parts and enhanced grades in the lower parts. There is only minor enrichment of Cu below the redox boundary, predominantly as covellite, chalcocite and non-stoichiometric phases varying between digenite and yarrowite. There is no well-developed, flat lying, supergene blanket of secondary Cu sulphides.

REGOLITH EXPRESSION

Surface rock chip sampling in the 1980's (Rabone, 1984) showed anomalous Au and As coincident with old workings. Copper extends away from the main mineralized zone into weakly mineralized rocks to the W. Barium is highly anomalous with >1% Ba coincident with the

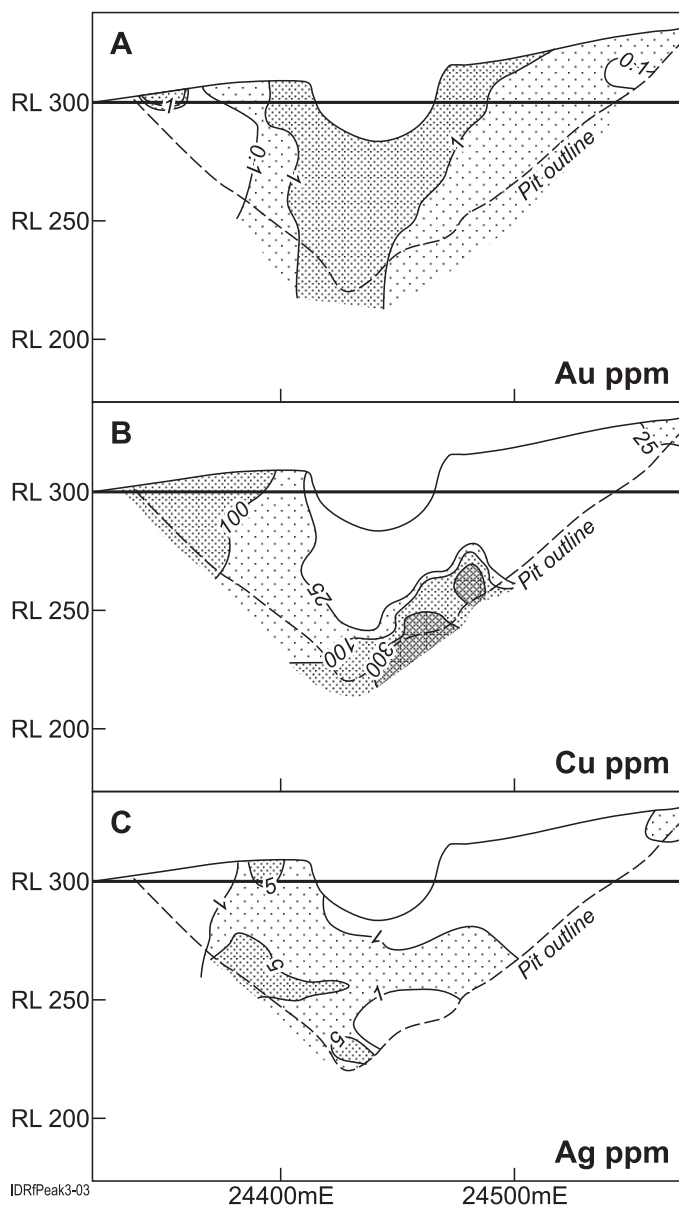


Figure 3 Sections of the main open cut showing distribution of Au (A), Cu (B) and Ag (C). Analyses are from grade control drilling. Mine grid and RLs are in metres.

mineralization. There has been no systematic soil sampling over the deposit.

Grade control drilling by Alkane Exploration Pty Ltd (Fig. 1) show strong depletion of Cu from the central and eastern part of the open cut. This depletion corresponds with areas of original high sulphide content and Au mineralization. Greater Cu concentrations occur (i) on the western, down-slope, side of the deposit, corresponding with less original sulphide, and (ii) at depth below the redox boundary. Silver shows a similar distribution. Arsenic was not analysed but the paucity of secondary arsenate minerals in the oxide zone suggests a similar depletion.

The high sulphide content of the primary mineralization resulted in extremely acid conditions during oxidation. The advanced argillic alteration assemblages offer few cations capable of removing H⁺ and thus have limited buffering capacity on the acid ground water.

The oxide zone is dominated by goethite (FeOOH), hematite (Fe₂O₃), jarosite (KFe₃(SO₄)₂(OH)₆) and some barite. Stability data for these minerals suggest a pH <2, consistent with present day oxidation; ground water collecting in the base of the open cut has a pH of 1.5. Here dissolved Cu remains in solution unless precipitated by evaporation. Wall faces of sulphide ore, exposed by mining, commonly developed blue to green surface coatings of chalcocite (CuSO₄.5H₂O) and cuprian melanterite ((Fe,Cu)SO₄.7H₂O).

Although there is minor supergene enrichment of Cu sulphides below

the redox boundary, the concentrations do not equate to the amounts of Cu removed from the oxide zone. It appears there has been significant lateral migration of Cu in solution. There is, therefore, potential for H⁺ neutralization and precipitation of copper in a lateral exotic deposit, possibly beneath the current township of Peak Hill.

SAMPLE MEDIA – SUMMARY TABLE

Sample medium	Indicator elements	Analytical methods	Detection limits (ppm)	Background (ppm)	Threshold (ppm)	Max value (ppm)	Dispersion distance (m)
Primary mineralization	Au	50g FA	0.01	0.05		101	
	Cu	AAS	5	50		4.85%	
	Ag	AAS	1	<1		44	
	As	AAS	20	20		4100	
	Ba	XRF	10	<10		8.5%	
Oxide zone	Au	50gFA + Aqua Regia/AAS	0.01	0.05		400	
	Cu	AAS	5	20		9000	>100
	Ag	AAS	1	<1		74	40
	As	AAS	20	10		5880	
Redox boundary	Cu	AAS	5	NA	NA	1.9%	
Surface rocks	Au	50g FA	0.002	0.02	0.8	8.7	
	Cu	DCP-AES*	5	20	100	550	100
	As	DCP-AES	5	5	20	1970	
	Ba	DCP-AES	5	50	180	3.5%	
Soils (limited samples)	Au	50g FA	0.002	NA	NA	0.75	
	Cu	DCP-AES	5	NA	NA	170	
	As	DCP-AES	5	NA	NA	270	

Note: Values for primary mineralization, oxide zone and redox boundary are based on grade control drilling by Alkane Exploration Pty Ltd. Values for surface rocks and soils are based on sampling reported by Rabone (1984). Dissolution by aqua regia.

*DCP-AES - Direct current plasma – Atomic Emission Spectroscopy

ACKNOWLEDGEMENTS

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