DEPARTMENT OF MINES AN ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 87/109
GEOLOGICAL INVESTIGATIONS AND EXPLORATION ACTIVITIES 1982-1986 AT MOUNT GRAINGER GOLDMINE, HUNDRED COGLIN, COUNTY HERBERT

GEOLOGICAL SURVEY

VOLUME 1 (OF 2)

by

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MINERAL RESOURCES

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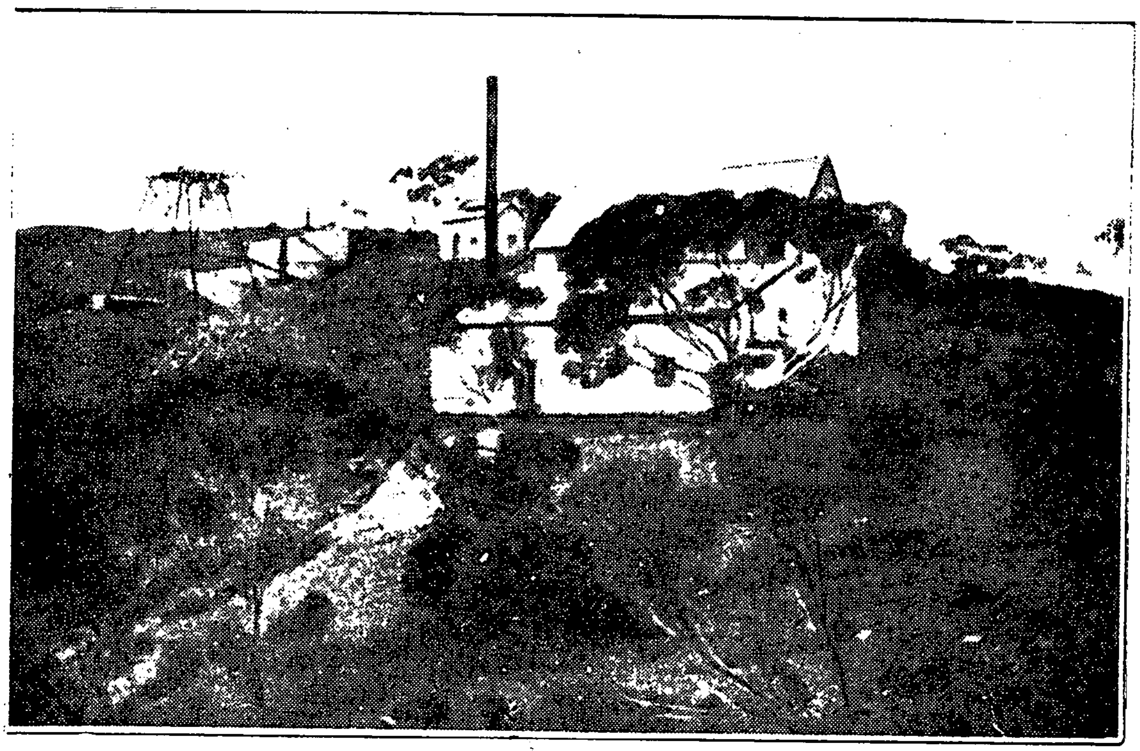

MAIN SHAFT AND BATTERY HOUSE. MOUNT GRAINGER.

FRONTISPIECE: Main Shaft and Battery House, Mount Grainger

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VOLUME 1

ABSTRACT

Stratabound gold mineralisation is confined to quartz-vein sets and stockworks in joints and fractures within a competent basal sandstone unit of Appila tillite, unconformably overlying Burra Group shales. Structure, host lithology and absence of evidence of any link with igneous intrusion show similarity to the Telfer goldmine in the Proterozoic, Paterson Range Province of Western Australia.

Eighty three channel samples from seventeen backhoe excavated costeans averaged 0.15 g/t Au and two assayed above 0.5 g/t Au. Average grade of 162 surface grab, rock chip and channel samples was 0.62 g/t Au and seven assayed above 2.0 g.t Au. Sixteen 10 kg bulk samples were crushed and split and each of four sub-samples (total 64) assayed for gold. Another of the sub-samples was pan concentrated and the concentrate assayed for gold. A further sub-sample was agitated sieved and size fraction assayed for gold and data indicate a bimodal distribution of gold in the basal sandstone.

Two bulk samples of 4.48 tonnes and 4.32 tonnes, excavated from backhoe trenches, were systematically sub-sampled by Australian Mineral Development Laboratories and gold contents of sixteen sub-samples screen fire assayed. Weighted average was 0.10 g/t Au. An additional eight, 1 kg sub-samples were pulverised to obtain 100 grams of +72 mesh which was screened to produce +36, +72 and -72 mesh sub samples for fire assay. Overall average grades were 0.24 g/t and 0.2 g/t. Eleven channel samples from the two trenches averaged 0.08 and 0.19 g/t Au and compared with a re-sample of sample balances from the initial bulk samples. Assays ranged from 0.10 to 0.16 g/t Au in MG.1 and 0.08 to 0.11 g/t Au in MG.2

Average grade of sixty nine channel samples from underground workings was 2.83 g/t Au. Eighteen of the samples assayed above 2.0 g/t Au. Several anomalously high assay results from below water level weighted the average up and were not confirmed in later samples by Western Mining Corporation Limited.

Ten reverse circulation percussion drillholes intersected the basal sandstone unit but failed to locate economic grade mineralisation. Best intersections were 6 m @ 0.21 g/t Au in hole 4 and 2 m @ 0.23 g/t Au in hole 9. Sample residue from selected intervals in the drillholes was combined and bulk cyanide leached giving a calculated grade of 0.12 g/t Au.

Bulk samples, representative of the basal sandstone unit were treated at Peterborough State Battery. Parcels 1571 and 1572 averaged 0.21 g/t and 0.28 g/t Au from material fed to the battery box and averaged 2.34 g/t and 0.56 g/t Au for material discharged from the battery box.

Seven parcels of ore (1592-1598) from both surface and underground locations averaged 2.0 g/t gold bullion recovered. Gold content of the bullion ranged from 8.5% to 31.3%. Samples of material discharged from the battery box averaged 0.85 g/t Au and tailings samples for all parcels averaged 0.22 g/t Au. Clearly evident was a progressive decrease in grades for material discharged from the battery box as the ore was treated indicating contamination within the battery.

Anomalous gold values correlate with anomalous copper, zinc and cobalt and arsenic values are slightly elevated in the presence of gold.

Sub-economic mineralisation has been demonstrated over a strike length of 700 m and width of 10 m. Trenching, drilling and bulk samples from open cuts effectively eliminates the possibility of locating a sizeable ore deposit amenable to open pit mining within ML 4830, 5011, 5017, 5018 and 5178. Further mapping and sampling may delineate small discrete ore shoots similar to those previously mined. Underground sampling has indicated a possible ore shoot 20 m below No. 2 level which warrants further testing.

INTRODUCTION

Mount Grainger goldfield is a general name for numerous mine workings covering 16 km^2 (4 km x 4 km), centred 10 km north of the township of Oodlawirra (Plate 1). Gold was discovered in this locality in 1894 and actively mined until 1915, with small scale mining and prospecting activities until the present.

In response to a request from Mr J. Simnovec (leaseholder), for assistance in locating and developing gold mineralisation at Mount Grainger, a two part geological investigation was commenced in August 1982, following a review of available data and an examination of the property in July 1982, by the author and B.J. Morris (Senior Geologist, Mineral Resources) who identified a potential for low grade gold mineralisation amenable to open cut mining.

Part one of the investigation consisted of an economic appraisal, mapping and sampling of mineralised structures within Mineral Leases (ML) 4830, 5011, 5017 and 5018 held by J.J. Simnovec and ML 5178 formerly held by M.R. Fry and D.L. Seymour and transferred to Jarmand Minerals and Exploration Pty. Ltd. This report summarises previous investigations and exploration activities, discusses results of work completed by Mineral Resources Branch and details of exploration by Abignano Limited.

Part two of the investigations consisted of a regional investigation to the east of Mount Grainger mine where minor gold and copper occurrences are known and anomalous gold, copper, lead, zinc, cobalt, manganese, barium and iron values had been detected by previous stream sediment surveys. Results of this phase of the investigations are detailed in Morris (1984b).

Historical notes on the mines within the goldfield and production statistics for each mine have been compiled by Fradd (1984). A summary of production statistics for the main mines and a brief history of past mining operations are included in this report.

LOCATION AND ACCESS

Mount Grainger goldfield is located 260 km north-northeast of Adelaide and 10 km north of Oodlawirra which is on the Barrier Highway between Adelaide and Broken Hill. Peterborough, with a population of approximately 3 000, is the nearest major settlement and is 32 km southwest of the goldfield (Fig. 1).

Workings are located in the hundreds Coglin and Nackara, county Herbert, in the District Council of Peterborough, part of Mid North Planning Area.

Road access is via an unsealed well graded, Council maintained road, northerly from Oodlawirra for a distance of 6.5 km. From this point a station track, which becomes impassable in times of heavy rain, is followed north easterly, past abandoned Wegunna homestead, a distance of 5.5 km until the mine site is reached. Terrain and vegetation cover restrict movement of vehicles around the leases although several access tracks have been bulldozed to the main mine workings.

TOPOGRAPHY

Mount Grainger goldfield covers a series of rounded, northerly to north-easterly trending ridges formed by quartzite and indurated siltstone. These ridges, the most prominent of which are Dustholes Range and Mount Grainger Range, are separated by pediments and colluvial plains.

Nackara Hill, 8 km east northeast of the mine area, attains a height of 650 m above sea level (a.s.l) and is the highest point in the goldfield area. Cooks Blow, (Plate 2), 2 km south of the main mine is 541 m a.s.l and Mount Grainger, 0.5 km north east of the mine is 562 m a.s.l.

Drainage radiates in all directions from Mount Grainger, the country falling rapidly to the north and west, and more gently to the south and southeast. Stream channels are actively eroding their headwaters but are more mature and meandering on the plains. West of the main mine, land is less dissected than east and north-east of the mine. There are no permanently flowing creeks in the area and drainage channels only flow following persistent heavy rains.

Nackara creek is the main drainage channel and flows north north-easterly along the eastern flank of Mount Grainger anticline, approximately 3.5 km east of the main mine area.

CLIMATE

Climatic conditions in the area are pleasant, although there is a tendency for extremes of temperatures.

Rainfall ranges from 200 mm to 300 mm with considerable seasonal variation, much falling in short periods, particularly as summer thunder storms resulting in local flash flooding.

Maximum summer temperatures are around 35°C while the winter temperatures average 10°C but may go as low as 0°C.

Inadequate rainfall and high summer temperatures result in poor pastures in the area and the need for water storage dams and bores for livestock.

SOILS AND VEGETATION

Soils are not well developed on the quartzite and tillite ridges especially on the freely drained slopes north of the mine area, which are destitute of soil cover except in shallow depressions and basins. On ridges, soils are generally powdery, brown, calcareous, loams while in the intervening plains and valleys soils tend to be deep, red-brown, calcareous earths and well drained, sandy soils.

Dense stands of mallee scrub (Eucalyptus socialis) cover the valleys and lower hill slopes south and west of the main mine workings. High hills and ridges north and east of the main mine, including Mount Grainger, are devoid of trees and are covered instead with tussock grasses, saltbush and occasional small shrubs.

Vegetation cover on the Dusthole range 3.5 km west of the mine consists of tussock grasses, shrubs and scattered mallee.

MINERAL TENURE

Table 1 details Mineral Claim (MC) and Mineral Lease (ML) holdings and ownership of the land within main Mount Grainger mine area as shown on Fig. 2. Much of the work discussed in this report refers to ML 4830, 5011, 5017, 5018 and 5178 in sections 179, 180, 183 and 134, hundred Coglin (Fig. 3), which is perpetual leasehold land.

TABLE 1

Mining Tenements, Mount Grainger Mine, As At 30.11.86

ML/MC Number	Area (ha)	Registered Owner	Expiry Date	Section Number	Ownership of Land
MC 1976	43.8	Jarmand Minerals & Expl. Pty. Ltd.	3.12.86	183 184	E.F.M. Markey Peterborough
MC 1977	176.46	As Above	3.12.86	134	L.E. Clapp Peterborough
MC 4830	19.44	J.J. Simnovec	13.2.89	183	E.F.M. Markey Peterborough
ML 5001	19.07	J.J. Simnovec	10.1.89	183	As Above
ML 5017	11.43	J.J. Simnovec	1.2.89	180	L.E. Clapp Peterborough
				183	E.F.M. Markey Peterborough
ML 5018	5.93	Amona Mining & Exploration Pty. Ltd.	1.2.89	183	E.F.M. Markey Peterborough
ML 5178	16.17	Jarmand Minerals & Explorations Pty. Ltd.	10.1.91	180 179 134	L.E. Clapp Peterborough

MC 1976 and MC 1977 were allowed to expire on 3.12.86 and the ground was included in Exploration Licence (EL) 1349 held by Wavrin Holdings Pty. Ltd. EL 1349 which covers 1657 km^2 surrounding Mount Grainger, has been renewed for a further twelve months and expires on 19.8.88. Wavrin Holdings Pty. Ltd. has negotiated an exploration agreement with Nobelex Ltd.

ML 5178 held by Jarmand Minerals and Explorations Pty. Ltd., plainted for non compliance of labour conditions, was forfeited in the Wardens Court and cancelled on the 23.7.87. The area fell back into EL 1349 when the plantiff failed to apply for an ML within the prescribed time.

HISTORICAL REVIEW

Fradd (1984) has compiled the history and production of Mount Grainger Goldfield. Gold was discovered in Nackara Creek in 1882 and in Buttamuck shaft in 1888. Alluvial gold was discovered near Buttamuck in 1891. No records exist as to how much alluvial gold has been won from Mount Grainger Goldfield. In 1893, A. Heaslip discovered a gold-bearing reef and the following year the first parcel of ore from the field was sent for treatment. In 1901 a fifteen head battery (Frontispiece) commenced crushing at Mount Grainger mine. This was sold in September 1906. Lockhart Jack (1913) reported that a sericitised lode 20 ft to 30 ft (6.0 m - 9.0 m) wide striking about N 25° E and dipping WNW between 45° and 55° was not uniformly auriferous but enriched by gold-bearing leaders branching from a persistent hanging wall vein up to 12 inches thick. At the time of Lockhart Jacks inspection, the bottom level in the main shaft was not accessible. However, the lode formation was reported to be 30 feet (9.0 m) wide assaying 9 dwts (14.0 grams) to 15 dwts (23.3 grams).

PAST PRODUCTION

Fradd (1984) stated that total recorded production from Mount Grainger goldfield is 65 801.04 grams of gold bullion from 5 024.48 tonnes of ore up to 31 December 1981. Ore known to have been treated on site is 2 458.72 tonnes which yielded 12 850.62 grams i.e. 5.23 g/t Au bullion. Tailings cyanided on site totalled 1 038.80 tonnes for 3 973.75 grams for a yield of 4.81 g/t Au bullion (Fradd, 1984).

Table 2 lists ore from the North Medora and South Medora mines treated at Peterborough State Battery up to December 1981 (Fradd, 1984).

Ore from Mount Grainger mine, including ore from Jones Shaft, treated at Peterborough State Battery is listed in Table 3.

TABLE 2

Ore From North Medora and South Medora Mines Treated
At Peterborough State Battery

Parcel Number	Year	Tonnes Treated	Battery Bullion grams (g)	Cyanide Bullion g	Combined Bullion Yield g	Combined Yield per tonne g/t	Total Extract. approx %
40	1894	4.1	20.2	-	20.2	4.9	84
41	1897	6.6	110.7	30.6	141.3	21.4	93
42	1898	5.1	437.0	70.0	507.0	99.4	98
48	1898	8.1	462.8	213.5	676.3	83.5	98
51	1898	4.3	112.0	87.5	101.8	46.3	96
57	1898	7.1	436.5	181.2	617.7	87.0	98
62	1899	5.1	358.4	139.5	497.9	97.4	97
103	1899	5.1	53.5	91.1	144.6	67.6	97
114	1900	12.2	283.2	116.0	399.2	31.1	?
147	1900	47.8	680.5	411.8	1 092.3	22.8	89
156	1900	43.9	228.1	84.3	312.4	7.1	74
187	1901	4.1	33.6	-	33.6	8.2	71
219	1902	17.9	349.9	248.5	593.4	33.4	93
229	1902	18.3	167.2	118.2	285.4	15.6	91
241	1902	5.6	39.0	-	39.0	7.0	70
248	1902	11.3	145.6	71.1	216.7	19.2	86
1439	1978	40.6	63.9	-	63.9	1.6	83
1498	1981	10.2	37.5	-	37.5	5.6	70
1499	1981	15.2	49.8	-	49.8	3.3	51
1502	1981	7.1	66.9	-	66.9	9.4	63
1513	1981	22.4	45.1	-	45.1	2.0	69
1517	1981	7.1	35.8	-	35.8	5.0	81
Total		309.2	4 517.2	1 863.3g	5 977.8g	19.3	

TABLE 3

Ore from Mount Grainger Mine, Including Jones Shaft, Treated at Peterborough State Battery

Parcel Number	Year	Tonnes Treated	Battery Bullion (grams)	Cyanide Bullion (grams)	Combined Bullion (grams)	Combined Yield/tonne g/t	Total Extraction %
65	1895	4.37	160.77	24.23	185.00	42.33	93.1
22	1897	6.09	33.24	20.99	54.23	8.90	85.3
32	1898	20.32	149.30	145.08	294.38	14.49	83.5
55	1898	5.08	124.99	55.08	180.07	35.45	95.4
59	1899	5.08	57.28	27.54	84.82	16.69	91.9
61	1899	5.33	73.87	32.66	106.52	19.98	91.8
71	1899	35.04	192.54	-	192.54	5.49	?
77	1899	28.45	239.50	244.42	489.92	17.22	90.8
79	1899	9.24	69.98	-	69.98	7.57	43.6
86	1899	101.60	376.35	-	376.35	3.70	?
89	1899	82.30	558.57	-	558.57	6.78	?
113	1900	105.66	676.50	-	676.50	6.40	?
132	1900	51.30	277.99	255.83	533.82	10.41	82.8
175	1901	11.43	161.99	27.67	189.66	16.59	91.2
253	1903	33.53	171.32	224.53	395.85	11.80	77.4
319	1906	15.24	70.11	32.07	102.18	6.70	76.7
326	1907	12.60	122.21	40.17	162.38	12.88	86.3
344	1908	7.21	892.15	337.47	1 229.62	170.54	97.4
351	1909	12.45	2 335.87	1 152.58	3 488.45	280.19	98.4
354	1909	24.38	2 002.42	783.81	2 786.23	114.28	96.1
358	1909	24.38	839.79	298.59	1 138.38	46.69	93.9
365	1909	6.35	29.68	-	29.68	4.67	65.2
375	1909	-	1 196.26	-	1 196.26	-	?
376	1909	6.20	105.75	34.99	140.74	22.70	88.3
382	1910	11.94	63.11	40.30	103.41	8.66	80.9
390	1910	9.40	308.25	206.77	515.02	54.79	92.3
391	1910	10.67	1 738.04	783.80	2 521.84	236.35	98.1
392	1910	18.29	358.53	149.30	507.83	27.76	90.1

Parcel Number	Year	Tonnes Treated	Battery Bullion (grams)	Cyanide Bullion (grams)	Combined Bullion (grams)	Combined Yield/tonne g/t	Total Extraction %
398	1911	18.29	425.86	425.86	1 304.40	71.32	95.6
400	1911	14.22	105.23	105.23	428.32	30.12	90.8
401	1911	5.84	34.28	34.28	217.34	37.21	83.9
478	1917	1.98	74.81	74.81	241.08	121.76	96.4
526	1928	4.06	48.73	48.73	142.04	34.98	92.0
528	1928	9.80	316.48	150.07	466.55	47.60	92.6
529	1928	5.33	64.93	24.95	89.88	18.55	86.3
657	1932	5.89	34.60	-	34.60	5.87	74.8
668	1932	14.22	18.40	101.60	120.00	8.44	84.9
669	1932	1.12	-	64.99	64.99	58.03	90.4
1325	1961	7.21	42.77	-	42.77	5.93	83.2
1326	1962	14.22	62.73	-	62.73	4.41	52.7
1330	1963	91.44	101.35	-	101.35	1.11	89.7
1331	1963	91.44	62.60	-	62.60	0.68	57.3
1345	1970	20.33	83.85	-	83.85	4.12	82.2
1346	1970	20.33	94.87	-	94.87	4.67	75.3
1347	1970	20.33	79.18	-	79.18	3.89	71.8
1348	1970	20.33	83.07	-	83.07	4.08	82.1
1350	1970	10.26	69.99	-	69.99	6.82	69.2
1354	1970	22.35	10.30	-	10.30	0.46	44.5
Total		1 062.96	16 155.75	5 984.14	22 203.89	20.79	-

Modified After Fradd (1984).

PREVIOUS INVESTIGATIONS

Mining activities and mineral investigations have been described by the following:

H.Y.L. Brown (1908) summarised reports submitted by Inspector of Mines in 1894, 1900 and 1901 and he examined the property in 1895 stating the rich lode formation is composed of hard and soft sandstone, quartzite, claystone and argillaceous sandstone.

R. Lockhart Jack (1913) produced the first comrephensive description of the goldfield and described two tillitic sequences. Certain sandstone horizons within the tillites were recognised as favourable host rocks and mineralisation was thought to be partially controlled by joints and faulting resulting from deformation and folding of the rock sequence. He observed an apparently persistent quartz vein along the hanging wall of the sandstone in the main mine area and suggested that such veins appeared to be along bedding slip planes and were most likely to persist at depth affording channel ways for the mineralising solutions. Cross cutting ferruginous leaders had yielded high grade patches of ore but were considered to be of limited extent.

Apart from two small dykes south east of the main mine, Lockhart Jack noted that sediments consisting of slate, fine grained sandstone, quartzite and some limestone occupied Mount Grainger goldfield area.

Mine workings at the main shaft, North Medora, South Medora and Dustholes mine were examined and mapped. No sampling of the lode material was reported. Production figures quoted by Lockhart Jack for main Mount Grainger mine are 2 885.5 tonnes of ore yielding 22 239 grams of gold i.e. 7.7 grams/tonne. Of this production, an estimated 305 tonnes had been extracted from a small stope approximately 20 m along the north drive on the 220 ft (67 m) level. These figures were recognised as unlikely to be complete.

R.W. Segnit (1939) after mapping and studying the stratigraphic succession in the goldfield area, proposed a complex system of strike faults to explain a postulated repetition of the tillite horizon at Mount Grainger, 3.5 km northwest at the Dustholes mine. Angular disconformities drawn on the maps to explain changes in strike and dip were not observed by Lockhart Jack.

M.N. Hiern (1966)

A syndicate working the main Mount Grainger mine in 1963 sought geological advice from the S.A. Department of Mines on exploratory drilling. Hiern inspected the site in December 1963 to formulate an exploration program and concluded that:

- configuration of the mineralised veins would present a difficult drilling target,
- coring of the arkose unit would be a problem with expected core loss rendering results meaningless.

Detailed surface and underground mapping of Mount Grainger and Medora mines was recommended with underground exploration development in the promising main shaft area.

W.A. Fairburn and L.G.B. Nixon (1966)

Detailed mapping and sampling of the main Mount Grainger mine failed to locate any mineable ore reserves. Apart from a hydrothermal zone exploited in the main stope above 120 ft (37 m) level and to a lesser extent on 220 ft (67 m) level, gold was concluded to occur sporadically throughout the hanging wall vein and associated quartz stringers within underlying arkose. The hydrothermal ore body was identified as being confined to an arkosic tillite bed where a dragfold plunging at 31° in a direction of 242° and approximating the plunge of Mount Grainger anticline, had provided a passageway for hydrothermal solutions presumably from an igneous source.

Sampling was designed to identify how the gold occurred and delineate mineralised zones. Forty nine samples were collected from surface workings on the arkosic tillite and hanging wall vein with only one sample assaying greater than 2.0 g/t Au. Underground sampling results indicated the patchy nature of gold mineralisation with two samples collected on the manganiferous hanging wall vein assaying 0.3 g/t and 12.7 g/t Au. North and South Medora mines were not sampled.

Exploration of the hydrothermal alteration zone within the arkosic tillite, particularly on the pitch of the ore shoot delineated by Lockhart Jack, was considered by Fairburn and Nixon to be the prime target.

R.G. Wright (1966) An investigation of the regional geology and mineralisation of Mount Grainger goldfield was undertaken as an Honours degree project after assisting W.A. Fairburn with mapping at Mount Grainger mine. Auriferous pyrite-quartz veins filling joints and fractures in competent sandstone quartzite beds were considered to be related to andesite intrusives in the adjacent Mount Grainger diapir. The most significant mineralisaton was noted at the base of Appila tillite at Mount Grainger and Medora mines and Pepuarta Tillite at Dustholes line of workings, in quartz veins controlled by folding and shear jointing. These veins were considered as Lower Palaeozoic.

Pyrite from Mount Grainger mine and Aureous mine (1.4 km NW of Mount Grainger) did not reveal any gold. However, inclusions of chalcopyrite and pyrrhotite were observed. Fine particles of gold (0.0025 mm) in size were recorded in vein quartz material, and is a characteristic of Dustholes lode.

Geosurveys of Australia Pty. Ltd. (1969) J.E. Johnson and A.T. Von Sanden reported on geological investigations of Special Mining Lease (SML) 211 at Mount Grainger. Diapiric emplacement of Callana Beds in the core of the anticline was questioned and the structural setting of the Mount Grainger anticline was considered not to be typical of diapirs which contain mineral deposits elsewhere in the Flinders Ranges. They concluded, there is little reason to suspect the presence of ore bodies in the core of the Mount Grainger anticline. Conformable shale, chert and dolomite are considered to be fractured and brecciated owing to their location on the culmination of the fold.

P.J. Binks (1970) In 1968, the South Australian Department of Mines undertook a drainage sampling survey of the Mount Grainger diapir. Five hundred sediment samples were collected at an average density of 31 samples per 2.6 km^2 and were analysed for copper, lead, zinc, cobalt and nickel. Although gold was the most significant mineralisation encountered in the area, samples were not analysed for gold, and its common associate arsenic. An extensive copper, lead, zinc anomaly associated with known mineralisation in Tindelpina Shale Member at Medina mine (1.5 km east of Mount Grainger mine) and within siltstone of Tapley Hill Formation and Tarcowie Siltstone was outlined in the northeast portion of the anticline.

Four rock chip traverses, three on the eastern limb and one on the western limb of the anticline were sampled across the Appila Tillite/Tindelpina Shale contact. Results of this work revealed anomalous copper and zinc associated with Tindelpina Shale Member.

Creeks draining Mount Grainger mine produced highly anomalous cobalt and nickel and of interest is the location of anomalous cobalt downstream from Medina mine. Based on stream sediment and rock chip results, follow up soil sampling was recommended on a surveyed grid east of Mount Grainger mine.

Gold Copper Exploration Ltd. Between 9 January 1970 and 23 February 1970, Gold Copper Exploration Pty. Ltd., (G.C.E.) crushed 180 tons of dump material from Mount Grainger, Medora and Dustholes mines at Peterborough State Battery for the return of 3.30 g/t Au. Battery tailings assayed 2.0 g/t Au indicating an average grade of 5.38 g/t Au. Ross (1970) concluded from the results of this bulk sampling that previous sampling was possibly not truly representative and more widespread gold mineralisation was indicated. Robertson Research (Australia) Pty. Ltd., were engaged as consultant geologists to G.C.E., and in May 1970, submitted an exploration program of mapping, sampling and assaying of bulk surface costeans, underground workings and all lode exposures, with bulk samples being treated in a processing plant to be constructed on site. Initial metallurgical testing suggested that optimum recovery could be anticipated from closed circuit cyanidation following crushing and grinding on site.

In addition to detailed mapping and sampling of most of the workings within Mount Grainger goldfield, Robertson Research (Aust) Pty. Ltd., on behalf of G.C.E., completed a regional geochemical stream sediment survey covering approximately 430 km^2 over the Mount Grainger Anticline (Miller and Brown, 1971). Sample density was about 8 per km^2 and 3 667 samples were analysed for Cu, Pb, Zn, Ba, Mn, Fe and Ag. A zone of anomalous copper, lead and zinc values was located in the nose of the Mount Grainger anticline, near Medina mine. Soil sample traverses over Medina copper mine revealed an elongate low order anomaly 60 m east of, and parallel to, the mineralised zone.

Sampling and mapping of all workings on Mount Grainger goldfield indicated that gold mineralisation was less extensive than first thought and that gold is confined to narrow, structurallly-controlled, quartz veins.

The Australian Mineral Development Laboratories In 1974, South Australian Department of Mines commissioned Australian Mineral Development Laboratories (AMDEL) to review literature on fine-gold mineralisation (Davy, 1974). Davy concluded that fine gold occurs as inclusions in sulphides, particularly pyrite and arsenopyrite due to quenching of a phase in which gold has been dissolved. Annealing at low temperatures may result in development of larger gold grains or its displacement peripheral to the sulphide. The following conditions were listed as applying to the formation of disseminated fine-gold deposits related to hot spring activity:

(i) deep or major faulting,
(ii) adularia and/or albite metasomatism,
(iii) chlorite-epidote metasomatism,
(iv) silicification and/or argillisation of non-supergene origin,
(v) association with arsenic (notably arsenopyrite),
(vi) some association with other base metals,
(vii) the presence of pyrite and other sulphides.

Hydrothermal fluids either contain gold inherently or mobilise gold from the host rocks or rocks through which they are passing.

As a follow up, AMDEL, at the request of South Australian Department of Mines, undertook a study of gold mineralisation in the Adelaide Geosyncline in 1977-78 and samples from Mount Grainger mine were submitted for analytical, petrographic and fluid inclusions investigations. Details of results are given in Appendix A. Henley (1977) reported that none of the vein samples collected contain more than 0.3 ppm Au and most contain less than 0.1 ppm Au. Arsenic was less than 50 ppm As in all samples and only traces of Cu and Pb were detected. Zinc values ranged up to 1 500 ppm Zn, barium to 800 ppm Ba and manganese to 3 000 ppm Mn. Silver was less than 1 ppm Ag in all samples.

Petrography showed that host rocks range from poorly sorted sandstone to micaceous and argillaceous sandstone (Henley, 1977). Ore veins consist of hydrothermal quartz with minor sulphides and traces of muscovite and carbonate. Some of the quartz in the veins has recrystallised as a result of deformation and fluid inclusions are rarer in recrystallised quartz (Henley, 1977).

Six quartz vein samples from Mount Grainger were studied for fluid inclusions. Primary homogenisation temperatures display a considerable range from a low of 110°C up to 530°C (Henley, 1978). Fluids responsible for the formation of quartz and the gold mineralisation are considered to have been moderate to high-temperature at some time and generally highly saline. In some samples, freezing tests indicated the possible presence of Co_2. Results are summarised in Appendix B.

Hamlyn Mining Pty. Ltd. acquired ML 4696 over Mount Grainger mine in June 1979. Parcel 1439 of 40.6 tonnes was treated at Peterborough State Battery on 29/3/78. Bullion recovered was 63.95 grams (i.e. 1.58 g/t Au bullion) and tailings assayed 0.32 g/t Au.

Three samples of ore were collected by J. Simnovec in 1978, two from the winze from No. 2 level to No. 3 level and one sample from 320 ft (98 m) No. 3 (329') level. Results are given in Appendix C and indicated potential high grade ore (average 16.9 g/t Au) below No. 2 level.

J.J. Martins (1978) South Australian Department of Mines and Energy completed regional stream sediment sampling over the nose of the Mount Grainger Anticline. Forty two samples were collected and the minus 20 fraction (850 microns) analysed by AMDEL for Cu, Pb, Zn, As, Ag and Au (gold detection limit 50 ppb). Anomalous Au values (maximum 4.6 ppm) were detected up to 500 m downstream from known workings but no Au was detected in other streams. Two slightly anomalous values of 0.1 and 0.2 ppm Au were obtained in streams draining the anomalous zone outlined by Binks (1970).

Weakly anomalous Cu, Pb, Zn and As values generally correlate with elevated Au values. Highest Cu value was 250 ppm which corresponds with 0.3 ppm Au in a stream draining Dustholes mine. In the anomalous zone outlined by Binks (1970), sample G 435/77, gave 140 ppm Cu, 1200 ppm Zn, 500 ppm Pb and 140 ppm As and gold assayed 0.1 ppm Au.

Amona Mining and Exploration Pty. Ltd. (J.J. Simnovec) In 1981, five parcels of low grade dump material from the hanging wall portion of the arkose unit were treated at the Peterborough State Battery.

A total of 62.1 tonnes produced 238.48 grams of bullion for an average yield of 3.84 g/t Au. Based on tests by Universal Inspection and Testing Company Pty. Ltd. in 1983 on samples of gold bullion, an average of 70% gold content is considered the norm so that average yield for the four parcels is approximately 2.69. g/t Au. All but 22.4 tonnes came from near North Medora shaft. Tailings from all parcels averaged 2.11 g/t Au and the average head grade was 5.9 g/t Au.

Anaconda Australia Incorporated Dr R. Marjoribanks (1981) inspected Mount Grainger goldfield and collected 15 samples in the South Medora - North Medora - Mount Grainger area and two samples from Dustholes line of workings. Sample descriptions and results are listed in Appendix D.

Highest gold value was 3.76 g/t Au, from kaolinised arkosic sandstone with small limonite spots from North Medora underlay shaft dump. Two samples from Dustholes assayed 1.09 and 1.43 g/t Au. The other samples ranged from <0.01 to 0.98 g/t Au. Channel samples across the exposed arkosic tillite between North Medora and Mt Grainger mines reported 0.98, 0.41, 0.1 and 0.08 ppm Au for 2 m intervals below the hanging wall vein (HWV). Anomalous but low gold values decreased away from the HWV.

Marjoribanks (1981) noted that the 180 tons of bulk samples treated at Peterborough by Gold Copper Exploration in 1970 represented shaft material from the upper 1.5 - 2.0 m of the arkosic tillite immediately below the HWV. Average gold content of these bulk samples was 5.8 g/t Au bullion. Anaconda grab samples of similar dump material (numbers 33, 37 and 39) ranged from 0.8 - 3.76 g/t Au and averaged 1.6 g/t Au.

Marjoribanks concluded that Mount Grainger is a hydrothermally altered sedimentary unit with mineralisation controlled by the permeable nature of the arkose. Igneous intrusion in the diapir may be the source for the hydrothermal fluids. Indicated tonnage and grade would not be economic although the discovery of small, high grade, shoots could support a small mining company or syndicate.

Amax Australia Limited Bull (1983) collected 14 samples, 9 underground at Mount Grainger mine, two from Dustholes and three of surface quartz veins and host rocks. Results and description of samples are in Appendix E. Samples from the main stope averaged 1.8 g/t Au, the peak value being 5.3 g/t Au.

Mineralogical studies of ore from a number of mines in the Adelaide Geosyncline showed most of the native gold grains to be less than 40 microns and commonly less than 20 microns. Fine grinding would be required to liberate a major portion of this native gold and it was concluded that this would not occur in a stamp battery such as operated at Peterborough.

B.J. Morris (1984a) completed 11 hand auger holes to 2.8 m to determine grade of tailings and slimes at Mount Grainger. A bulk sample of each was subjected to an agitation cyanide leach test to determine the amount of extractable gold. Stockpiles were surveyed by tape and compass and later stadia surveyed by SADME Survey Section.

An indicated 1 900 tonnes of tailings, previously cyanided, containing 0.87 g/t Au and 370 tonnes of slimes containing 3.54 g/t Au are stockpiled in ML 4830. An estimated 46% of contained gold in tailings and 90% of contained gold in slimes are considered extractable.

B.J. Morris (1984b) completed regional mapping, soil and rock chip sampling over the nose of Mount Grainger anticline to locate gold and base metal deposits. A total of 692 soil samples and 63 rock chip samples were collected with anomalous gold in 22 of the rock chip samples. Anomalous cobalt values generally correlated with auriferous quartz veins, and mineralised quartz veins were associated with anomalous arsenic. Gold mineralisation was found to be confined to sandstone-quartzite beds in Appila tillite. Morris considered that gold was remobilised during orogenesis by hot saline connate water from fine grained gold placer deposits in sandstone - quartzite units analogous to the gold bearing quartz-pebble conglomerate - type Witwatersrand deposits. Further detailed rock chip sampling was recommended to test sandstone-quartzite beds in Appila tillite in the Mt Grainger anticline and within tillite sequences elsewher in the Adelaide Geosyncline. Copper, lead, zinc and cobalt anomalies at the base of Tapley Hill Formation and near the contact of Tarcowie Siltstone and Tapley Hill Formation were also recommended for additional detailed rock chip sampling.

W.P. Fradd (1984) prepared a review of the history and production of the Mount Grainger Goldfield. Total recorded production to 31 December 1981 is given as 65 801.04 grams of gold bullion from 5 024.48 tonnes of ore.

B.P. Thomson (1984), was contracted by Hannes, Walpole and Barlow Pty. Ltd. to review the geology and gold mineralisation of Mount Grainger mine area and to discuss results of bulk sampling carried out by Abignano Limited. Thomson estimated production at 35 835 grams of gold from 4 709 tonnes of ore, an average yield of 7.6 g/t Au.

Two bulk samples of wet weights 4.48 and 4.32 tonnes were excavated from trenches on the floor of No. 2 and No. 3 open cuts respectively, (Fig. 7) adjacent to bulk samples previously taken to Peterborough Battery. Each trench was excavated from footwall to as close as possible to the hanging wall contact of the Arkose unit. Mr A.L. Keats, consultant metallurgist and Mr P. Capps, metallurgist, AMDEL, designed a special sample procedure for low grade gold ore, outlined in AMDEL Report OD 6507/84 (Appendix F). Individual fraction assay results and calculated head assays are given in table 1 of the AMDEL report. Both bulk samples were found to contain approximately 0.1 g/t Au.

Abignano Limited requested AMDEL to re-sample these bulk samples to further check the gold content. Results of this sampling, given in AMDEL Report OD 6991/84 (Appendix F), gave assays ranging from 0.10 to 0.16 g/t Au for MG 1 and 0.08 to 0.11 g/t Au for MG 2, and show close agreement with values previously obtained. Each bulk re-sample weighed approximately 1.1 tonnes and represented about one quarter of the original bulk. The portion remaining from each bulk sample was transported to Peterborough and passed through the State Battery on the 10-11 July 1984 (Brink, 1984).

As a further check, 8 sample splits of 1 kg each were taken from AMDEL streams 1 and 2 (Appendix F) and submitted to Sampling Analytical and Management Services Pty. Ltd. (SAMS). These were pulverised to obtain 100 g of +72 mesh (210 microns). Each 100 g sample was screened to produce +36, +72 and -72 mesh (420 and 210 microns) sub-samples which were fire assayed for gold. Results are included in Appendix G and show an overall average of 0.24 g/t and 0.2 g/t Au for bulk samples MG 1 and MG 2 respectively.

Thomson (1984) concluded that grade variations would inhibit a major open-pit operation and suggested that selectively mined small tonnages from the more mineralised parts of the basal sandstone could be amendable to heap leaching.

Abignano Limited - G.B. Brink (1984) summarised work completed under the Abignano-Amona Mining - J. Simnovec joint venture. Two bulk samples collected from open cuts 2 and 3 have been discussed above.

However, two halves of the bulk samples originally split off by AMDEL were run through the Peterborough State Battery. Results were:

TABLE 4

Residue of Bulk Samples MG1 and MG2 Run Through Peterborough State Battery

	Tonnage	Au Bullion Recovered (grams)	Tailings Assay (g/t)	Head Grade (g/t)
MG 1 Open Cut 2 Parcel	2.25	6.0	1.2	3.8
MG 2 Open Cut 3 Parcel	2.25	3.5	2.4	3.9

Peterborough Battery certificates on bulk samples MG1 and MG2 are included in Appendix H.

Ten reverse circulation percussion holes were drilled for Abignano Limited by Northbridge Drilling in July 1984. Samples were collected over one metre intervals when the arkose unit was intersected. Location of the holes is shown on Figures 6, 7 and 8. Assay results, depth of sample and sample weights are listed in Appendix I. Two holes, one vertical and one at 60°, were drilled at each site and sections through the holes are shown in figures 38, 39, 40, 41 and 42.

Of significance, is the report for hole 10 in the field drill log indicating fine visible gold in sandstone between 51-52 m. Assay for this interval was 0.05 g/t Au leaving some doubts about sampling and gold assaying techniques. The joint venture was subsequently terminated.

<u>Western Mining Corporation - P. Woolrich (1984)</u> collected samples from Mount Grainger in November 1984 and additional sampling was completed in June/July 1985. Assay results and sample data sheets are included in Appendix J. A sample of hanging wall tillite with thin quartz ironstone veins at Buttamuck well (sample number 892725) assayed 7.60 g/t Au. Anomalous cobalt (110 ppm), bismuth (9.4 ppm), arsenic (110 ppm) and mercury (20 ppb) correlate with the high gold content.

Manganese rich vein quartz from No. 3 open cut (sample number 892723) assayed 1.84 g/t Au and was anomalous in cobalt (195 ppm), silver (3.5 ppm), arsenic (320 ppm) and bismuth (3.5 ppm).

Underground sampling gave disappointing results, the highest value encountered being 0.28 g/t Au (sample number 893001), consisting of tillite with quartz ironstone stockwork close to the footwall contact at the northern end of No. 1 level. All other results were less than 0.05 g/t Au. Sample number 893047 in the sublevel below No. 2 level while containing less than 0.02 g/t Au was anomalous in mercury (290 ppb) and slightly elevated in arsenic (95 ppm) compared with other samples.

A small piece of amalgam from milled strake concentrates of Parcel 1592 was assayed by Woolrich and found to contain 537 g/t Au and 12.6% Cu, with minor amounts of Pb, Zn, Fe and S. (Appendix J).

Western Mining Corporation did not proceed with a joint venture or option arrangement.

Jarmand Minerals and Explorations and Cambrian Resources NL - D.L. Seymour (1984-1985) were granted Exploration Licence (EL) 1190 on 6 November 1983. EL 1190, centred on Mt Grainger Goldfield, covered 257 km^2.

Seymour (1984a) considered the geological and structural setting at Mount Grainger was suited to stratabound gold mineralisation similar to Telfer Mine in Western Australia. Initial investigations comprised a review of mining history and recent exploration activities in the area. A traverse south of the South Medora mine using the Petrex K-V fingerprint geochemical technique failed to detect anomalous values over the strike projection of the basal sandstone. Representative rock chip samples of mineralisation were submitted to Fox Laboratories in Sydney and reconnaisance mapping at a scale of 1:20 000 was commenced.

Geochemical assay results (Seymour, 1984b) for seven samples from the Mount Grainger mine area and two samples from Dustholes detected a contrast in the geochemical fingerprints of the mineralisation. A summary of the results and description of the samples appears in Appendix K. Gold values for Mount Grainger samples were all below the limit of detection and Cu, Pb, Zn, Co, As, Cd, Bi, Mo, Sb, Sn, V and W were all background values. NI and Cr were slightly elevated.

Two samples from Dustholes (4474 and 4475) assayed 1.67 and 1.61 g/t Au respectively. Copper (175 and 723 ppm), arsenic (27 and 270 ppm), lead (102 and 757 ppm), zinc (1366 and 847 ppm) silver (0.57 and 1.29 ppm), bismuth (15 and 16 ppm) and cobalt (29 and 183 ppm) were all correspondingly anomalous.

Detailed geological mapping at 1:1 000 scale of the Appila Tillite mineralised quartzite horizon from the southern boundary of ML 5017 to the Wegunna Homestead was completed. (Seymour, 1984c).

Further geological mapping confirmed strike continuity of prospective quartzite horizons and revealed a decrease in width and degree of alteration southward along strike. Thirty one backhoe costeans totalling 581.9 metres were excavated mapped and 56 chip-channel samples collected (Seymour, 1984d).

Disappointing analytical results were recorded from the costean samples. Seven out of 56 samples assayed over 0.05 ppm Au and five of these sampled arkosic quartzite horizons. There was no correlation between copper and gold, cobalt and gold and zinc and gold. (Seymour, 1984e).

1:1 000 geological plans were compiled over a strike length of 2 500 metres from the southern boundary of ML 5017 and two major parallel strike-slip faults were recognised which are believed to form a graben-like downthrow block with localised dip reversals. (Seymour, 1985a).

Results of orientation stream sediment sampling by C.S.R. Ltd, which involved collection of 5 kg samples, concentration of the finer fraction for cyanide leaching with precipitation of any dissolved gold onto zinc metal, were reported (Seymour, 1985c). Drainages north and south of Mt Grainger mine returned low gold assays although the main creek draining the main Mount Grainger workings was anomalous in gold. Dustholes drainages also reported higher gold values and were anomalous in copper and silver. Elsewhere copper and silver values were at background levels.

Seymour (1985d) concluded in the final quarterly report by Jarmand Minerals and Cambrian Exploration that Aureous Line workings represented a limited tonnage potential and no further work was warranted. Gold-sulphide mineralisation at Dustholes was considered to be localised along oblique faults crossing Gumbowie Arkose Member of the Pepuarta Tillite and in minor drag folds. Such a well-defined set of geological controls would significantly limit tonnage potential. Small workings e.g. Paddy's Gun, located north of Mt Grainger mine are narrow vein-like showings of gold mineralisation and have no economic potential.

A group of workings adjacent to Oodlawirra township are considered to be colluvial/alluvial deposits representing remnants of Tertiary to Recent alluvial terraces. No further work was recommended in this area.

Seymour noted Mount Grainger gold mineralisation was difficult to sample quantitatively except by large bulk samples and also recognised a surface depletion of gold by leaching. Two Mineral Claims (MC 1976 and MC 1977) were pegged to cover the southern extension of Mt Grainger and the area in the nose of the Mount Grainger Anticline (Fig. 5) whre Morris (1984b) outlined a Co-Pb-Zn anomaly in Tarcowie Siltstone which hosts gold mineralisation elsewhere in the Adelaide geosyncline. These tenements have since lapsed and the area is now included within Exploration Licence 1349 held by Wavrin Holdings Pty. Ltd.

Wavrin Holdings Pty. Ltd.- Dr C. Giles (1986) spent one day (18.3.86) sampling open cuts on the mineralised arkosic tillite to establish which rocks or vein sets were host to gold mineralisation. Descriptions of the samples and assay results are listed in Appendix L. A strong vertical, North-South, cross-strike lode component with local enrichment and a generally thin but well developed conformable hanging wall vein was noted. Dr Giles believed there is considerable remnant ore remaining, and that alteration is more extensive than previously recognised with good indications of ore in all drives east and west along the stockwork zone.

Other Companies are known to have inspected and sampled at Mount Grainger e.g. Aurex Pty. Ltd. (T. Delahunty) and Broad Arrow Gold Mines Pty. Ltd., (C. McCormick). However, results of their work are not available.

GEOLOGICAL SETTING

Regional

Mount Grainger Goldfield is located on the eastern margin of the Adelaide Geosyncline near the nose of the northerly trending, steeply plunging, overturned Mount Grainger anticline shown on the ORROROO 1:250 000 Geological Map Sheet (Binks, 1971).

TABLE 5

Principal Rock Units in the Mount Grainger Anticline

PROTEROZOIC	Adelaidean	Marinoan	Wilpena Group		Brachina Formation Ulupa Siltstone - siltstones & sandstones
PROTEROZOIC	Adelaidean	Sturtian	Umberatana Group	Yerelina Sub-group	Grampus Quartzite - silicified quartz sandstone Pepuarta Tillite - feldspathic sandstone & shale Gumbowie Arkose Member - sandstone
PROTEROZOIC	Adelaidean	Sturtian	Umberatana Group	Farina Sub-group	Enorama Shale Calcareous shale & silty shale
PROTEROZOIC	Adelaidean	Sturtian	Umberatana Group	Farina Sub-group	Etina Formation Limestone and Shale
PROTEROZOIC	Adelaidean	Sturtian	Umberatana Group	Farina Sub-group	Tarcowie Siltstone Wavy bedded siltstones
PROTEROZOIC	Adelaidean	Sturtian	Umberatana Group	Farina Sub-group	Tapley Hill Formation Uniform, laminated, flaggy, siltstones Tindelpina Shale Member Carbonaceous, pyritic, laminated shale
PROTEROZOIC	Adelaidean	Sturtian	Umberatana Group	Yudnamutana Sub-group	Appila Tillite Boulder tillite, diamictite, quartzite, siltstone and shales
PROTEROZOIC	Adelaidean				Unconformity
PROTEROZOIC	Adelaidean	Torrensian	Burra Group	Belair Sub-group	Silstones and shales, partly dolomitic - feldspathic quartzite beds at base
PROTEROZOIC	Adelaidean	Torrensian	Burra Group		Saddleworth Formation Siltstones, shales and black pyritic slates, calcareous siltstone with dolomitic and pyritic layers
PROTEROZOIC	Adelaidean	Torrensian			Unconformity
PROTEROZOIC	Adelaidean	Willouran	Callanna Beds		Siliceous shales, thin bedded cherts, earthy dolomites and basic intrusives (Andesites and Trachytic Andesites).

Regional geology is dominated by Proterozoic sediments comprising shale, siltstone, sandstone, dolomite and tillite of the Adelaidean System (Fig. 4). Table 5 summarises the principal rock units in the Mount Grainger Anticline.

CALLANNA BEDS. The oldest rocks exposed in the Mount Grainger Anticline are shale, chert and dolomite occupying the core of the anticline and considered by most writers to be diapirically emplaced. Binks (1968) considers diapiric breccias have been intruded along the Oodlawirra fault together with andesite dykes. Johnson and Von Sanden (1969) believe the core of the anticline contains conformable shale, chert and dolomite not diapirically emplaced and consider brecciation represents intense fracturing due to the position of rocks on the culmination of the fold.

Lockhart-Jack (1913) noted a lamprophyre dyke approximately 1.6 km south of Cooks Blow near the western boundary of section 132, hundred Coglin. A second dyke rock, an epidote amphibolite, was also observed by Lockhart-Jack.

Wright (1966) described amygdaloidal and trachytic andesites as blocks rafted up in the diapir. He also mapped dykes consisting of large euhedral to subhedral andesine phenocrysts in an intergranular groundmass of fine andesine crystals and secondary chlorite, intruding the diapir. All basic rocks observed were strongly altered due to the effects of late magmatic fluids. Wright noted the lack of contact metamorphism at the dyke-country rock boundary and the lack of chilled margins in the dyke rocks.

Farrand (1984) examined two specimens of altered Andesite (RS58-RS59), consisting of fine grained well shaped plagioclase laths exhibiting strong preferred orientation in flow lines. Biotite is an abundant constituent of the groundmass which also contains ragged interstitial flakes of chlorite, in specimen RS58. However, the absence of biotite and the presence of untwinned feldspar phenocrysts is the main difference in specimen RS59. Farrand has suggested the rocks originated as a lava rather than an intrusive or a pyroclastic sediment. Both specimens exhibit strong indications of hydrothermal reactions and potash metasomatism.

Assays for these samples are:

TABLE 6

Assay Results for Samples of Andesite Dykes

Sample No.	Au	Cu	Pb	Zn	Co	Ag	As
A 4870/83	<0.01	2	6	12	<5	1	<20
A4871/83	<0.01	4	8	49	20	1	<20

(Results in parts per million)

BURRA GROUP sediments are considered to be largely lagoonal to shallow marine (Preiss, 1979) and are essentially a rift confined sequence. Sedimentation commenced with fluvial and deltaic clastic cycles and the oldest member is about 1 000 million years (Parkin, 1969).

Burra Group occupy part of the core of the anticline and are exposed along the western and southern margin of the diapir. Dark grey, laminated and contorted siltstone, calcareous siltstone and shale overlay feldspathic quartzite and interbedded grey phyllites and are correlated with Saddleworth Formation. Along the margin of the diapir the shales and siltstone are bleached whereas away from the diapir they weather to a mustard yellow colour.

Farrand (1984) described three rock specimens RS56, RS57 and RS64 as feldspathic sandstone, silicified sandstone and ferruginous sandstone respectively, composed essentially of quartz, kaolinitic clay and muscovite mica. RS57 shows a complex history of recrystallisation.

Wright (1966) mapped Cook's Blow, 2 km south of the main mine, as a ferruginous and silicified mass of Burra Group siltstone which suffered brecciation during movement of the diapir.

Quartz veining is common within Burra Group siltstone and Wright (1966) noted the western edge of the diapir is characterised by wide spread quartz veining and silicification. Sample MGS 68 (A 4880/83) comprised brecciated ferruginous quartz veins in ferruginous shale near the Burra Group - diapir contact. Assay results are listed in Table 7. Two sets of veins were observed:

150° - 330° dip 75° to East

230° - 050° dip 55° to South

These vein orientations parallel the main Landsat Lineament trends in the Nackara Arc (Fig. 43).

TABLE 7

Assay Results for Brecciated Quartz Veins in Burra Group

Sample No.	Au	Cu	Pb	Zn	Co	Ag	As
A4880/83	<0.01	115	24	14	10	<1	70

(Results in parts per million)

Gold has been mined from transgressive quartz veining in Burra Group siltstone from the Jones Shaft workings (Fig. 32) (PlateS 19-20). A shallow pit has been excavated on a quartz vein striking at 060° located 40 m north-east of No. 5 open out (Fig. 6). Quartz veining in Burra Group shale striking at 035° and cutting obliquely across the bedding have been observed near the north east corner of ML 5018 (Fig. 7). Several shallow pits have also been excavated on quartz veins in Burra Group shale near the north east corner of ML 4830 (Fig. 8).

UMBERATANA GROUP comprises cycles of sedimentation associated with tillite and unconformably overlies Burra Group rocks, clearly seen on No. 2 level main shaft (Plates 27 and 28). Binks (1971) noted that Umberatana Group outcrop over a wide area of the Orroroo 1:250 000 map sheet and consists of up to 3 650 metres of tillite, siltstone and minor dolomite and limestone.

Appila Tillite: has a varied lithology of boulder tillite, quartzite and siltstone. Base of the Tillite is characterised by fractured pale brown, poorly sorted, sandstone 2 m to 12 m thick containing a stockwork of quartz veins, 1-10 cm thick.

Overlying this basal member is a thick boulder tillite sequence containing pebbles and boulders of quartzite, limestone, granite, gneiss and schist up to 1 m in diameter, and interbedded dark brown gritty beds and light brown spotted shales. Farrand (1984) examined two granitoid clasts from this boulder tillite (RS 46 and RS 47) and classified them as granodiorites. RS 46 showed strong sericitic alteration and is cut by hematitic quartz veins. Both specimens were collected 50 metres southwest of South Medora underlay shaft (Fig. 6).

Chemical analysis results for RS 47 are given below:

TABLE 8

Assay Results for Sample of Granodiorite Boulder in Appila Tillite

Sample No.	Au	Cu	Pb	Zn	Co	Tl	Ag	As
RS 47 (A1611/83)	<0.1	125	15	8	20	15	<1	<20

(Results in parts per million)

Farrand (1984) examined three specimens of spotted siltstone or silty shale (RS 49, RS 52 and RS 55) and noted they consisted of clay, sericite, quartz and amorphous iron oxide with the platy minerals strictly oriented along the direction of the bedding. A weak metamorphic foliation, almost perpendicular to bedding, was observed in RS 49 and RS 55.

Farrand concluded the cavities were derived from the redistribution of material already in the sediment and in RS 55 the spots have a disturbing effect on the bedding, indicating they originated as solid grains, possibly pyrite.

Specimen RS 55, collected around the collar of the old main shaft (Fig. 7) was submitted for geochemical analyses, results are listed below:

TABLE 9

Assay Results for Sample of Spotted Shale, In Appila Tillite

Sample No.	Au	Cu	Pb	Zn	Co	Ag	As
RS 55 (A 4867/83	0.16	110	28	45	12	3	230

(results in parts per million)

Several cycles of deposition have been mapped in the boulder tillite with sandstone and shale beds separating the boulder and gritty tillite units. Thin dolomite beds have been mapped by Morris (1984) near the top of Appila Tillite.

Tapley Hill Formation: Conformably overlying Appila tillite Tapley Hill Formation consists of uniform well laminated blue grey flaggy siltstone, up to 500 metres thick.

Tindelpina Shale Member: a black carbonaceous pyritic finely laminated shale marks the base of Tapley Hill Formation and has been mapped as being about 20 m thick (Wright, 1966).

Tarcowie Siltstone: This formation consists predominantly of grey-green siltstone, sandy siltstone and sandstone, and has a characteristic "wavy" bedding reflecting ripple-marked bedding planes. Wright (1966) mapped the base of the formation as consisting of massive, dark grey-brown calcareous sandstone and greywacke interbedded with grey-green, laminated siltstone.

Townsend (1987) mapped a 40 metre thick sandstone unit at Waukaringa goldfield which he informally named Cox Sandstone Member.

Wright (1966) noted that a 1.5 m thick gritty sandstone bed in Tarcowie Siltstone is host for Aureous Line gold mineralisation at Mount Grainger.

Etina Formation: Wright (1966) mapped outcrops of sandy limestone and shale forming an arcuate bed around the north western part of Mount Grainger Anticline, about 300 m west of Aureous Line.

Enorama Shale: consists of grey-green well laminated calcareous shale and siltstone, 1 300 to 1 400 m thick. Wright (1966) noted that the formation grades into softer, light grey shale becoming increasingly reddish toward the top.

Pepuarta Tillite: Lockhart Jack (1913) recognised the presence of a second tilite unit at Mount Grainger. Pepuarta Tillite consists of grey siltstone and soft, light-grey powdery greywacke containing erratics. Wright (1966) noted angular clasts up to 0.3 m in diameter. He also noted that the unit is more massive and dolomitic toward the top.

Gumbowie Arkose Member: is a coarse grained, light-brown, ripple marked and cross bedded feldspathic sandstone with shale interbeds. This unit marks the base of the upper glacial sequence and is a 6-10 m thick unit along the eastern edge of Dustholes Range. A stockwork of quartz ironstone veins emplaced into axial plane faults and folds in Gumbowie Arkose, host gold mineralisation at the Dusthole and adjoining mines.

Grampus Quartzite: A silicified, angular quartz, grey to brown, clean, ripple marked, quartzite conformably overlies Pepuarta tillite and is interbedded with grey to white siltstone and shale. As with other sandstone and quartzite beds in the area joints and fractures are filled with quartz. Grampus Quartzite is resistant to weathering and forms the prominent Dustholes Range.

WILPENA GROUP commences with a carbonated - sandstone - siltstone sequence followed by a dominantly shallow water marine and lagoonal mud sequence of siltstone (Thomson, 1969). In the Mount Grainger Anticline, Wilpena Group is represented by Ulupa Siltstone, a grey and reddish brown, becoming greeny siltstone and shale sequence with abundant limonite spots, suggested by Wright (1966) to occur as pseudomorphs after pyrite inferring an original alkaline, reducing environment.

Structural

Mount Grainger Anticline is one of a series of north-south trending folds which occurred in the early Palaeozoic Delamerian Orogeny. Binks (1968) mapped Mount Grainger Anticline thrusted against the Oodlawirra Syncline effectively eliminating the eastern limb of the anticline and overturning it to the east. Thomson (1984) considred Mount Grainger "diapir" to be block faulted, possibly bounded by steep reverse faults.

Figure 43 shows Landsat Photo Lineaments superimposed on geology in the Mount Grainger Goldfield - Nackara Arc. A major lineament trending at 325° passes through Mount Grainger diapir, Mount Grainger mine, Dustholes mine and Buttamuck Hill and can be traced continuously to south of Hawker. Pitcairn Range goldmines (Altimeter and Altitude) are situated on this lineament. Approximately 4 km north west of Pitcairn mines and also on this linement are several kimberlite plugs and dykes of Late Jurrasic age (Ferguson, et. al., 1979), considered to be related to deep seated fractures. The Mount Grainger Lineament passes through the northern extremity of the Paleozoic, Bendigo granite, which has a north-south, elongated, tear drop shape, similar to the Mount Grainger Diapir. Late Cambrian-Ordovician granites, associated with a variety of basic dyke rocks, occur in an arcuate belt along the western margin of the Murray Basin.

A second lineament, the Terowie-Orroroo lineament, has a similar trend to the Mount Grainger lineament and is also associated with kimberlite intrusions 15 km southeast of Terowie. Kimberlitic dykes have been observed to have either an 050°-080° or a 320°-330° trend and generally parallel major lineament trends.

The Mount Grainger lineament also parallels other major structures such as the Macdonald Fault and Norwest fault. At Waukaringa, Townsend identified a breccia cross cutting the eastern nose of Waukaringa Syncline, trending at 325° and paralleling several strong airphoto lineaments. A major fracture zone with a 340° trend has been identified at Teetulpa, (Horn and Fradd, 1986).

Intrusion of the diapir at Mount Grainger created a radial pattern of faulting around the nose of the anticline and is considered by Wright (1966) to have affected lithology and thickness of the sediments. A marked thinning of Upper Umberatana Group rocks is seen on the western limb of the anticline toward the south. Along the western side of the diapir a zone of strong brecciation may represent the major deep seated fracture identified by Landsat.

Mapping by Fairburn and Nixon (1966), in the vicinity of Mount Grainger mine identified an overturned fold axis plunging 40° at 243°. Further north the fold axis exhibits a steep northerly plunge. Binks (1971) attributed this to severe buckling of the northern part of the fold due to emplacement of the diapir.

Fairburn and Nixon mapped two sets of quartz filled joints considered to be important structural controls for the mineralised veins. A major auriferous set strikes at 195° and a minor, essentially barren quartz set trends at 015°-025°.

Rocks in the Mount Grainger Anticline are mainly unmetamorphosed although a weak foliation due to the development of fine flakes of chlorite and sericite has been identified by Wright (1966) and indicates lower Greenschist Facies grade metamorphism. Farrand (1984) also noted some elongation of quartz and mica with a preferred orientation within quartz grains in some micaceous sandstones and more so in the argillaceous sediments.

Mineralisation

Lockhart Jack (1913) concluded that mineralisation had been controlled by structure and that veins along bedding-slip planes were the most likely to persist at depth.

Fairburn and Nixon (1966) concluded that most gold production at Mount Grainger mine was from a structurally controlled zone of hydrothermal wall rock alteration. Mineralisation was confined to an arkosic tillite unit and controlled by drag folding and shear jointing.

Wright (1966) believed hydrothermal mineralisation was from andesite dykes in the Mount Grainger Diapir and was concentrated in a fractured sandstone at the base of the tillite overlying impervious shales.

Gold mineralisation on the Mount Grainger goldfield is largely confined to arkosic sandstone units in two tillite formations and quartzite units within the interglacial sequence. Gold mineralisation is found to a lesser extent within transgressive quartz veining in Burra Group shales. Local tectonism preferentially fractured the competent arkose sandstone units allowing selective mineralisation by auriferous solutions. Vein quartz is hydrothermal (Henley, 1977) and Collins (1978) concluded from fluid inclusion studies that moderate to high temperatures (150°C-500°C) and highly saline solutions were involved.

Wright (1966) noted that minerals associated with the quartz veining include pyrite, chalcopyrite, minor pyrrhotite, micaceous hematite, siderite, kaolinite, sericite and tourmaline. Gold is associated with the pyrite and sometimes occurs as free gold, considered to be secondary (Plates 31 and 32). Wright observed that the gold rarely exceeds 0.0025 mm in size.

Farrand (1984) suggested that the gold may have been deposited shortly after sedimentation when sulphur complexes broke up and the sulphur precipitated from solution as early diagenetic pyrite. The gold may have been concentrated in the 'spots' of the spotted shales and remobilised into the quartz veined sandstones. Alternatively the gold may not be syngenetic and may have been introduced at any stage in the history of the rock sequence. Farrand observed no evidence of an exogenic mobile phase apart from the late stage sericite veins.

Morris (1984) considered that the sandstone appeared to have acted as a permeable layer for hydrothermal fluids and groundwater. He suggested that hydrothermal fluids may have been derived from an igneous source with mineralisation derived from this source or secreted from the sedimentary pile through which the fluids passed. Alternatively, connate water, heated and mobilised by either regional orogeny or local hot spot, may have remobilised gold contained as fine-grained gold placer deposits in the tillite.

Farrand (1984) suggested hydrothermal solutions were chemically active but not high temperature and petrographic evidence indicates potassium was mobile during hydrothermal alteration of the host rocks. Kaolinisation is observed to be more intense in the vicinity of quartz veins. Scattered through patches of kaolinitic replacement are tufts of muscovite.

GEOLOGICAL MODEL

Morris (1984) favoured secretion of gold from country rock by connate water, heated and mobilised by either regional orogeny or local hot spot. He noted that the basal sandstone, deposited under fluvio-glacial conditions, represents a major break in sedimentation where sorting and concentration of detritus incorporated placer gold deposits. This was subsequently remobilised an redeposited in open fractures and faults in the arkose. Morris considered the fluvio-glacial sandstone and quartzite units of the Adelaide Geosyncline to be analogous to the gold bearing Witwatersrand quartz-pebble conglomerate - type deposits.

Whitten (1967) noted auriferous quartz veins striking northerly in zones of more intense folding occurring in Rhynie Sandstone in the Clare Hills. Gold is thought to have become concentrated in veins from detrital dispersions of gold within sandstone.

Robertson and Martin (1978) recorded gold mined from quartz veins in the Sturt tillite at the Moppa Goldfield north of Greenock and also from a locality near Hamilton. Base metal anomalies associated with the upper Sturt Tillite and basal Tapley Hill Formation were outlined by Robertson and Martin. However, no gold anomalies were located at the detection limit of 3 ppm.

Fluvio-glacial quartzite units contain gold at Mongolata, Dustholes, Hennings (Parnaroo), Pitcairn, Orama Hill, Kings Bluff, Nillinghoo, Moppa and the recent discovery of gold in basal Appila Tillite near Terowie. Geochemical signature of the Mount Grainger deposit supports the gold placer model. Arsenic and silver values are low even where gold values are high e.g. samples A 32/83 and A 33/83 (Table 34). Copper, a constant associate of gold in all types of deposits is anomalous in surface samples but extremely low in samples collected below water level, even where gold values are high (Table 34).

Thomson (1984) believes that the confinement of lines of workings i.e. Dustholes, Aureous and Mount Grainger, to stratigraphic horizons points to a structural control and contribution of gold from numerous stratigraphic levels in hot metalliferous brines released from the entire Adelaidean sequence during metamorphism and high Paleozoic heat flow.

The following model is proposed for gold mineralisation at Mount Grainger:

Fine grained gold particles were deposited as placer concentration in sandstone under fluvio-glacial conditions. Winnowing and reworking tended to further concentrate the gold, particularly in the basal sandstone of Appila Tillite. Source of the gold could have been the Willyama Complex where the Bimba unit of the Broken Hill Group, a massive pyrite/pyrrhotite zone in sericitic quartz-feldspar-biotite schists, contains anomalous gold. Many gold occurrences are known within the Willyama Complex.

Folding of the sedimentary succession in the Mount Grainger Anticline and emplacement of a diapiric core caused fracturing of competent units and bedding plane slippage. Fracture systems open during hydrothermal activity would be most favourable to the deposition of mineralisation.

Mineralising convection cells containing fluids largely made up of meteoric water passed along deep seated, regionally penetrative, fractures and into the brittle, fractured and highly permeable sandstone units culminating in a stratabound quartz vein stockwork. Metals in the fluids maybe derived partly from igneous intrusions or partly leached from country rock. The author favours the latter there being no evidence for any relationship of mineralisation with igneous intrusion or volcanic activity.

SADME INVESTIGATIONS

In July 1982 the Author and B.J. Morris, Senior Geologist, Mineral Resources, visited Mount Grainger and collected five samples from the main mine workings and one sample from a newly excavated open cut (No. 1 - Shattered Dream) where sulphide mineralisation (pyrite) in quartz veins had been uncovered. Results of analyses are listed in Table 10. Gold values, while anomalous, were generally low except for sample A 617/82 which assayed 6.6 g/t Au, and was anomalous in Co (330 ppm), Ni (1 000 ppm), Ag (0.6 ppm) and Bi (25 ppm).

Following this brief inspection a program of geological mapping, costeaning, channel sampling and bulk sampling was devised and implemented.

Geological Mapping

Geological mapping using 1:5 000 scale aerial photograph enlargements was undertaken around the nose of Mount Grainger Anticline to define extent of the basal sandstone bed of Appila tillite. Mapping of this unit is shown on Fig. 5. South of Orroroo Treasure mine the sandstone bed has a progressively subdued relief and negligible exposure, being traced mainly by minor float and scattered outcrops. Faults have disrupted this bed and complicated the structure.

North of Heather Bell workings (Fig. 5) outcrop is offset to the north west by approximately 150 metres and becomes difficult to trace around the nose of the fold. A pattern of radial faulting has been identified around the nose of Mount Grainger Anticline. Appila tillite is terminated east of Cooks Blow by a major east-north easterly trending fracture zone about 200 m wide (Fig. 5).

TABLE 10

Mount Grainger Mine

Samples Collected by B.J. Morris, July, 1982.

Sample No.	(Detection Limit)	Au g/t (0.1)	Cu ppm (1)	Pb ppm (1)	Zn ppm (20)	Co ppm (5)	Ni ppm (5)	Cr ppm (20)	As ppm (50)	Ag ppm (0.1)	Ba ppm (200)	Mn ppm (10)	Mo ppm (3)	V ppm (10)	Be ppm (1)	W ppm (50)	Bi ppm (1)	Cd ppm (3)	Ga ppm (1)	Ge ppm (1)	In ppm (10)	Sb ppm (30)	Sn ppm (1)
A 612/82	Medora Mine Area - No. 1 Open Cut. (Shattered Dream).	0.1	30	1	ND	80	100	ND	ND	ND	200	6000	6	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
A 613/82	220 level H.W.V. - Mount Grainger Main Shaft.	0.9	20	4	150	60	100	40	100	0.2	400	10000	ND	100	ND	ND	ND	ND	6	ND	ND	ND	2
A 614/82	220 level - chips across arkosic sst unit.	0.2	6	2	40	20	80	80	ND	ND	200	3000	ND	100	ND	ND	ND	ND	10	ND	ND	ND	3
A 615/82	220 level - across FW contact - Main Shaft.	0.1	4	3	60	40	80	80	ND	ND	600	10000	ND	150	ND	ND	ND	ND	10	ND	ND	ND	2
A 616/87	240 level H.W.V. - @ entrance to winze.	0.1	3	3	ND	20	60	60	ND	ND	ND	3000	ND	80	ND	ND	ND	ND	10	ND	ND	ND	1
A 617/82	15 M down E underlie limonite/geothite pseudo-morphs after pyrite in fine mica matrix - old main stope.	6.6	15	4	ND	300	1000	80	ND	0.6	ND	1500	3	200	1	50	25	ND	10	ND	ND	ND	6
	HIGH	6.6	30	1	150	300	1000	80	100	0.6	600	10000	6	200	1	50	25	<3	10	<1	<10	<10	6
	LOW	0.1	3	4	<20	20	60	<20	<50	<0.1	<200	1500	<3	30	<1	<50	<1	<3	<1	<1	<10	<10	<1
	AVERAGE	1.33	13	3	46	86	236	58	37	0.16	266	5583	2.5	110	<1	<50	<2	<3	8	<1	<10	<10	2

Gold Analysis - by Fire Assay - Code K 4/1 (Amdel)
Other Analyses - Semi Quantitative Emission Spectrographic - Codes A1 & A2 (Amdel)
ND = Not detected at limit quoted.

TABLE 11

Geochemical Analyses for Regional Samples Collected from Mount Grainger Anticline

		Au g/t	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ag ppm	As ppm	Tl ppm
NGS 6	1230/82	1.3	16	5	34	210	<1	<20	NA
MGS 22	1147/83	<0.1	90	5	50	270	<1	20	NA
MGS 23	1148/83	<0.1	60	5	80	65	<1	50	NA
MGS 35	1611/83	<0.1	125	15	8	20	<1	<20	15
MGS 42	1612/83	0.3	1400	35	1450	7400	3	50	65
MGS 55	A 4867/83	0.16	110	28	45	12	3	230	NA
56	4868	0.05	10	22	7	<5	<1	<20	NA
57	4869	0.03	9	18	5	<5	<2	<20	NA
58	4870	<0.01	2	6	12	<5	1	<20	NA
59	4871	<0.01	4	8	49	20	1	<20	NA
60	4872	0.04	465	6	125	60	4	<20	NA
61	4873	<0.01	6	<5	5	<5	<1	<20	NA
62	4874	0.06	33	8	20	6	<1	<20	NA
63	4875	<0.01	145	<5	540	110	3	<20	NA
64	4876	<0.01	145	8	1060	48	3	20	NA
65	4877	<0.01	155	14	29	<5	2	20	NA
66	4878	<0.01	6	6	4	<5	<1	<20	NA
67	4879	<0.01	2	<5	6	<5	<1	<20	NA
MGS 68	4880/83	<0.01	115	24	14	10	<1	70	NA
	HIGH	1.3	1400	35	1450	7400	4	230	65
	LOW	<0.1	2	<5	4	<5	<1	<20	15
	AVERAGE	0.12	1.53	12	186	435	1.63	37	40

NA = Not Analysed

Samples of basal Appila Tillite, Burra Group and Diapiric rocks including intrusive "dykes" were collected for geochemical and petrographic analysis. Location of these samples is shown on Fig. 4 and results of geochemical analyses in Table 11. Petrographic descriptions compiled by Farrand (1984) are summarised in Table 12, and descriptions by AMDEL are included in Appendix M.

TABLE 12

Summary of Petrographic Descriptions of Regional Samples

Field No.	Petrographic No.	Rock Name
MGS 56	RS 56	Fine, Feldspathic Sandstone
57	57	Silicified Sandstone
58	58	Altered Andesite
59	59	Altered Andesite
61	RS 60	Micaceous Quartzite
62	61	Diamictite
64	62	Quartzite Breccia with Fe replacement.
65	63	Fe Mineralisation in a Quartzite
MGS 66	RS 64	Ferruginous Sandstone with disruptive quartz veining.

Geological mapping at a scale of 1:500 covering ML 5017, 5018 and a large portion of ML 4830 (Fig. 6, 7 and 8) was compiled on base plans prepared from survey data obtained and plotted by N. Edwards and A. Hack of SADME Survey Section. Some geological data was recorded in conjunction with surveying. Geological plans have been prepared for No. 1 level Main Shaft (Fig. 9), No. 2 level Main Shaft (Fig. 10), North Medora workings (Fig. 12) and Jones Shaft workings (Fig. 32). A 3-D reconstruction of main shaft and underground workings has been prepared (Fig. 11).

Mapping of Appila Tillite within ML 5017, 5018 and 4830 has identified nine distinctive units. At the base is poorly sorted micaceous sandstone, arkose, diamictite, quartzitic and sericitic in places, up to 15 m thick. The unit has been displaced by faults near Orroroo Treasure (Fig. 6), between Shattered Dream Open Cut and North Medora (Fig. 6 and 7), at a point 50 m north of the Main Underlay shaft (Fig. 8) and near Heather Bell workings (Fig. 8) where displacement is about 150 m to the north-west. Between Shattered Dream open cut and North Medora underlay shaft the unit is thickest, possibly due to drag folding. The basal unit is strongly fractured and jointed with a stockwork of quartz veins (Plates 17, 18 and 26). There appears to be a dominant set of veins which strike 080°-260° and dip south at about 45°. A second vein set, much smaller and less frequent, o.5 cm to 2 cm thick, strikes at 150°-330° and dips 80° to the east. Other smaller vein sets are noted (Plates 18 and 23) and anastomosing of veins observed (Plate 26). Regular offsetting of the hanging wall vein by later emplaced veinlets and fractures which are generally perpendicular to the arkose unit are exhibited in Plate 29.

Vein sets in No. 2 open cut were mapped after excavation in March 1983. In the face was a strong, pinkish white, quartz vein with pyrite striking at 270° and dipping 40° to the south. This vein was immediately below the hanging wall contact of the arkose.

A major set of veins striking at 063° and dipping 45° to the east was mapped and identified as the main set. These were cut and sometimes displaced by a second major set striking at 010°-015° and dipping 45° to the west. Both vein sets comprised white quartz with minor iron oxides and manganese. No sulphide mineralisation was noted.

Narrow, 5 mm, quartz veinlets striking at 108° and dipping north at 65° were identified as a third set and were also white quartz but without iron oxides. Numerous randomly oriented veinlets were observed forming a true quartz vein stockwork. Veins were not sampled individually.

Samples of basal sandstone/arkose were submitted to AMDEL for routine petrographic descriptions and are summarised in table 13, with full descriptions contained in appendix M. Several were suggested to have strong volcanic affinities and the mineral pyrophyllite was identified in samples RS 42, RS 44, RS 48, RS 50, RS 51 and RS 54. In view of this, thin sections were submitted to Dr M. Farrand, SADME, who described them as diamictites, sandstones and quartzites, of probable glaciogene origin, altered by low to moderate temperature hydrothermal processes (Farrand, 1984).

TABLE 13

Summary of Routine Petrographic Descriptions of Basal Sandstone of Appila Tillite

Client No.	RS No.	Thin Section	Location	Dr A. Kemp AMDEL	Dr M. Farrand SADME
MGS 29	41	C 39 699	NE Corner of No. 2 open cut	Clayrich Sandstone Volcaniclastic origin	Diamictite, ?Tillite.
MGS 30	42	C 39 700	As Above	Silicified Quartzite Strong volcanic component	Quartzite Water laid sandstone.
MGS 31	43	C 39 701	Just Below HW contact No. 2 Open Cut	Silicified Metaquartzite	Quartzite As for RS 42.
MGS 32	44	C 39 702	South Wall No. 3 Open Cut	Altered Sandstone Tuffaceous/sedimentary origin	Hydrothermally altered Sandstone. Waterlaid.
MGS 36	48	C 39 706	Shattered Dream area Fig. 6	Altered feldspathic sandstone	Micaceous sandstone stream deposit.
MGS 38	50	C 39 708	No. 1 open cut Above Pinkish quartz vein	Hydrothermally altered greywacke/conglomerate acid volcanic clasts.	Diamictite, ?Tillite fluvio-glacial origin.
MGS 39	51	C 39 709	No. 3 open cut south wall	Medium grained feldspathic sandstone hydrothermally altered	Argillaceous sandstone - slightly pyritic. Water laid.

Two samples of basal sandstone collected underground in main shaft workings (MGU 18 - RS 66 and MGU 19 - RS 67) are described in Appendix O. These samples assayed 13.2 and 0.6 g/t Au respectively and were analysed for a range of elements, results listed in Table 36.

Overlying the basal sandstone unit is a pale-brown siltstone/shale sometimes with a pitted appearance and sideritic spots. A sample collected by B.J. Morris from No. 2 level main shaft (RS 40) is described as a micaceous siltstone with cavities probably resulting in leaching of siderite which developed as concretions during diagenesis (Appendix N and Plate 21).

Poorly sorted, brown, limonitic, sometimes sandy, pebble tillite overlies the siltstone and is in turn overlian by pale-brown shale, sometimes spotted and containing ferruginous, sandy beds.

A boulder tillite with spotted and pitted shale beds overlies the ferruginous sandy beds. Spotted grey-greyish brown siltstone and shale similar to RS 40 overlies the boulder tillite. Samples MGS 37 (RS 49), near Shattered Dream open cut (Fig. 6), MGS 40 (RS 52), adjacent to North Medora vertical shaft (Fig. 7) and MGS 44 (RS 55) from the collar of Old Main Shaft (Fig. 7) are representative of this unit and the shale unit underlaying the boulder tillite. Descriptions are contained in Appendix M and in Farrand (1984).

Pebble Tillite, in part sandy and limonitic, overlays grey-greyish brown siltstone and is overlain by more spotted siltstone. A thick sequence of boulder Tillite with sandstone and quartzite interbeds which are sometimes in discontinuous lenses (Fig. 7) overlays the sequence described. Spotted shaley beds are seen in the Boulder Tillite unit. Sample MGS 33 (RS 45) collected about 40 m west of Medora Extended vertical shaft (Fig. 6) and described as a Polymict Greywacke by Dr A. Kemp (Appendix M) and as a Polymict Breccia by Dr M. Farrand (1984) is typical of the upper Boulder Tillite unit. Carbonate is present in this sample. Clasts are dominantly of sedimentary origin although some fragments from a plutonic igneous source were identified. Two samples of hydrothermally altered and veined leucogranite boulders occur within the tillite (MGS 34 - RS 46 and MGS 35 - RS 47) are described in Appendix M.

Quartzite interbeds in the boulder tillite are fractured, quartz veined, hydrothermally altered and contain pseudomorphs of goethite/limonite after pyrite. Samples MGS 76 (RS 68), MGS 77 (RS 69) and MGS 78 (RS 78) located approximately 80 m west of Shattered Dream open cut (Fig. 6), are representative of a quartzite interbed and are described in Appendix O.

Costeaning

During August 1982 sixteen trenches were cut across the arkose/sandstone unit at the base of Appila Tillite in the South and North Medora areas (Fig. 6 and Fig. 7 respectively), and one trench excavated between main underlay shaft and Heather Bell workings (Fig. 8), for a total of 270 metres. All trenches were mapped and, where possible, sampled over 2 m intervals with a maximum of 3 m. Sample interval was dependent on geology. Sampling was carried out by the author and Abdulaziz Ziab of Directorate General of Mineral Resources, Saudi Arabia, with 2-4 kg samples being channelled from the wall of costeans.

Plans, sections and analytical data are presented in Figures 14-28. Analytical results and sample descriptions are given in Table 14.

- Trench 1 (Fig. 13). Located 110 m southeast of North Medora where there is a 30 m dislocation of sandstone and tillite. Aim of the costean was to expose the hanging wall contact which normally contains a strongly auriferous quartz vein and also to test a zone of silicification and quartz veining with manganese and iron oxides, in the arkose. Highest gold values were 0.4 g/t in samples A 1178/82 and A 1183/82 which represent ferruginised sandstone and silicified sandstone with quartz veining. Samples A 1178/82, A 1179/82 and A 1180/82 gave anomalous cobalt values, 130, 140 and 310 ppm respectively. Average grade of channel samples was 0.28 g/t Au.

- Trench 2 (Fig. 14). Was an extension of a shallow open cut referred to as "Shattered Dream". This had exposed several quartz veins containing pyrite, considerable sericite, specular hematite and silicification. A yellow mineral present in cavities in the quartz veins was identified as sulphur (Appendix P). A peak gold value of 0.4 g/t was obtained from sample A 1187/82 which also gave 80 ppm copper, 230 ppm cobalt, and

100 ppm arsenic. Anomalous copper, zinc and cobalt values were obtained from samples A 1190/82, A 1191/82, A 1192/82 and A 842/83. Average grade of channel samples was 0.17 g/t Au.

- Trench 3 (Fig. 15). Located 40 m south of North Medora underlie shaft, this trench was excavated to determine the location of the basal sandstone unit which is covered by scree and alluvium. Hanging wall and foot wall contacts were fully exposed. In the centre of the trench a hard, silicified, quartzite with quartz veining, could not be channel sampled. Chips of this outcrop assayed <0.1 g/t Au, 50 ppm Cu, 5 ppm Pb, 50 ppm Zn, 60 ppm co, <1 ppm Ag, 20 ppm As, 75 ppm Ni, <10 ppm Cr, <10 ppm Bi, <20 ppm V, <1 ppm Cd, 20 ppm Tl, 2.80% Fe, 7400 ppm Mn, 600 ppm Ba, and 0.01% sulphur.

Highest gold assay was 0.4 g/t in sample A 1197/82 over 3.0 m of sandstone immediately below the hanging wall contact. This sample was anomalous in cobalt (230 ppm), copper (90 ppm) and arsenic (100 ppm). Average grade of channel samples was 0.16 g/t Au.

- Trench 4 (Fig. 16). Located adjacent to North Medora underlie this trench exposed both hanging wall and footwall of the sandstone. Samples A 1204/82 and A 1205/82 assayed 0.3 g/t over 4.5 m immediately below the hanging wall contact. Basal sandstone, exposed over a 10.0 m width, gave a weighted average of 0.23 g/t Au, with the bottom 3.0 m containing 0.1 g/t. Cobalt values were all at background levels except for sample A 1206/82 which assayed 95 ppm and in which copper and zinc were slightly elevated at 40 and 42 ppm respectively.

- Trench 5 (Fig. 17). Forty five metres north east of North Medora underlie shaft, this trench exposed eleven metres of sandstone with a zone of silicification, ferruginisation and sericite over 2 m wide from 4 m to 6 m below the hanging wall vein, which at this locality is unrecognisable. Best gold values were 0.2 g/t over 5.5 m. Overall, the sandstone unit had a weighted average of 0.15 g/t Au.

- Trench 6 (Fig. 18). A zone of strong silicification 2.0 m below the hanging wall contact could not be sampled. Samples A 1220/82 and A 1221/82 assayed 0.2 and 0.6 g/t Au respectively, the latter being the highest gold value in the trenching program. Copper zinc and cobalt values were anomalous in these two samples. A1220/82 contained 95 ppm, 120 ppm and 170 ppm and A 1221/82 contained 170 ppm, 220 ppm and 85 ppm for Cu, Zn and Co respectively. This is now the site of No. 2 open cut (Fig. 7). Average gold value of channel samples was 0.28 g/t Au.

- Trench 7 (Fig. 19). Located between Trenches 4 and 5, the sandstone is 12 m thick at this point. There is very little silicification present with significantly less iron and manganese oxides. Weighted average of gold assays over 12.0 m of exposed sandstone was 0.12 g/t Au. A narrow, 4 cm wide, quartz-pyrite vein 50 cm above the sandstone-shale contact (hanging wall), assayed 0.2 g/t and was anomalous in arsenic at 100 ppm. Sample 1520/82 was anomalous in cobalt at 290 ppm and just above background in copper and arsenic, at 55 and 30 ppm respectively, but the gold assay was <0.1 g/t Au.

- Trench 8 (Fig. 20). 70 m along strike from North Medora underlie, the sandstone has a small flexure and thickens from 8 m (in adjacent trench 6) up to 12.0 m. Silicification and alteration is minimal. A pinkish, red-brown, ferruginous, pyritic quartz vein 2 cm wide about 1.0 m above the hanging wall sandstone/siltstone contact, was sampled (A 2959/85) and assayed 0.88 g/t Au and contained 43 ppm cu, <5 ppm Pb, 17 ppm Zn, 36 ppm Co, 3 ppm Ag and 94 ppm As. Highest gold value in the trench was 0.2 g/t Au (A 1525/82), taken from 0-2 m below the hanging wall contact. A quartz vein at 6.8 m was sampled (A 1530/82) and assayed 0.1 g/t Au. Anomalous cobalt values corresponded with above background copper and zinc, but not in this case with anomalous gold. Overall weighted average of gold values was 0.12 g/t over a width of 12.5 m.

- Trench 9 (Fig. 21). Located 90 m north east of North Medora underlie, this trench is now the No. 4 open cut (Fig. 7). The sandstone is 10.5 m thick at this location and exhibits less silicification and alteration than adjoining trenches. Highest gold value was 0.3 g/t (A 1532/82) and weighted average for gold over the whole sandstone was 0.17 g/t.

Anomalous cobalt, (170 ppm) copper, (90 ppm) zinc, (95 ppm) and arsenic, (40 ppm) correspond to the higher gold value in sample A 1532/82. Samples A 1533/82 and A 1534/82 were also anomalous in these elements.

- Trench 10. Excavated 30 m south of North Medora underlie shaft exposed the sandstone/arkose unit for mapping purposes. Two samples, A 1200/82 and A 1201/82 were collected, results are tabulated in Table 15.

- Trench 11 (Fig. 22). Adjacent to South Medora main underlie shaft (Fig. 6), this trench now forms part of No. 5 open cut. Sandstone unit is about 9.0 m thick although the footwall contact is not exposed in the trench. There is a strong flexure in the sandstone with a thinning to 5.0 m between trenches 11 and 12, 10.0 m to the north.

Two channel samples and one chip sample were obtained from trench 11. Sample A 2221/82 and A 2222/82 were 1.0 m channels from the hanging wall contact. Both assayed <0.1 g/t Au although A 2221/82 contained anomalous copper (110 ppm) and cobalt (520 ppm) values. This sample consisted of arkose with quartz veining and iron and manganese oxides.

Special sample A 2223/82 consisted of chips from quartz veining in silicified arkose and assayed <0.1 g/t Au. Copper, zinc and cobalt values were anomalous at 310, 130 and 840 ppm respectively.

- Trench 12 (Fig. 23). Located 15 m north of South Medora underlie shaft, this trench exposed 6.5 m of basal sandstone unit which is strongly silicified with ferruginous quartz veins for 2.0 m above the footwall contact. Samples collected of this material assayed <0.1 g/t Au. However, sample A 2220/82 of quartz veining immediately above the basal contact, contained anomalous copper (180 ppm) zinc (90 ppm) and cobalt (980 ppm).

- Trench 13 (Fig. 24). Five metres north of trench 12 the sandstone has thickened to 9.0 m, with quartz veining and abundant iron and manganese oxides from 1.0 m to 3.0 m below the hanging wall contact. Sample A 2217/82 included this section and assayed <0.1 g/t Au although anomalous copper (110 ppm) and cobalt (390 ppm) values were recorded. Sample A 2218/82 contained background values for all elements.

- Trench 14 (Fig. 25). 26.0 m north of South Medora underlie, the sandstone unit has thickened to 7.0 m and is strongly silicified near the footwall contact. Four channel samples across the unit all gave <0.1 g/t Au. No other elements recorded anomalous values.

- Trench 15 (Fig. 25). Located 35 m north of South medora underlay shaft (Fig. 6), two samples were taken from 1 to 2 m and 2 to 3 metres below the hanging wall contact of the arkose unit. Sample A 2215/82 recorded an assay of 0.1 g/t Au and is anomalous in copper (280 ppm), zinc (120 ppm) and cobalt (1200 ppm). Sample A 2216/82 had less ferruginous quartz veining than A 2215/82 and assayed <0.1 g/t Au, 110 ppm Copper, 55 ppm zinc and 370 ppm cobalt, (Table 14). Hanging wall and footwall contacts of the sandtone unit were not exposed.

- Trench 16 (Fig. 27) is located 130 m south west of Heather Bell workings in the north east corner of ML 4830 (Fig. 8). This trench was excavated mainly for geological mapping purposes and did not fully expose the arkose unit. Sample A 1227/82 was collected over 2.7 m immediately below the hanging wall contact of the arkose and assayed 0.2 g/t Au. No other elements were anomalous.

A chip sample of ferruginous material containing micaceous hematite within a spotted shale unit 4.5 m above the hanging wall of the arkose assayed 0.7 g/t Au over 0.5 m.

This trench requires extending a further 7 m to the southeast and an old trench 70 m north should be re-excavated and sampled where the arkose is strongly silicified.

TABLE 14

Analytical Results and Description of Trench Samples

Sample Number	Sample Interval (m)	Cu ppm (2)	Pb ppm (5)	Zn ppm (2)	Co ppm (5)	Ag ppm (1)	As ppm (20)	Au g/t (0.1)	Sample Description
TRENCH NO. 1									
A 1178/82	1.5	60	5	32	130	<1	20	0.4	Sandstone with limonite pseudomorphs after pyrite - minor Fe/Mn oxides.
A 1179/82	0.5	60	5	38	140	<1	<20	0.3	As Above. More ferruginous.
A 1180/82	1.0	160	5	85	310	<1	40	0.2	Limonitic tillite - dips steeply (70°) to west.
A 1181/82	2.0	50	5	38	90	<1	<20	0.2	Quartz veinlets in shale/siltstones with minor Fe/Mn oxides.
A 1182/82	2.0	22	5	22	45	<1	<20	0.3	Sandstone with minor quartz veining.
A 1183/82	2.0	36	<5	36	75	<1	<20	0.4	As Above. Increased silicification and iron oxides.
A 1184/82	3.0	40	5	24	50	<1	50	0.2	Sandstone with minor quartz veining.
A 1185/82	3.0	14	5	18	15	<1	60	0.2	As Above.
TRENCH NO. 2									
A 1186/82	2.0	38	5	30	100	<1	20	0.2	Sandstone with quartz veins and limonite - some silicification.
A 1187/82	1.5	80	5	80	230	<1	100	0.4	Sandstone (Alteration zone) qtz veining with specular hematite, mica & sericite, Mn & Fe oxides.
A 1188/82	1.5	18	5	24	30	<1	<20	0.1	As above but with less Mn & Fe oxides present.
A 1189/82	2.3	12	5	24	25	<1	<20	0.1	Quartz vein in sandstone - no alteration - minor Mn & Fe oxides.
A 1190/82	2.6	90	5	100	380	<1	<20	0.2	As above.
A 1191/82	Chip	270	5	180	530	<1	90	0.1	Limonitic boxwork in quartz veining in Sandstone.
A 1192/82	Chip	200	5	160	440	<1	<20	0.2	As above.
A 1193/82	Chip	70	5	28	55	<1	80	0.1	Chip sample - Ironstone hanging wall vein?
A 842/82	Chip	280	15	180	900	<1	30	0.2	Ferruginous quartz vein in sandstone with sericitic alteration.
A 843/83	Chip	36	10	28	90	<1	50	0.1	Same vein as above but greenish yellow tinge - sericite.
TRENCH NO. 3									
A 1194/82	3.5	120	5	20	30	<1	<20	0.1	Shale in hanging wall of sandstone.
A 1195/82	0.5	130	5	24	15	<1	<20	0.2	Limonitic vein within shale.
A 1196/82	2.0	26	<5	20	15	<1	20	0.1	Shale in hanging wall of sandstone.
A 1197/82	3.0	90	5	70	230	<1	100	0.4	Sandstone with quartz veins and Mn & Fe oxides.
A 1198/82	2.5	12	<5	18	15	<1	20	0.2	Arkose with minor quartz veinlets.
A 1199/82	4.5	8	5	20	20	<1	<20	0.1	Arkose with minor quartz veinlets.
A 1149/83	Chips	50	5	50	60	<1	20	<0.1	Sample quartz vein in silicified quartzite - minor sulphide - mica/sericite alteration.
TRENCH NO. 4									
A 1203/92	1.2	55	5	24	15	<1	<20	0.2	Limonitic shale horizon.
A 1204/82	1.0	22	<5	12	10	<1	<20	0.3	Contact between shale & arkose with minor quartz veining.
A 1205/82	3.5	12	5	14	15	<1	20	0.3	Arkose/sandstone with quartz veinlets.
A 1206/82	2.5	40	<5	42	95	<1	<20	0.2	As above.
A 1207/82	3.0	12	5	22	10	<1	20	0.3	As above.
A 1208/82	3.5	4	<5	26	5	<1	<20	0.1	As above.

Values in parts per million Spectroscopy
Gold Analysis by Fire Assay code K 4/1
Other Analyses by Atomic Absorption Spectroscopy

Sample Number	Sample Interval (m)	Cu ppm (2)	Pb ppm (5)	Zn ppm (2)	Co ppm (5)	Ag ppm (1)	As ppm (20)	Au g/t (0.1)	Sample Description
TRENCH NO. 5									
A 1209/82	0.6	16	<5	16	10	<1	<20	<0.1	Ferruginous contact between shale and arkose - hanging wall vein.
A 1210/82	1.2	16	5	20	20	<1	<20	0.1	Arkose with minor ferruginous quartz veins.
A 1211/82	1.5	16	<5	28	25	<1	<20	0.1	As above.
A 1212/82	1.2	6	<5	14	10	<1	<20	0.1	As above.
A 1213/82	1.5	6	5	8	10	<1	<20	0.1	Silicified arkose - quartz veins with minor Fe & Mn oxides and some sericite.
A 1214/82	Chip	8	5	12	30	<1	<20	<0.1	Chips from 5cm wide ferruginous quartz vein with sericite.
A 1215/82	1.5	8	5	12	5	<1	<20	0.2	Kaolinised arkose with minor quartz veins.
A 1216/82	1.5	18	<5	22	50	<1	<20	0.2	Arkose with minor quartz veinlets.
A 1217/82	2.5	32	5	44	50	<1	<20	0.2	As above.
TRENCH NO. 6									
A 1218/82	1.0	14	5	26	15	<1	<20	0.2	Arkose with minor quartz veins.
A 1219/82	1.0	18	5	22	20	<1	<20	0.1	As above.
A 1220/82	1.0	95	5	120	170	<1	<20	0.2	As above.
A 1221/82	1.0	170	5	220	85	<1	<20	0.6	Arkose with more quartz veins plus Mn & Fe oxides.
TRENCH NO. 7									
A 1517/82	0-1	65	<5	16	20	1	20	0.2	Arkose
A 1518/82	H.W.V.	20	5	18	55	1	100	0.2	Hanging wall vein - Arkose/shale contact.
A 1519/82	1-3	8	<5	12	5	<1	20	0.1	Arkose/sandstone
A 1520/82	3-5	55	<5	38	290	<1	30	<0.1	Arkose/sandstone
A 1521/82	5-7	14	<5	18	35	<1	30	0.1	Arkose/sandstone
A 1522/82	7-9	22	5	24	25	<1	20	<0.1	Arkose/sandstone
A 1523/82	9-12	8	5	22	15	1	30	0.2	Arkose/sandstone
TRENCH NO. 8									
A 1524/82	0-2	10	5	10	10	1	20	0.1	Arkose/sandstone
A 1525/82	2-4	46	5	44	75	1	20	0.2	Arkose/sandstone
A 1526/82	4-6	50	5	50	110	1	30	0.1	Arkose/sandstone
A 1527/82	6-8	6	<5	24	5	<1	30	0.1	Arkose/sandstone
A 1528/82	8-10	32	<5	55	65	<1	40	0.1	Arkose/sandstone
A 1529/82	10-12.5	6	5	16	5	<1	30	0.1	Arkose/sandstone
A 1530/82	qtz vein	12	5	14	20	<1	30	0.1	Quartz vein @ 6.8 metres
TRENCH NO. 9									
A 1531/82	0.5-2	8	<5	32	10	1	30	0.1	Arkose/sandstone
A 1532/82	2-5	90	5	95	170	1	40	0.3	Arkose/sandstone
A 1533/82	5-6	85	<5	120	310	1	30	0.2	Arkose/sandstone
A 1534/82	6-8	130	5	130	410	1	30	0.1	Arkose/sandstone
A 1535/82	8-11.2	16	5	36	20	1	30	0.1	Arkose/sandstone

Values in parts per million Spectroscopy
Gold Analysis by Fire Assay code K 4/1
Other Analyses by Atomic Absorption Spectroscopy

Sample Number	Sample Interval (m)	Cu ppm (2)	Pb ppm (5)	Zn ppm (2)	Co ppm (5)	Ag ppm (1)	As ppm (20)	Au g/t (0.1)	Sample Description
TRENCH NO. 10									
A 1200/82	Ironstone	180	5	48	80	<1	150	0.2	Ironstone vein.
A 1201/82	0-1	140	5	30	95	<1	60	0.2	Channel sample of quartz veinlets in Arkose
TRENCH NO. 11									
A 2221/82	1.0	110	5	65	520	<1	20	<0.1	Arkose with quartz veining & limonitic boxworks - from 4 to 5 m from start.
A 2222/82	1.0	24	5	12	30	<1	20	<0.1	Quartz veining - from 5 to 6 m from start.
A 2223/82	Chip	310	5	130	840	1	20	<0.1	Quartz vein - chips from north wall - Approximately 7 m from start.
TRENCH NO. 12									
A 2219/82	2.0	26	5	18	75	<1	20	<0.1	Arkose with numerous Fe stained quartz stringers 3 to 5 m from start.
A 2220/82	1.0	180	5	90	980	<1	20	<0.1	Quartz vein with limonitic boxwork + Mn & Fe oxides 5 to 6 m from start.
TRENCH NO. 13									
A 2217/82	2.0	110	5	60	390	<1	20	<0.1	Arkose/sandstone immediately below H/W vein - Contains ferruginous qtz veins 2 to 4 m from start.
A 2218/82	2.0	24	5	22	60	<1	20	<0.1	Arkose 4 to 6 m from start.
TRENCH NO. 14									
A 2211/82	3.0	22	5	20	35	<1	20	<0.1	H/W vein and spotted shale and tillite 0 to 3 m from start.
A 2212/82	3.0	18	5	22	30	<1	<20	<0.1	Arkose with ferruginous quartz veinlets 3 to 6 m from start.
A 2213/82	3.0	10	5	14	40	<1	20	<0.1	As above 6 to 9 m from start.
A 2214/82	1.0	18	5	16	90	<1	<20	<0.1	Quartzite? and quartz veining adjacent to shale contact 9 to 10 m from start.
TRENCH NO. 15									
A 2215/82	1.0	280	5	120	1200	<1	30	0.1	Arkose below H/W vein - with ferruginous quartz veins 0 to 1 m from start.
A 2216/82	1.0	110	5	55	370	<1	30	<0.1	As above - less quartz veining present 1 to 2 m from start.
TRENCH NO. 16									
A 1225/82	Chips	32	5	60	30	<1	100	0.1	Limonitic shale with minor quartz veins - Surface sample 13 m south of Trench 16.
A 1226/82	0.5	30	5	55	20	<1	60	0.1	Chips of limonitic (spotted) shale.
A 1227/82	2.7	12	5	18	15	<1	<20	0.2	Channel of Arkose with minor quartz veins.
A 1228/82	Chips	6	5	18	60	<1	<60	0.7	Chips - ferruginous material - micaceous hematite, sandy tillite?
A 1229/82	2.0	2	5	20	40	<1	<20	0.2	Arkose with ferruginous/micaceous hematite - silicified.

Values in parts per million Gold
Analysis by Fire Assay code K 4/1
Other Analyses by Atomic Absorption Spectroscopy
All samples except A 2215/82, A 2216/82 and A 2223/83, taken from the south wall of the trenches.

Grain Size Analysis

Low gold values in the costean program suggested either possible laboratory error or lack of consistency in gold particle size creating a problem in obtaining homogeneous sub-samples for assaying. With respect to the latter, Burn (1984) emphasised the problem with the following example:

'A single spherical particle of gold about 210 microns in diameter in a 100 gram sample would assay just under 1 g/t Au. An aliquot of 10 grams frm the larger sample would have a 1 in 10 chance of containing that single gold particle and gold content of this sub-sample would be either 0 g/t or about 10 g/t Au.'

With this in mind, sixteen bulk samples of approximately 10 kg each were collected in 1983 by W. Fradd, Field Assistant, Mineral Resources, and pulverised in a portable crusher (Plates 10 and 11). In conjunction with collection of bulk samples, a chip/channel sample was taken at each site and submitted to AMDEL for assay. Results are listed in Table 15, samples 1595/83 to 1610/83 inclusive.

After crushing, the bulk sample was split and three sub-samples sent to AMDEL, one to Comlabs Pty. Ltd., one panned and concentrate submitted to AMDEL and one taken to SADME Core Library where it was agitated sieved to 4750, 2360, 1180, 850, 600, 300, 150, 75 and -75 microns. Each size fraction was assayed for gold by AMDEL and all samples were analysed for copper, lead, zinc, cobalt, thallium, silver and arsenic, except for those samples submitted to Comlabs.

TABLE 15

Analytical Results of Channel and Sizing Samples

Sample Descriptions	Chip/Channel Samples Amdel Fire Assay	Chip/Channel Samples Comlab Fire Assay	Chip/Channel Samples Comlab AAS Analysis	Panned Concentrates Amdel Fire Assay	Crushed Chip Channel Sample Splits Amdel - Fire Assay			B.S. Opening 4750 microns	2360 microns	1180 microns	850 microns	600 microns	300 microns	150 microns	75 microns	-75 microns
North Medora Open Cut No. 2. Location 1.	1595/83 0.7	0.10	0.40	1682/93 3.9	1614/83 0.3	1615/83 0.2	1616/83 0.2	<0.1	0.6	0.6	0.5	0.1	0.1	0.1	0.4	0.8
As above - Face sample - Quartz/ Ironstone - Loc. 2.	1596/83 0.7	0.10	0.40	1683/83 2.8	1617/83 0.4	1618/83 0.9	1619/83 0.5	0.6	0.3	0.3	0.2	0.2	0.3	0.2	0.5	1.9
As above - East Wall Qtz/Ironstone - Loc. 3.	1597/83 0.1	<0.10	<0.10	1684/83 0.2	1620/83 <0.1	1621/83 <0.1	1622/83 0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
As above - E. wall approx. 4 m from corner - Loc. 4.	1598/83 <0.1	<0.10	<0.10	1685/83 <0.1	1623/83 <0.1	1624/83 <0.1	1625/83 <0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
As above - N.W. corner Qtz/ Ironstone - Loc. 5.	1599/83 <0.1	<0.10	<0.05	1686/83 0.2	1626/83 <0.1	1627/83 2.2	1628/83 <0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1
As above - West wall - Qtz/ Ironstone - Loc. 6.	1600/83 0.2	<0.10	<0.05	1687/83 0.1	1629/83 <0.1	1630/83 <0.1	1631/83 4.3	<0.1	<0.1	<0.1	<0.1	<0.1	4.6	<0.1	<0.1	<0.1
Orroroo Treasure Open Cut Sth end M.L. 5017.	1601/83 3.4	0.90	1.65	1688/83 13.9	1633/83 1.5	1634/83 1.3	1635/83 1.5	<0.1	0.9	0.5	0.2	0.2	0.3	0.5	5.0	5.6
Bulldozer Scrape south of Sth. Medora Open Cut/ Shaft.	1602/83 0.1	<0.10	0.20	1689/83 0.2	1636/83 0.2	1637/83 0.2	1638/83 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.2
Sth. Medora Sahft ore dump - material from underlay.	1603/83 4.6	1.00	1.20	1690/83 34.0	1640/83 1.3	1641/83 0.7	1642/83 1.0	0.1	0.5	0.1	0.2	0.2	<0.1	<0.1	2.0	5.7
North Medora Open Cut No. 3 Ore in Sth. wall.	1604/83 <0.1	0.10	0.15	1691/83 0.7	1643/83 0.2	1644/83 10.2	1645/83 0.3	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.3
Trench 11 - Immed-iately North of Sth. Medora underlay.	1605/83 <0.1	<0.10	<0.05	1692/83 0.4	1647/83 0.1	1648/83 2.6	1649/83 <0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1
Shattered Dream Lode - North Medora Open Cut No. 1.	1606/83 0.3	0.30	0.20	1693/83 0.4	1650/83 0.8	1651/83 0.9	1652/83 0.6	<0.1	0.3	0.2	0.2	0.1	0.4	<0.1	0.1	0.4

Sample Descriptions	Chip/Channel Samples Amdel Fire Assay	Chip/Channel Samples Comlab Fire Assay	Chip/Channel Samples Comlab AAS Analysis	Panned Concentrates Amdel Fire Assay	Crushed Chip Channel Sample Splits Amdel - Fire Assay			B.S. Opening 4750 microns	2360 microns	1180 microns	850 microns	600 microns	300 microns	150 microns	75 microns	-75 microns
Trench 8. - north of No. 2 open cut.	1607/83 <0.1	0.20	<0.05	1694/83 0.3	1654/83 <0.1	1655/83 0.2	1656/83 2.2	<0.1	<0.1	<0.1	*0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trench 7. - Beside track at Nth Medora shaft.	1608/83 0.2	<0.10	<0.5	1695/83 0.2	1657/83 <0.1	1658/83 0.1	1659/83 <0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
South Underlay at Jones Shaft workings. Qtz/ Ironstone.	1609/83 4.3	2.80	2.70	1696/83 6.1	1660/83 2.3	1661/83 2.3	1662/83 2.5	0.5	3.6	4.2	2.0	1.9	2.1	1.2	3.9	1.8
Trench 14. - South Medora open cut area.	1610/83 2.3	<0.10	<0.05	1697/83 0.2	1663/83 <0.1	1664/83 0.4	1665/83 <0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

All Analyses by Fire Assay except for Comlab duplicate sample.

Results of gold assays are contained in Table 15 and Appendix Q includes grain size analysis sheets with sample weight data. Histograms of gold assay for size fractions of each sample are provided in Fig. 29. Results of analyses for Cu, Pb, Zn, Co, Tl, Ag and As are listed in Table 16.

Although not conclusive, data indicate a bimodal distribution of gold in basal sandstone of Appila Tilite. Gold reports in the 75 micron and lower size range and also in the 1 000 to 2 360 micron size range. An exception is the quartz-ironstone sample collected from Jones Shaft where gold reports consistently throughout all size fractions, as well as in sample splits and the original channel sample.

Comlab Pty. Ltd., analyses were invariably lower, often by as much as 75% (Table 15). Of particular interest were high gold assays in some sample splits, where original channel samples and Comlab assays showed no gold. For example, sample from No. 3 open cut (sample split 1644/83) assayed 10.7 g/t Au while the next highest assay was only 0.7 g/t Au for panned concentrate, indicative of the presence of coarse gold particles which may present difficulties in achieving representative gold analyses.

TABLE 16

Results of Cu, Pb, Zn, Co, Tl, Ag and As Analyses For
Original Channel, Panned Concentrates & Sample Splits

Location	Sample	Sample No.	Cu	Pb	Zn	Co	Tl	Ag	As
North Medora Open Cut No. 2 Location 1	Original Channel	1595/83	130	5	150	280	<10	1	50
	Panned Conc.	1682/83	100	2	220	470	30	1	60
	Split No. 1	1614/83	160	15	170	410	20	1	30
	Split No. 2	1615/83	160	15	170	400	20	1	50
	Split No. 3	1616/83	160	15	170	390	20	1	40
As Above - Face Sample Quartz/ Ironstone - Loc. 2	Original Channel	1596/83	180	10	95	120	10	1	100
	Panned Conc.	1683/83	300	20	140	280	30	3	170
	Split No. 1	1617/83	200	15	100	180	20	1	80
	Split No. 2	1618/83	230	15	100	170	20	1	80
	Split No. 3	1619/83	200	15	90	150	20	1	70
As Above East Wall Qtz/Ironstone Loc. 3.	Original Channel	1597/83	120	5	140	210	<10	<1	20
	Panned Conc.	1684/83	290	10	250	490	10	1	<20
	Split No. 1	1620/83	160	15	160	300	10	<1	<20
	Split No. 2	1621/83	160	10	150	280	10	<1	<20
	Split No. 3	1622/83	150	10	150	280	10	<1	<20
As Above East Wall approx. 4 m from corner - Loc. 4.	Original Channel	1598/83	110	5	150	90	<10	<1	20
	Panned Conc.	1685/83	220	10	280	190	10	<1	20
	Split No. 1	1623/83	110	5	140	110	10	<1	<20
	Split No. 2	1624/83	100	5	130	100	10	<1	<20
	Split No. 3	1625/83	110	5	130	100	10	<1	<20
As Above - N.W. corner - Qtz. Ironstone - Loc. 5.	Original Channel	1599/83	55	5	50	120	<10	<1	20
	Panned Conc.	1686/83	160	10	200	420	20	<1	30
	Split No. 1	1626/83	100	5	100	270	10	<1	<20
	Split No. 2	1627/83	120	10	130	300	10	1	<20
	Split No. 3	1628/83	100	10	110	270	10	<1	<20
As Above - West Wall - Quartz/ Ironstone - Loc. 6.	Original Channel	1600/83	140	5	120	290	<10	<1	<20
	Panned Conc.	1687/83	280	10	270	660	10	<1	20
	Split No. 1	1629/83	140	10	120	340	10	<1	<20
	Split No. 2	1630/83	140	5	120	360	10	<1	<20
	Split No. 3	1631/83	120	5	110	300	10	<1	<20
Orroroo Treasure Open Cut - South end of ML 5017	Original Channel	1601/83	50	5	42	85	<10	<1	60
	Panned conc.	1688/83	75	15	85	160	20	1	90
	Split No. 1	1633/83	46	10	38	65	10	1	40
	Split No. 2	1534/83	50	10	38	65	10	1	60
	Split No. 3	1635/83	60	10	46	70	10	1	40

Location	Sample	Sample No.	Cu	Pb	Zn	Co	Tl	Ag	As
Bulldozer Scrape South of Sth. Medora Open Cut/ Shaft.	Original Channel	1602/83	30	<5	38	80	<10	<1	<20
	Panned Conc.	1689/83	55	10	95	65	<10	<1	<20
	Split No. 1	1636/83	26	5	24	35	<10	<1	<20
	Split No. 2	1537/83	23	5	20	30	<10	<1	<20
	Split No. 3	1638/83	24	5	20	30	<10	<1	<20
South Medora Shaft Ore Dump-Material from Underlay.	Original Channel	1603/83	22	<5	24	90	<10	<1	20
	Panned Conc.	1690/83	210	25	140	980	30	1	80
	Split No. 1	1640/83	65	10	44	230	10	<1	20
	Split No. 2	1641/83	65	10	55	220	10	1	<20
	Split No. 3	1642/83	55	10	44	210	10	<1	<20
North Medora Open Cut No. 3 - Ore in Sth. Wall.	Original Channel	1604/83	830	20	1200	4300	20	1	70
	Panned Conc.	1691/83	490	25	430	2600	40	2	80
	Split No. 1	1643/83	270	15	240	1300	30	1	60
	Split No. 2	1644/83	280	15	230	1300	30	1	60
	Split No. 3	1645/83	330	15	280	1600	30	1	50
Trench 11 - North of Sth. Medora Underlay	Original Channel	1605/83	100	5	60	430	<10	<1	<20
	Panned Conc.	1692	340	20	200	1600	30	1	40
	Split No. 1	1647/83	200	10	110	700	10	1	<20
	Split No. 2	1648/83	190	10	100	690	10	1	30
	Split No. 3	1649/83	190	10	110	720	20	1	30
Shattered Dream Lode - North Medora Open Cut No. 1	Original Channel	1606/83	65	5	44	270	<10	<1	30
	Panned conc.	1693/83	310	15	200	960	20	1	40
	Split No. 1	1650/83	260	10	150	660	20	1	20
	Split No. 2	1651/83	260	10	180	680	20	1	30
	Split No. 3	1652/83	270	10	150	690	20	1	30
Trench 8 - North of No. 2 open cut.	Original Channel	1607/83	10	<5	22	10	<10	<1	<20
	Panned Conc.	1694/83	110	5	130	250	10	<1	<20
	Split No. 1	1654/83	50	5	46	95	<10	<1	<20
	Split No. 2	1655/83	55	5	50	95	<10	<1	<20
	Split No. 3	1656	50	5	46	95	<10	<1	<20
Trench 7 - beside track to North Medora Shaft.	Original Channel	1608/83	350	5	330	1100	<10	<1	<20
	Panned Conc.	1695/83	370	15	300	1000	20	1	30
	Split No. 1	1657/83	170	10	130	530	10	1	<20
	Split No. 2	1658/83	160	10	130	500	10	1	<20
	Split No. 3	1659/83	160	10	130	510	10	1	<20
South Underlay at Jones Shaft Workings - Quartz/ Ironstone.	Original Channel	1609/83	410	15	540	490	10	1	70
	Panned conc.	1696/83	210	25	290	290	40	2	80
	Split No. 1	1660/83	220	25	280	230	40	2	70
	Split No. 2	1661/83	210	20	270	220	30	2	90
	Split No. 3	1662/83	210	25	260	220	40	2	70

Location	Sample	Sample No.	Cu	Pb	Zn	Co	Tl	Ag	As
Trench 14 - South Medora open cut area	Original Channel	1610/83	20	5	22	45	<10	<1	<20
	Panned Conc.	1697/83	38	5	30	200	10	<1	<20
	Split No. 1	1663/83	18	5	16	75	10	1	<20
	Split No. 2	1664/83	18	5	16	70	10	1	<20
	Split No. 3	1665/83	18	10	14	70	10	<1	<20

All Results in parts per million

Detection Limits	Cu	Pb	Zn	Co	Tl	Ag	As
	(2)	(5)	(2)	(5)	(10)	(1)	(20)

AMDEL Reports		
	1595/83 - 1610/83	AC 5226/83
	1682/83 - 1697/83	AC 5338/83
	1614/83 - 1665/83	AC 5225/83

Bulk Sampling 1961-1981

Table 17 lists all parcels of material from the Mount Grainger and Medora mines treated at the Peterborough State Battery from 1961 to 1983. Unfortunately battery records do not list exact location of parcels although those taken between 17.1.83 and 7.11.83 have been accurately recorded by Department of Mines and Energy personnel. Average head grade of material treated between 1961 and 1983 was 3.26 g/t Au and recovered grade was 2.34 g/t Au bullion. Battery crushings between 1961 and 1978 averaged 2.16 g/t Au bullion recovered while calculated average head grade of material treated was 2.96 g/t Au. Appendix R is a flow sheet for operations at the Peterborough State Battery.

Gold Copper Exploration Pty. Ltd., (G.C.E.) crushed and treated 180 tons of dump material from Mount Grainger, Medora and Dustholes mines at the Peterborough Battery between January, 1970 and March 1970, for a return of 3.30 g/t Au bullion, the highest recovery being 7.00 g/t, lowest 0.97 g/t and battery tailings assaying an average of 2.07 g/t. Reports by G.C.E., lodged with the Department of Mines and Energy do not give locations for parcels treated or provide details of the 1970 bulk testing program. The Companys consultants on the project (Robertson Research (Aust.) Pty. Ltd.) have not been able to provide location details.

The above encouraging results obtained by G.C.E. in 1970 are summarised in table 18.

TABLE 17

Parcels of Ore From Mount Grainger Mine Treated at Peterborough Battery, 1961-1983

Parcel No.	Date	Operator	Weight (t)	Bullion Recovered By Battery (g)	Tailings (g/t)	Bullion Yield/Tonne (g/t)	Battery Extraction %	Head Grade (g/t)	Location and Comments
1325	28/11/61	Jones & Sickerdick	7.1	42.78	1.23	6.03	83.0	7.26	Location unknown
1326	18/12/61	Jones & Sickerdick	14.2	62.72	4.02	4.42	52.4	8.44	Location unknown
1330	9/7/63	Jones & Sickerdick	91.4	101.35	0.13	0.90	89.5	1.24	Location unknown
1331	23/8/63	Jones & Sickerdick	91.4	62.59	0.52	0.68	56.8	1.20	Location unknown
1345	9/1/70	T. Zolotovs	20.3	83.84	0.91	4.13	81.9	5.04	Treatment costs paid by Gold Copper Expl. P/L
1346	21/1/70	T. Zolotovs	20.3	94.86	1.56	4.67	74.9	6.23	Treatment costs paid by Gold Copper Expl. P/L
1347	30/1/70	T. Zolotovs	20.3	79.18	1.56	3.90	71.4	5.46	Treatment costs paid by Gold Copper Expl. P/L
1348	12/2/70	T. Zolotovs	20.3	83.07	0.91	4.09	81.8	5.00	Treatment costs paid by Gold Copper Expl. P/L
1350	23/2/70	T. Zolotvs	10.2	69.98	3.11	6.86	68.8	9.97	Treatment costs paid by Gold Copper Expl. P/L
1354	1/5/70	T. Zolotovs	12.2	10.30	0.58	0.84	59.3	1.42	Treatment costs paid by Gold Copper Expl. P/L
1439	29/3/78	J. Michailevs	40.6	63.95	0.32	1.58	83.1	1.90	Orroroo Tressures & Sth Medora (M.C. 840).
1498	28/4/81	J. Simnovec	10.2	57.53	2.47	5.64	69.5	8.11	North Medora underlay shaft dump.
1499	22/5/81	J. Simnovec	15.3	34.21	2.20	2.24	50.4	4.44	North Medora underlay shaft dump *1.
1502	2/7/81	J. Simnovec	7.1	66.87	5.50	9.42	63.1	14.91	North Medora underlay shaft dump *2.
1513	30/10/81	J. Simnovec	22.4	44.10	0.91	1.97	68.4	2.88	South Medora underlay shaft dump material.
1517	18/11/81	J. Simnovec	7.1	35.77	1.24	5.04	80.3	6.28	North Medora underlay shaft dump material.
1541	17/1/83	J. Simnovec	12.2	27.22	0.33	2.23	87.5	2.56	No. 2 open cut - Included 3 tonne from No. 1 O/C.
1546	11/4/83	J. Simnovec	5.1	9.33	0.31	1.83	85.7	2.14	No. 2 open cut - Footwall sample - gold spilled.
1549	1/6/83	J. Simnovec	7.1	8.95	0.31	1.26	80.2	1.57	No. 2 open cut - Footwall to hanging wall sample.
1552	14/6/83	J. Simnovec	8.1	13.61	0.47	1.68	78.3	2.15	No. 3 open cut - Footwall to hanging wall sample.
1557	6/7/83	J. Simnovec	3.0	1.11	0.78	0.37	32.2	1.15	No. 3 open cut - Mainly quartz - Screened material.
1571	7/11/83	J. Simnovec	4.1	7.20	0.34	1.76	84.2	2.09	Sth Medora open cut - No. 5 cut.
1572	7/11/83	J. Simnovec	9.1	14.78	0.25	1.62	86.6	1.87	Orroroo Treasure open cut - No. 6 cut.
			459.1	1075.30		2.34		3.26	

Notes: *1 & 2 The tonnages recorded for Parcels 1499 and 1502 should have been 12.2 and 10.2 tonnes respectively.
Parcels 1513 and 1517 consisted of screened material.

TABLE 18

Summary of Bulk Samples from Mount Grainger and Medora Mines
Treated at Peterborough by Gold Copper Exploration

Parcel No.	Date	Tonnage	Bullion Recovered by Battery (grams)	Tailings Assays (g/t)	Bullion Yield/ Tonne (g/t)	Battery Extraction (%)	Head Grade (g/t)
1345	9/1/70	20.3	83.84	0.81	4.13	81.9	5.04
1346	21/1/70	20.3	94.83	1.56	4.67	74.9	6.23
1347	30/1/70	20.3	79.18	1.56	3.90	71.4	5.46
1348	12/2/70	20.3	83.07	0.91	4.09	81.8	5.00
1350	23/2/70	10.2	69.98	3.11	6.86	68.8	9.97
1354	1/5/70	12.2	10.30	0.58	0.84	59.3	1.42
		103.6	421.23		4.07	73.0	5.41

Parcel 1439 of 40.6 tonnes, treated in 1978 by J. Michailevs on behalf of Hamlyn Mining Pty. Ltd., returned 1.58 g/t Au bullion and had a calculated head grade of 1.90 g/t Au. This parcel is known to have been taken from dumps around South Medora and Orroroo Treasure underlay shafts in former Mineral Claim 840.

In 1981, current lessee, J. Simnovec, treated five parcels of dump material totalling 62.1 tonnes from North Medora and South Medora underlay shafts at the Peterborough Battery. Bullion recovered was 238.48 grams, i.e. 3.48 g/t. Tailings assays averaged 2.46 g/t Au and ranged from a high 5.50 g/t Au to a low 0.91 g/t Au. Battery extraction averaged 66.3% and calculated head grade treated was 5.89 g/t Au bullion. A summary of these parcels is listed in Table 19. Tonnages listed for parcels 1499 and 1502 were incorrectly entered in the battery book and should read 12.2 and 10.2 tonnes respectively, altering calculated head grades to 5.0 g/t and 12.06 g/t respectively.

TABLE 19

Summary of Bulk Samples from Medora Mines Treated at Peterborough Battery by J.J. Simnovec

Parcel No.	Date	Tonnage	Bullion Recovered by Battery (grams)	Tailings Assays (g/t)	Bullion Yield/ Tonne (g/t)	Battery Extraction (%)	Head Grade (g/t)
1498	28/4/81	10.2	57.53	2.47	5.64	69.5	8.11
1499	22/5/81	15.3	34.21	2.20	2.24	50.4	4.44
1502	2/7/81	7.1	66.87	5.50	9.42	63.1	14.91
1513	30/10/81	22.4	44.10	0.91	1.97	68.4	2.88
1517	18/11/81	7.1	35.77	1.24	5.04	80.3	6.28
		62.1	238.48		3.84	66.3	5.89

Gold bullion recovered by battery treatment of parcels 1498, 1499, 1502, 1513 and 1517 was sent by the lessee, J. Simnovec, to the Perth Mint for refining and a copy of the certificate issued by the Perth Mint is contained in Appendix S.

<u>SADME Bulk Sampling, 1983</u>

Results of earlier bulk sampling by Gold Copper Exploration were confirmed by grades obtained by J.J. Simnovec and indicated the hanging wall portion of the sandstone - arkose unit averaged around 5 g/t Au. This suggested that channel samples collected by SADME from trenches excavated in 1982, described earlier in this report, together with samples collected by Fairburn and Nixon (1966), were not representative of the ore grade, and signified that large volume samples were required to improve accuracy. Emphasis was placed on the fact that bulk samples treated by G.C.E., and Simnovec consisted of mullock from dumps around the old shafts, representing material discarded by the old miners as barren or low grade, but indicative of the sandstone unit encountered at depth.

Following disappointing results from channel sampling of trenches, it was decided to extract bulk samples from trenches where anomalous or detectable gold had been encountered. Seven open cuts, up to 6 m deep were excavated, the locations of which are shown on Figs. 6, 7 and 8. Representative parcels of the sandstone (arkose) unit were extracted from open cuts 1, 2, 3, 5 and 6 and were treated at the Peterborough State battery. Details are given in table 20.

Four buttons of gold bullion from Parcels 1541, 1546, 1549 and 1552 were submitted by J. Simnovec to Universal Inspection and Testing Company Pty. Ltd., for determination of gold content, (Appendix T).

A sample of amalgam from parcel 1552 was also submitted to AMDEL for qualitative spectrographic analysis (Appendix U). The Amalgam contained greater than 5% Au and an appreciable amount (in excess of 12%) of Cu. Silver content was around 4 000 ppm and other elements present included Ca, Zn, Ti, Fe, Ni, Sb, Pb and V.

Slag from smeltings of Parcel 1552 was assayed by AMDEL with results recorded in Appendix V. Gold was present in appreciable quantity (1850 ppm) in slag from the third smelt (Sample PBS 11).

Tailings samples from parcels 1541, 1546, 1571 and 1572 were submitted to AMDEL. Results are reported in Table 21, and include a large range of elements analysed. Table 22 contains gold assays for head and tail samples collected by W. Fradd from parcels 1571 and 1572 treated at Peterborough Battery in 1983. For parcel 1571 samples of the feed material to the battery box were collected (A4942/83 - A4955/83) as well as crushed material passed from the battery box to the top plate. Average grade of head samples was 0.20 g/t Au while average grade of material from the battery box was 2.34 g/t Au. This anomalous result required further investigation. Tailings averaged 0.15 g/t Au.

TABLE 20

Summary of Parcels Treated at Peterborough Battery in 1983 Program

Parcel No.	Open Cut	Date	Tonnage	Bullion Recovered by Battery (grams)	Tailings Assays (g/t)	Bullion Yield/ Tonne (g/t)	Battery Extraction (%)	Head Grade (g/t)
1541	North Medora - No. 2 Open Cut and Shattered Dream No. 1 Open Cut.	17/1/83	12.2	27.22	0.33	2.23	87.5	2.56
1546	North Medora - No. 2 Open Cut - Footwall.	11/4/83	5.1	9.33	0.31	1.83	85.7	2.14
1549	North Medora - No. 2 Open Cut F.W. to H.W.	1/6/83	7.1	8.95	0.31	1.26	80.2	1.57
1552	North Medora - No. 3 Open Cut - F.W. to H.W.	14/6/83	8.1	13.61	0.47	1.68	78.3	2.15
1557	North Medora - No. 3 Open Cut - Screened Material.	6/7/83	3.0	1.11	0.78	0.37	32.2	1.15
1571	South Medora Open Cut No. 5.	7/11/83	4.1	7.20	0.34	1.76	84.2	2.09
1572	Orroroo Treasure Open Cut No. 6	7/11/83	9.1	14.78	0.25	1.62	86.6	1.87
			48.7	82.20		1.69	76.4	2.05

TABLE 21

Results of Tailings Assays from Parcels 1541, 1546, 1571 and 1572
Treated at Peterborough Battery

Sample No.	Parcel No.	Location	Au g/t	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Ag ppm	As ppm	Fe %	Total S %
A 950/83	1541	Composite of Tailings No. 1 and No. 2 cuts.	0.20	85	20	85	140	100	<10	<1	20	1.70	0.03
A 851/83	1541	Tailings from No. 1 Open Cut	0.40	75	25	90	140	90	<10	<1	<20	1.70	0.02
A 852/83	1541	Tailings from No. 2 Open Cut	1.00	110	40	70	250	110	10	1	40	6.00	0.23
A 853/83	1546	No. 2 Open Cut - Footwall.	0.20	80	20	85	140	100	<10	<1	20	1.50	0.01
A 223/84	1572	Orroroo Treasure No. 6 Open Cut	0.24	)									
A 224/84	1572	Orroroo Treasure No. 6 Open Cut	0.26	)	Other Elements Not Analysed.								
A 225/85	1571	South Medora No. 5 Open Cut.	0.34	)									
		Detection Limits		(2)	(5)	(2)	(5)	(50	(10)	(1)	(20)	(5)	

Cd	Pt g/t	Pd g/t	Hg ppm	Bi ppm	Mn %	V ppm	Se ppm	Te ppm	Tl ppm	Total C %	Ba ppm	Al ppm	Ca ppm	Mg ppm	Si ppm
<1	<0.1	<0.005	5.1	<10	1.00	<20	<1	14	<10	0.08	800	10000	6000	1000	>10000
<1	<0.1	<0.005	164.0	<10	0.94	<20	<1	<1	<10	0.05	600	10000	800	600	>10000
<1	<0.1	<0.005	4.0	<10	0.99	<20	<1	4	<10	0.11	800	8000	8000	600	>10000
<1	<0.1	<0.005	12.1	<10	0.99	20	<1	1	<10	0.06	800	10000	4000	600	>10000
(1)	(0.1)	(0.005)	(0.05)	(10)	(5)	(20)	(1)	(1)	(10)	(0.01)	(3)	(100)	(100)	(100)	(100)

Gold Analysis by fire assay. AMDEL Reports AC 4315/83, AC 4611/83 and A 3624/84

TABLE 22

Results of Head and Tail Samples from Parcels 1571 and 1572 Treated at Peterborough Battery

Parcel 1571

4 tonnes from South Medora Open Cut. Commenced crushing at 1.25 p.m. on the 7/11/83. Assay results in grams per tonne (ppm).

7/11/83

Time	Head	Assay	Box	Assay	Tails	Assay
1.25 pm						
2.35	4942/83	0.38	4956/83	2.90	4957/83	0.50
3.00	4943/83	0.09	4958/83	0.50	4959/83	0.16
3.30	4944/83	0.20	4960/83	5.70	4961/83	0.20
4.00 pm	4945/83	0.08	4962/83	0.26	4963/83	0.05

8/11/83

Time	Head	Assay	Box	Assay	Tails	Assay
9.00 am						
9.20	4946/83	0.07	4964/83	16.00	4965/83	0.28
9.50	4947/83	0.06	4966/83	0.22	4967/83	0.16
11.00*	4948/83	0.07	4968/83	0.36	4971/83	0.16
11.30**	4949/83	0.10	4972/83	0.52	4974/83	0.06
12.00	4950/83	1.10	4975/83	2.10	4976/83	0.08
1.00 pm	4951/83	0.05	4977/83	0.70	4978/83	0.10
1.30	4952/83	0.16	4979/83	0.40	4980/83	0.06
2.00	4953/83	0.10	4981/83	0.24	4982/83	0.09
3.00	4954/83	0.22	4983/83	1.50	4984/83	0.09
3.45 pm	4955/83	0.16	4985/83	1.40	4986/83	0.07
	Average	0.20	Average	2.34	Average	0.15
				(1.50 dwt/t)		(=0.10 dwt/t)

* Sample 4969/83 Collected from 2nd Trough 33.00 g/t Au
Sample 4970/83 Collected from 3rd Trough 5.10 g/t Au

** Sample 4973/83 Collected from 2nd Trough 35.00 g/t Au

Parcel 1572

Sampling, Crushing and treatment of Ore at Peterbrough State Battery. 7/11/83 - 11/11/83. Parcel 1572 was teken from the Orroroo Treasure open cut in Mineral Lease 5017.

7/11/83

Time	Head	Box	1st Trough	2nd Trough	3rd Trough	Bottom Trough	Launder
9.35							
10.05	4921/83 0.36	4987/83 1.90	4988/83 4.90	4989/83 1.90	4990/83 2.60	4991/83 0.42	4992/83 0.58
10.35	4922/83 0.30	4993/83 0.44	4994/83 3.00	4995/83 7.00	4996/83 1.90	4967/83 0.50	4998/83 0.64
11.05	4923/83 4924/83 0.42 0.16	4999/83 0.26	5000/83 1.10	5001/83 3.00	5002/83 3.50	5003/83 0.17	5004/83 0.24
11.35	4925/83 0.14	5005/83 0.40	5006/83 1.60	5007/83 5.30	5008/83 2.60	5009/83 0.22	5010/83 0.70
12.05	4926/83 0.40	5011/83 0.54	5012/83 1.10	5013/83 0.52	5014/83 0.34	5015/83 0.12	5016/83 0.20
1.35	4927/83 0.09	5017/83 2.40	5018/83 1.20	5018/83 1.00	5020/83 3.20	5021/83 0.18	5022/83 0.22
2.35	4928/83 0.24	5023/83 1.00	5024/83 5.00	5025/83 5.80	5026/83 1.90	5027/83 0.20	5028/83 0.24
3.25	4929/83 0.08	5029/83 0.12	5030/83 7.40	5031/83 0.64	5032/83 1.90	5033/83 0.16	5034/83 0.34
3.55	4930/83 4931/83 0.14 0.12	5035/83 2.0	5036/83 4.20	5037/83 5.20	5038/83 0.54	5039/83 0.14	5040/83 0.22
AVERAGE	0.22	1.03	3.28	3.37	2.05	0.23	0.38

PARCEL 1572

8/11/83

Time	Head	Box	1st Trough	2nd Trough	3rd Trough	Bottom Trough	Launder
8.50							
9.20	4932/83 0.20	5041/83 0.24	5042/83 34.00	5043/83 9.80	5044/83 3.90	5045/83 0.46	5046/83 0.84
10.30	4933/83 1.00	5047/83 0.30	5048/83 1.10	5049/83 1.30	5050/83 1.20	5051/83 0.18	5052/83 0.58
11.10	4934/83 0.10	5053/83 0.24	5054/83 0.98	5055/83 1.20	5056/83 1.20	5057/83 0.38	5058/83 0.68
11.40	4935/83 0.30	5059/83 0.10	5060/83 3.40	5061/83 0.44	5062/83 1.30	5063/83 0.20	5079/83 0.70
1.00	4936/83 0.22	5080/83 0.26	5081/83 2.70	5082/83 2.50	5083/83 0.86	5084/83 0.18	5085/83 0.22
1.30	4937/83 0.20	5086/83 0.18	5087/83 13.00	5088/83 8.30	5089/83 1.10	5090/83 0.16	5091/83 0.32
2.10	4938/83 0.60	5092/83 0.34	5093/83 2.20	5094/83 2.40	5095/83 0.88	5096/83 0.10	5097/83 0.58
3.10	4939/83 0.28	5098/83 0.22	5099/83 0.16	5100/83 0.38	5105/83 1.40	5102/83 0.10	5103/83 0.26
3.45	4940/83 0.14	5104.83 0.14	5105/83 12.00	5106/83 4.30	5107/83 0.94	5108/83 0.34	5109/83 0.96
AVERAGE	0.34	0.22	7.73	3.40	1.42	0.23	0.57

Parcel 1572

No longer sampling the troughs or the head. Samples collected of the crushed material leaving the box and the tails at the end of the fourth plate.

9/11/83

Time	Box	Assay	Tails	Assay
9.25	5111/83	0.36	5112/83	0.08
9.55	5113/83	0.34	5114/83	0.10
10.25	5115/83	0.12	5116/83	0.07
11.05	5117/83	0.20	5118/83	0.08
12.00	5119/83	0.22	5120/83	0.10
1.15	5121/83	1.80	5122/83	0.06
2.00	5123/83	0.22	5124/83	0.05
3.00	5125/83	0.72	5126/83	0.05
3.45	5127/83	0.58	5128/83	0.08

10/11/83

Time	Box	Assay	Tails	Assay
9.00 am	5129/83	1.10	5130/83	0.06
9.30	5131/83	0.26	5132/83	0.05
10.00	5133/83	<0.01	5134/83	0.40
10.30	5135/83	0.34	5136/83	0.03
11.00	5137/83	0.26	5138/83	0.03
11.30	5139/83	0.12	5140/83	0.05
AVERAGE		0.44		0.09

Samples for parcel 1572 were also collected from ore passing to the battery box, crushed material from the battery box, four troughs between the plates and from the tailings launder. Average head grade of uncrushed ore was 0.28 g/t Au while crushed ore from the battery box averaged 0.56 g/t Au. Average grade of samples collected on the first day of crushing was higher (1.03 g/t Au) than on the following days (0.22 g/t and 0.44 g/t Au), strongly suggesting contamination.

Notes on Individual Parcels

Parcel 1541

Material treated in this parcel was obtained from two locations:

3.0 tonnes from No. 1 open cut (Shattered Dream)
9.2 tonnes from No. 2 open cut (North Medora).

Shattered Dream material consisted of white quartz with a ferruginous boxwork and some fresh sulphide (pyrite). In part, the quartz was pinkish in colour with cavities often containing a yellowish mineral identified by X-ray powder diffractometry as sulphur (Appendix P). A minor proportion of the sample contained sandstone with minor limonitic quartz veinlets and sericite.

Material from No. 2 open cut was taken from the footwall part of the sandstone unit as the hanging wall had not been exposed at that stage of the excavation. Sandstone consisted of a bleached white, medium-grained, friable material with abundant white quartz veins and minor iron oxides. Parcel 1541 was treated after a parcel from Kirkeeks Treasure gold mine.

Parcel 1546

Consisted of a sample of ore from the footwall section of the sandstone unit of No. 2 open cut. This parcel was treated at Peterborough after a parcel from Sullivans mine at Tarcoola.

Parcel 1549

A representative sample of the entire sandstone unit in No. 2 open cut, treated at Peterborough after a parcel from Sullivans mine at Tarcoola.

Parcel 1552

A representative sample of the entire sandstone unit in No. 3 open cut. Material was rich in iron, contained some sulphides and abundant manganese. This parcel was treated after a parcel of ore from Kirkeeks Treasure gold mine.

Parcel 1557

Material from No. 3 open cut was screened (Plate 6) and the fine material put through the battery. This parcel was treated after a parcel of ore from Dustholes gold mine. Three tonnes of ore yielded only 1.11 grams of gold bullion (0.37 g/t). This was significantly less than any of the other parcels treated and could be due to either less contamination from preceeding parcels or from screening out of gold associated with the quartz rock.

Parcel 1571

A representative sample from No. 5 open cut at South Medora (Fig. 6). This parcel was treated at Peterborough after a parcel from Sullivans mine, Tarcoola. Recovered bullion was 7.20 grams from 4.1 tonnes of ore (1.76 g/t Au bullion).

Parcel 1572

A representative sample of the entire sandstone unit in No. 6 open cut at Orroroo Treasure (Fig. 6). This sample was treated after a parcel from Sullivans mine Tarcoola, and yielded 1.62 g/t gold bullion from 9.1 tonnes of ore.

All parcels treated in this program followed parcels of high grade ore from either Kirkeeks Treasure or Sulivans mines except for Parcel 1557 which followed ore treated from Dustholes mine. This resulted in a significantly lower yield of bullion, suggesting that contamination through the battery is a very real consideration.

Bulk Sampling by Abignano Limited

Two bulk samples, MG 1 (4.5 tonnes) and MG 2 (4.3 tonnes), representative of the entire sandstone/arkose unit were taken from open cuts 2 and 3 respectively under careful supervision of Mr B. Brink. At each site the floor of the open cut was scraped

TABLE 23

Mount Grainger Goldmine

Results of Channel Samples Taken from Backhoe Trench Excavated for Bulk Sample MG 1 Tested at AMDEL, Open Cut No. 2.

Sample Number	Description	Assay (ppm) *	Check Assays (ppm) **	Cu ppm (2)	Pb ppm (5)	Zn ppm (2)	Mn ppm (5)	Fe % (5)	Ag ppm (1)	As ppm (20)
A 160/84	Quartz veins in Arkose - sample from face of open cut - Hanging wall of Arkose - Fe staining.	0.22	-	150	<5	180	2.10%	6.50	<1	30
A 161/84	Sandstone/Arkose with few iron stained quartz veins - North wall of trench for 1.5 m.	0.03	-	48	<5	50	6900	2.40	<1	<20
A 162/84	As Above - next 1.5 m	0.14	0.16	34	<5	46	4100	2.20	<1	<20
A 163/84	As Above - next 1.5 m	0.03	-	70	<5	100	7700	2.10	<1	<20
A 164/84	Abundant quartz veining with limonite staining toward the footwall of the trench - Sample over 1.5 m.	0.01	0.04	22	<5	66	2500	3.70	<1	<20
A 165/84	Coarser grained sandstone toward footwall contact of Arkose unit - less quartz veining - next 1.5 m.	0.04	-	20	<5	86	2200	5.20	<1	20

* Assay by Atomic Absorption.
** Check Assay by Fire Assay.

TABLE 24

Mount Grainger Goldmine

Results of Channel Samples Taken from Backhoe Trench Excavated for Bulk Sample MG.2 Tested at Amdel, Open Cut No. 3.

Sample Number	Description	Assay (ppm) *	Check Assays (ppm) **	Cu ppm (2)	Pb ppm (5)	Zn ppm (2)	Mn ppm (5)	Fe % (5)	Ag ppm (1)	As ppm (20)
A 166/84	Arkose with minor quartz limonite veining - North wall from face to S.east for 1.5 m.	0.18	-	12	<5	24	3900	3.20	<1	<20
A 167/84	Next 1.5 m - Arkose with quartz veining which dips to east & is strongly limonitic at 2.7 m to 3.0 m.	0.49	0.46	60	6	48	870	17.50	2	90
A 168/84	White Quartz veins with Mn staining - Coarser grained pinkish Arkose - next 1.5 m.	0.03	0.04	38	<5	32	5700	2.30	<1	<20
A 169/84	Less quartz veining - still pinkish Arkose - next 1.5 m minor Mn staining.	0.07	-	86	<5	90	1.40%	4.40	<1	<20
A 170/84	Coarse grained Arkose with quartz veining showing boxworks with limonite and minor Mn staining - Next 1.5 m.	0.21	0.26	28	<5	32	650	6.70	<1	<20

N.B. Footwall Contact of Arkose not exposed.

* Assay by Atomic Absorption
** Check Assay by Fire Assay

clean and a shallow backhoe trench excavated from hanging wall to footwall. The floor of the trench was swept clean and samples placed in steel drums for transportation to AMDEL pilot plant at Thebarton in Adelaide.

Crushing, sub-sampling and gold assay results for these bulk samples are contained in Appendix F. These indicate an average gold grade of 0.13 and 0.09 g/t Au for bulk samples MG 1 and MG 2 respectively.

C.M. Horn channel sampled the trenches with results presented in Tables 23 and 24. Highest gold assay in Trench MG 1 (Open Cut 2) was 0.22 g/t Au. In Trench MG 2 (Open Cut 3) highest value was 0.49 g/t Au over 1.5 m and a check assay gave 0.46 g/t Au. Average grade of channel samples in MG 1 was 0.08 g/t Au and in MG 2, 0.19 g/t Au.

Remainder of the bulk sample from the AMDEL sub sampling program was transported back to Peterborough State Battery for further testing. Results are presented in Table 25.

TABLE 25

Summary of Results of Bulk Samples MG.1 and MG.2 Treated at Peterborough

Sample No.	Parcel No.	Tonnage	Gold Bullion Recovered (grams)	Tailings Assay g/t Au	Head Grade g/t Au
MG 1	1585	2.3	6.0	1.27	3.9
MG 2	1585	2.5	3.5	2.55	3.9

In November/December 1984 seven parcels or ore totalling 62.1 tonnes were mined and treated at Peterborough State Battery by Abignano Limited. Details of individual parcels are given below:

Parcel 1592 (MG-5)

From North Medora underlay shaft, 20 m level (Fig. 12), opposite the drive south. Material consisted of quartz/manganese stockwork in sandstone predominantly from the hanging wall/mid arkose unit.

Parcel 1593 (MG-3)

Material consisted of loose fill from the floor of the main stope just above No. 1 level (Fig. 9). Much of the material comprised large rocks, possibly backfill, and very little fines. The sample is not considered to be representative of the sandstone unit or of the alteration zone in Main Stope.

Parcel 1594 (MG-4)

From No. 2 level next to the main shaft (Fig. 11). This was a truly representative sample, ore being broken from hanging wall, centre of the arkose unit and footwall. Material consisted of ferruginous quartz veining in sandstone with abundant mica alteration in the centre portion of the lode.

Parcel 1595 (MG-6)

From South Medora shaft approximately 10 m vertically below the surface. Ore consisted of sandstone with large fragments of ferruginous quartz. Specimens containing aggregates of small specks of free gold (supergene) were picked out after blasting (Plate 32). Sample was not representative of the entire sandstone unit.

Parcel 1596 (MG-8)

Obtained from No. 4 open cut at North Medora (Fig. 36), this was a representative sample of the entire sandstone unit from footwall to hanging wall, about 3 m below the surface. Material consisted of a bleached, medium-grained, sandstone, pinkish in colour toward the hanging wall contact. White quartz veining is abundant in the north eastern wall of the open cut.

Parcel 1597 (MG-7)

From No. 1 (Shattered Dream) open cut, (Fig. 6). The material consisted predominantly of very large fragments of pinkish-white quartz with minor amounts of sulphide (pyrite) and highly silicified sandstone with sericitic alteration.

Parcel 1598 (MG-9)

From No. 7 Open Cut situated between South Medora and Orroroo Treasure open cuts (Fig. 6). This parcel had been raised and stockpiled during previous sampling by SADME. Material consisted mainly of bleached sandstone with some large quartzite pebbles and boulders and only minor amounts of ferruginous quartz vein.

All parcels, except 1598, were weighed at Yongala weighbridge and dockets submitted to the battery manager. Weights recorded in the battery book have been reduced to allow for moisture content, except for Parcels 1597 and 1598 which remained the same (Table 26).

TABLE 26

Summary of Weighbridge and Battery Record Weights, Parcels 1592-1598

Parcel No.	Weighbridge Weight	Battery Recorded Weight
1592	9.3 tonnes	8.0
1593	5.6	5.0
1594	7.0	6.0
1595	8.4	8.0
1596	10.8	10.00
1597	11.0	11.0
1598	10.0 (estimated)	10.0
62.1 tonnes	58.0	

Mining and treatment of the ore parcels was supervised by W. Fradd, Field Assistant, Mineral Resources Branch, SADME. In addition to normal tailings samples collected by the Battery Manager, Mr P. Talbot, 140 samples were collected by W. Fradd as the parcels were milled. Samples of the head material (passing from battery box) and tails material (passing strakes) were collected. Results are contained in Table 27. Samples of the strake concentrate were also submitted to AMDEL for assay (Table 28) and the remainder of the concentrate milled and amalgamated in a ceramic amalgam barrel. Although the volume of concentrate varied for each parcel and exact weights were not recorded, concentate parcels were estimated to average about 3 kg. Amalgamation results are listed in Table 29.

TABLE 27

Results of Sampling at Peterborough State Battery
Parcels 1592 - 1598 Inclusive

Parcel 1592 (MG-5)

9.3 tonnes from North Medora underlay Shaft.

Date	Time				Sample Number	Head Assay g/t	Sample Number	Tail Assay g/t
19.11.84	11.10	11.25	11.40	11.55	A2518/84	6.7	A2527/84	0.4
	12.10	1.15	1.30	1.45	19/84	1.5	28	0.5
	2.00	2.15	2.45	-	-	-	-	-
20.11.84	-	-	-	9.50	A2520/84	4.8	A2529/84	0.4
	10.05	10.20	10.45	11.00	21	1.4	30	0.4
	11.15	11.30	11.45	12.55	22	2.1	31	0.6
	1.10	1.25	1.40	1.55	23	3.2	33	0.7
	2.10	2.25	2.40	2.55	24	3.2	33	0.9
	3.10	3.25	3.40	3.55	24	1.9	34	0.5
21/11/84	9.15	9.30	10.05	10.20	A2526/84	1.7	A2535/84	0.4
	1.24	1.40	1.55	2.10	A2536/84	2.6	A2546/84	0.3
	2.25	2.40	2.55	-	A2537/84	2.2	A2547/84	0.4
						2.84		0.50

PARCEL 1593 (MG-3)

5.6 tonnes from floor of main stope 120 Level.

20.11.84	9.45	10.00	10.15	10.30	A2538/84	0.8	A2548/84	0.5
	10.50	11.05	11.20	11.35	39	1.7	49	0.4
	11.50	1.00	1.15	1.30	40	1.0	50	0.6
	1.45	2.00	2.15	2.30	41	0.7	51	0.5
	2.45	3.00	3.15	3.30	A2542/84	1.2	A2552/84	0.5
	3.45	-	-	-	-	-	-	-
21.11.84	-	9.05	9.20	9.35	A2543/84	0.9	A2553/84	0.3
	10.10	10.25	11.00	11.15	44	0.7	54	0.4
	11.30	11.45	12.00	12.15	A2545/84	1.7	A2555/84	0.4
						1.09		0.45

Parcel 1594 (MG-4)

7.0 Tonnes from 220 Level - Main Shaft.

Date	Time				Sample Number	Head Assay g/t	Sample Number	Tail Assay g/t
22.11.84	11.35	11.50	12.05	12.20	A2512/84	0.4	A2515/84	0.2
	1.40	1.55	2.10	2.25	A2513/84	0.4	16	0.1
	2.40	2.55	3.10	3.25	A2514/84	1.2	A2517/84	0.2
	3.50	-	-	-	-	-	-	-
26.11.84	-	9.15	9.30	9.45	A2652/84	0.4	A2653/84	0.3
	10.00	10.15	10.30	10.45	A2654/84	0.5	55	0.3
	11.00	11.15	11.30	11.45	A2656/84	0.7	57	0.2
	12.00	1.20	1.35	1.50	A2658/84	0.4	59	0.2
	2.05	2.20	2.35	-	A2660/84	0.9	A2661/84	0.3
						0.61		0.22

Parcel 1595 (MG-6)

8.6 tonnes from South Medora underground.

Date	Time				Sample Number	Head Assay g/t	Sample Number	Tail Assay g/t
22.11.84	1.45	2.00	2.15	2.30	A2508/84	1.0	A2510/84	0.1
	2.45	3.00	3.15	3.30	A2509/84	1.1	A2511/84	0.1
	3.55	-	-	-	-	-	-	-
26.11.84	-	9.20	9.35	9.50	A2636/84	0.3	A2637/84	0.1
	10.05	10.20	10.35	10.50	38	0.6	39	0.2
	11.05	11.20	11.35	11.50	40	0.5	41	0.2
	1.25	1.40	1.55	2.10	42	1.4	43	0.1
	2.25	2.40	3.25	3.40	A2644/84	0.8	A2645/84	0.1
	3.55	-	-	-	-	-	-	-
27.11.84	-	9.05	9.20	9.40	A2646/84	0.4	A2647/84	0.1
	9.55	10.10	10.125	10.40	48	0.3	49	0.1
	10.55	11.10	11.25	11.40	A2650/84	0.4	A2651/84	0.1
						0.68		0.12

Parcel 1596 (MG-8)

10.8 tonnes from No. 4 Open Cut

Date	Time				Sample Number	Head Assay g/t	Sample Number	Tail Assay g/t
27.11.84	3.00	3.15	3.30	3.45	A2662/84	0.2	A2663/84	0.1
	4.00	-	-	-	-	-	-	-
28.11.84	-	8.55	9.10	9.25	A2664/84	0.9	A2665/84	0.1
	9.40	9.55	10.10	10.25	66	0.2	67	0.1
	12.45	1.00	-	-	-	-	-	-
29.11.84	-	-	9.25	9.40	A2668/84	0.3	A2669/84	0.1
	10.00	10.15	10.30	10.45	70	0.4	71	0.2
	11.00	11.15	11.30	1.10	72	0.3	73	0.1
	1.50	2.05	2.20	2.45	74	0.3	75	0.1
	3.00	3.15	3.30	3.45	76	0.2	77	0.1
30.11.84	10.05	10.20	10.35	10.40	78	0.2	79	0.1
	11.05	11.20	-	-	A2680/84	0.1	A2681/84	0.1
						0.31		0.11

Parcel 1597 (MG-7)

11.0 tonnes from No. 1 Open Cut.

28.11.84	9.00	9.15	9.30	9.45	A2682/84	0.5	A2683/84	0.2
	10.00	10.15	10.30	12.50	84	0.2	85	0.1
	1.05	-	-	-	-	-	-	-
29.11.84	-	9.30	9.43	10.05	A2686/84	0.3	A2687/84	0.1
	10.30	10.35	10.50	11.05	88	0.2	89	0.2
	11.20	1.00	1.15	1.40	A2690/84	0.2	A2691/84	0.1
	1.55	2.10	2.35	2.50	92	0.2	93	0.1
	3.05	3.20	3.35	3.50	94	0.2	95	0.1
30.11.84	10.10	10.25	10.40	10.55	96	0.1	97	0.1
	11.10	11.35	11.50	12.05	98	0.2	99	0.1
	1.40	1.55	2.10	2:25	A2700/84	0.1	A27801/84	0.1
						0.22		0.12

Parcel 1598 (MG-9)

10.0 tonnes from No. 7 Open Cut.

Date	Time				Sample Number	Head Assay g/t	Sample Number	Tail Assay g/t
3.12.84	10.50	11.05	11.20	11.35	A2704/84	0.2	A2712/84	0.1
	11.50	1.10	1.25	1.40	05	0.3	13	0.1
	1.55	2.10	2.25	2.40	06	0.1	14	0.1
	2.55	3.20	3.35	3.50	07	0.3	15	0.4
4.12.84	8.45	9.00	9.15	9.30	08	0.2	16	0.1
	9.45	10.00	10.15	10.30	09	0.1	17	0.1
	10.45	11.00	11.15	11.30	10	2.2	18	0.1
	11.45	1.30	1.45	-	A2711/84	0.1	A2719/84	0.2
						0.44		0.15

Note

Head and Tailings were sampled every 15 minutes (crushing time) and bagged every hour i.e. Four samples per bag.

Exceptions were:

Parcel 1592 - Samples A2536/84 - A2547/84 - 45 minutes
Parcel 1594 - Samples A2660/84 - A2661/84 - 45 minutes
Parcel 1596 - Samples A2680/84 - A2681/84 - 30 minutes
Parcel 1598 - Samples A2711/84 - A2719/84 - 45 minutes

TABLE 28

Assays of Concentrate Samples from Strake Tables, Parcels 1592 - 1598

Sample Number	Parcel Number	Description	Assay g/t
A2633/84	1592	North Medora underlay	18.7
A2634/84	1593	Floor of 120 level main stope	26.3
A2632/84	1594	220 Level main shaft	7.1
A2635/84	1595	South Medora shaft	5.7
A2702/84	1596	No. 4 Open Cut	1.5
A2723/84	1596	No. 4 Open Cut	5.8
A2703/84	1597	No. 1 Open Cut	2.0
A2722/84	1597	No. 1 Open Cut	7.8
A2720/84	1598	No. 7 Open Cut - From Strake Table	3.7
A2721/84	1598	No. 7 Open Cut - Concentrates from bottom well	75.0

TABLE 29

Results of Milling and Amalgamation of Concentrates, Parcels 1592 - 1598.

Parcel	Amalgam (grams)	Comments
1592	3.88	
1593 & 1595	12.31	Conc. milled & amalgamated together.
1594	1.75	
1596	6.54	
1597	Nil	
1598	Not Weighed	Concentrates from strakes and wells milled and amalgamated separately.

Retorting and Smelting

Amalgam from parcels 1592, 1593 and 1594 were retorted first and the amalgam kept separate in foil containers. Parcels 1595, 1596 and 1597 were then retorted and finally 1598. Sponge was weighed after cooling in air but at the request of the lessee was not put in acid as is usual practice.

Slag from the smelting operations was collected and forwarded to Abignano Limited. Small prills of bullion were observed in some of the slag fragments examined under a microscope. After weighing, the buttons of bullion were all placed in acid except for the one from parcel 1598. The button from parcel 1593 (No. 1 level) bubbled furiously and was still active when finally removed from the acid. The other bullion buttons all reacted mildly in acid and ceased to bubble after a short period of time, indicating a much lower level of acid reactive residue.

Weight reductions were recorded in all bullion buttons (Table 30) particualrly parcel 1592 which dropped from 22.0 grams to 12.70 grams. Overall, total weight of bullion recovered was reduced from 155.0 grams to 123.95 grams after the acid bath. Bullion weights recorded in the Battery book at Peterborough are the original weights prior to acid treatment. Reduction of these weights effectively reduces the overall average grade from 2.49 g/t Au bullion to 2.00 g.t Au bullion.

After acid bathing and reweighing, all bullion buttons were forwarded to Abignano Limited who commissioned Warman International Ltd. to determine Au, Ag and base metal content of each button. Results are contained in Appendix W, and show an extremely high base metal content. Recalculated head grades range from a high of 0.43 g/t Au for parcel 1594 to a low of 0.15 g/t Au for parcel 1597. The average was 0.38 g/t Au.

During scraping of the battery plates most amalgam was obtained from plates 3 and 4 suggesting that much of the gold is very fine. If fine gold is the major contributor, problems may occur in recovery, e.g. fine particles riding suspended on coarser heavier material passing over the plates.

In general, gold bullion recovered from the amalgam of each parcel was about one sixth of the weight. No native copper or other native metals have been observed and the silver content is low, with a Au:Ag ratio of about 10:1.

TABLE 30

Final Bullion Weights, Parcels 1592-1598

Parcel No.	Tonnage (tonnes)	Original Bullion Weight (grams)	Final Bullion Weight (grams)	Grade (g/t)
1592	9.3	12.5	11.50	1.24
1593	5.6	22.0	12.70	2.27
1594	7.0	29.5	24.44	3.49
1595	8.4	26.0	21.55	2.57
1596	10.8	20.0	14.75	1.37
1597	11.0	25.0	19.01	1.73
1598	10.0	20.0	20.00	2.0
	62.1	155.0	123.95	2.0

Average grade of bullion = 2.00 g/tonne

During cleaning of the plates for parcel 1592 (North Medora), the mercury bowl was accidently spilt and although most was recovered, some may have been lost explaining the lower bullion weight.

Summary Comments

Results of bulk sampling by Abignano Limited are summarised in Table 31.

Documentary evidence clearly points to battery contamination as the source of elevated gold recoveries, compared with the channel sampling and bulk sample, sub-sampling programs. Bulk

TABLE 31

Summary of Results of Mount Grainger Bulk Sampling Program, Parcels 1592-1598

Parcel No.	Name & Location	Date Crushing Commenced	Date Crushing Completed	Battery Used	Tonnage (tonnes)	Amalgam (grams)	Retorted (grams)	Smelted (Bullion) (grams)*	Bullion After Acid (grams)	Tailing (g/t)	Grade (g/t)	% Au in Bullion	Comments
1592	Nth. Medora Underground No. 1 level. 60' ML. 5018	19/11/84	22/11/84	1	9.3	66.16	13.99	12.5	11.50	2.10	1.24	31.3	Mercury from top well was accidently split into the launder but most was recovered.
1593	120' level Main Shaft Mt. Grainger mine ML. 4830	20/11/84	21/11/84	2	5.6	101.09	26.44	22.0	12.70	1.20	2.27	10.4	Large amount of coarse particles in amalgam obtained from box.
1594	220' level Main Shaft Mt. Grainger mine ML. 4830	22/11/84	26/11/84	1	7.0	173.40	34.60	29.5	24.44	1.20	3.49	12.4	What appeared to be copper wire obtained from the box.
1595	Sth. Medora Underground ML. 5017	22/11/87	27/11/84	2	8.4	176.71	31.43	26.0	21.55	0.50	2.57	11.7	
1596	Open Cut No. 4 Nth. Medora ML. 5018	27/11/84	30/11/84	1	10.8	124.41	21.64	20.0	14.75	0.40	1.37	12.0	Minute amount of mercury from bottom well was inadvertently put in headings from parcel 1597.
1597	Shattered Dream No. 1 Open Cut ML. 5017	28/11/84	30/11/84	2	11.0	161.16	25.53	25.0	19.01	0.56	1.73	8.5	
1598	Open Cut No. 7 Sth. Medora ML. 5017	3/12/84	4/12/84	Both	10.0 (est)	151.63	23.33	20.0	20.0	1.36	2.00	8.7	Tonnage was estimated as weighbridge was closed.
					62.1	954.56	176.96	155.0	123.95	1.01	2.00		

*N.B. Smelted gold is only measured to the nearest half gram.
Tonnages listed are those shown on weighbridge dockets.
Average grade of bullion as recorded in the battery book is 2.49 grams/tonne.

Note: Figures for amalgam, retorted and bullion are those recorded in battery book. The bullion was treated with acid which significantly reduced the weights (see table).

samples MG.1 and MG.2 were subjected to sub-sampling assay by AMDEL and recorded approximately 0.1 g/t Au. Channel samples from the trenches from which bulk samples MG.1 and MG.2 were excavated, averaged 0.05 g/t Au and 0.2 g/t Au respectively.

Contamination of bulk parcels treated at Peterborough is evident from sampling of feed material and discharge from the battery box for parcels 1571-1572. Average grade of feed material, parcel 1571, was 0.20 g/t Au while average grade of discharge from battery box was 2.34 g/t Au and average grade of tailings was 0.15 g/t Au.

On the first day of crushing, parcel 1572 averaged 0.22 g/t Au for feed material, 1.03 g/t Au for discharge from battery box and 0.23 g/t Au for tailings. Day two of the crushing gave an average feed grade of 0.34 g/t Au and discharge from the box, a grade of 0.22 g/t Au.

Sampling of Parcels 1592-1598 showed a progressive reduction in grade of discharge from the battery box as successive parcels were treated. Head assays for parcels 1592 and 1593 averaged 2.84 g/t Au and 1.09 g/t Au respectively. Following parcels (1594 and 1595) gave average head grades of 0.61 and 0.68 g/t Au respectively. Parcels 1596 and 1597 gave average head grades of 0.31 and 0.22 g/t Au, indicating a flushing out of the battery as the ore parcels were treated.

Bulk samples from Mount Grainger have been treated at Peterborough after high grade ore from either Sullivans (Tarcoola) or Kirkeeks Treasure (Nillinghoo) prospects except for parcel 1513 which followed ore from Argosy mine (Birdwood) and yielded 0.91 g/t Au bullion and parcel 1557 which followed ore from Dustholes mine (Mount Grainger goldfield) and produced a significantly lower yield of 0.37 g/t Au bullion.

Head samples from parcel 1598 (No. 7 open cut) were resubmitted to AMDEL for check assay and results are listed in Table 32.

TABLE 32

Battery Head Samples, Original and Check Assays.

Original Number	Check Number	Original Assay g/t	Check Assay g/t
A 2704/85	A 1/85	0.2	0.2
5/84	2/85	0.3	0.3
6/84	3/85	0.1	0.4
7/84	4/85	0.3	0.4
8/84	5/85	0.2	0.2
9/84	6/85	0.1	0.2
10/84	7/85	2.2	0.2
A 2711/84	A 8/85	0.1	0.2

The only anomalous results in Table 32 relate to sample A10/84, suggesting either the presence of discrete coarse gold particles or laboratory error.

Underground Sampling

Fairburn and Nixon (1966) collected sixteen samples from No. 2 Level (220 ft), eight samples from No. 1 Level (120 ft) and nine from the Main Stope above No. 1 level. Results are listed in Table 33 and locations are shown on Figs. 30 and 31.

TABLE 33

Gold Analyses for Samples Collected Underground by Fairburn & Nixon, 1966

No. 2 Level		No. 1 Level		Main Stope	
Sample No.	Au g/t	Sample No.	Au g/t	Sample No.	Au g/t
A 1542/66	<0.3	A 1558/66	0.3	A 1566/66	0.6
43	<0.3	59	0.3	67	0.9
44	35.8	60	<0.3	68	<0.3
45	0.3	61	<0.3	69	3.4
46	<0.3	62	<0.3	70	0.3
47	0.3	63	<0.3	71	12.5
48	<0.3	64	<0.3	72	1.5
49	<0.3	A 1565/66	<0.3	73	4.9
50	<0.3			A 1574/66	6.7
51	<0.3				
52	<0.3				
53	<0.3				
54	<0.3				
55	0.3				
56	<0.3				
A 1557/66	0.3				

TABLE.34

Results of Samples Collected Below No. 2 Level

Sample No.	Description	Au (0.1)	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Ni (5)	Bi (10)	Mn (5)	V (20)	Cd (1)	Fe (5)	Hg (0.05)	S (0.01)	Se (1)
A 30/83	H.W. Vein 7 m down winze below No. 2 level.	0.1	6	5	40	5	<1	<20	20	10	1800	<20	<1	2.80	<0.05	0.01	2
A 31/83	Qtz/Ironstone stringer in Arkose below H.W. Vein - Location as above.	0.3	8	5	120	15	<1	20	20	<10	1.2%	20	<1	10.60	<0.05	0.04	<1
A 32/83	Qtz + sericitic alteration - from sub-level 20 m down winze.	20.6	6	20	220	190	1	50	190	20	530	20	<1	31.50	0.10	0.02	5
A 33/83	As above - sample split.	19.8	6	15	260	210	1	60	210	20	490	30	<1	35.20	0.20	0.03	2
A 34/83	Qtz + limonite, manganese and sericitic alt. - NE sublevel.	5.0	4	25	200	65	<1	70	55	10	690	20	<1	48.40	0.10	<0.10	<1
A 35/83	Qtz vein material + sericitic alt and minor sulphides - location as above.	1.1	2	5	22	15	<1	<20	15	<10	270	<20	<1	2.30	0.15	0.03	<1
A 36/83	Qtz, limonite, maganese, sericitic alt Similar to 34/83 - NE sublevel.	8.1	4	25	180	160	1	40	130	10	910	20	<1	34.70	0.50	0.01	2
A 37/83	As above - sample split.	9.9	4	55	160	140	1	30	100	<10	720	30	<1	37.40	0.55	0.01	<1

Note: Results in parts per millin except for Fe and S which are in %.

Detection Limit shown in brackets

AMDEL Reports AC 3845/83 and AC 4317/83

All samples from No. 1 level assayed 0.3 g/t Au or less and only one sample from No. 2 level assayed greater than 0.3 g/t Au. Sample A 1544/66 taken from the pillar adjacent to Main Shaft (Fig. 31) assayed 35.8 g/t Au indicating remnant ore.

Samples from the Main Stope ranged from a low of <0.3 g/t Au to a high of 12.5 g/t Au. Locations of these samples are shown on Fig. 30. Average grade of Main Stope samples was 3.45 g/t Au.

In January 1983 the author and W.P. Fradd (SADME), collected eight samples from below water level after the main shaft had been pumped almost dry. Results are listed in Table 34. Six of the eight samples were taken in sublevel drives about 20 m down the winze from No. 2 level (Fig. 11). A zone of intense sericitic alteration, which could either be a new ore shoot or the down plunge extension of the ore shoot developed on No. 2 level drive north (Fig. 11 and Fig. 31), was sampled.

Samples A 33/83 and A 37/87 were split from samples A 32/83 and A 36/83 respectively and the assay results correlate remarkably well. Cobalt and zinc values were anomalous and correlate with high gold values. Mercury analyses gave anomalous values (0.50 and 0.55 ppm) with gold values of 8.1 and 9.9 g/t Au respectively. High grade gold values in samples A 32/83 and A 33/83 also correlate with anomalous mercury values (0.10 and 0.20 ppm respectively).

Twenty nine samples were taken along the drive in the arkose unit on No. 2 level. Sample descriptions and results are listed in Table 35 with sample locations shown on Fig. 31. Gold values range from <0.005 g/t Au to 2.3 g/t Au, the best value being obtained from ferruginous quartz veinlets below the hanging wall vein, in the stope above No. 2 level drive north (Fig. 31). Average grade of No. 2 level samples is 0.26 g/t Au and equates with the grade of the sandstone unit from surface sampling.

Eighteen samples were collected from No. 1 level and the Main Stope, the locations being outlined on Fig. 30 and results listed in Table 36. Gold assays averaged 2.33 g/t Au because of higher values from the Main Stope, (A 617/82, A 10/84 and A 1254/82). Sample A 9/84 assayed 10.9 g/t Au and was channeled over 1.5 m in the cross-cut below No. 1 level. This indicates that the ore shoot in the Main Stope continues below No. 1 Level, but it is not considered to be the same shoot stoped on No. 2 level.

High gold values correlate with high values of cobalt, silver and nickel and anomalous bismuth, arsenic, uranium and zinc.

TABLE 35

Mount Grainger Mine - Underground Samples - No. 2 Level

Sample Number	Assay Number	Sample Interval	Au (0.1)	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Ni (5)	Cr (10)	Ba (1)	Mn (5)	Be (2)	Mo (3)	V (1)	W (50)	Bi (1)	Cd (3)	Ga (1)	Ge (1)	In (10)	Sb (30)	Sn (1)	Tl (10)	% S -	% Fe (5)
	A 613/82	-	0.9	20	4	150	60	0.2	100	100	40	400	10000	X	X	100	X	X	X	6	X	X	X	2	NA	NA	NA
	A 614/82	-	0.2	6	2	40	20	X	X	80	80	200	3000	X	X	100	X	X	X	10	X	X	X	3	NA	NA	NA
	A 615/82	-	0.1	4	3	60	40	X	X	80	80	600	10000	X	X	150	X	X	X	10	X	X	X	2	NA	NA	NA
	A 616/82	-	0.1	3	3	X	20	X	X	60	60	X	3000	X	X	80	X	X	X	10	X	X	X	1	NA	NA	NA
MGU 1	A 1242/82	1.4 m	0.2	2	5	32	55	1	20	25	X	200	1600	NA	NA	X	NA	X	1	NA	NA	NA	NA	NA	X	0.94	3.40
MGU 2	A 1243/82	0.5 m	0.1	26	10	120	230	1	140	340	20	200	1800	NA	NA	20	NA	X	1	NA	NA	NA	NA	NA	X	0.25	24.10
MGU 3	A 1244/82	0.8 m	0.2	4	X	100	110	1	20	35	10	200	1400	NA	NA	20	NA	X	1	NA	NA	NA	NA	NA	X	0.03	12.30
MGU 4	A 1245/82	1.0 m	0.1	4	15	55	100	X	X	25	10	600	1700	NA	NA	X	NA	X	X	NA	NA	NA	NA	NA	X	0.03	3.30
MGU 5	A 1246/82	1.0 m	0.2	2	15	140	60	1	40	40	10	300	1500	NA	NA	30	NA	X	1	NA	NA	NA	NA	NA	X	0.23	14.30
MGU 6	A 1247/82	0.8 m	0.5	4	X	110	40	1	20	25	10	300	420	NA	NA	X	NA	X	1	NA	NA	NA	NA	NA	X	0.07	6.30
MGU 7	A 1248/82	0.5 m	2.3	20	10	350	70	2	120	80	10	80	1500	NA	NA	30	NA	X	2	NA	NA	NA	NA	NA	X	0.04	42.50
MGU 8	A 1249/82	1.0 m	0.3	8	45	110	70	2	20	60	10	40	440	NA	NA	30	NA	10	1	NA	NA	NA	NA	NA	X	0.04	35.60
MGU 9	A 1250/82	1.0 m	0.2	8	10	130	80	X	130	50	10	6000	4.00%	NA	NA	40	NA	X	1	NA	NA	NA	NA	NA	X	0.11	9.70
MGU 14(a)	A 858/83	2.0 m	<0.1	10	35	200	35	1	40	NA	NA	NA	3900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	28.7
MGU 15(a)	A 859/83	1.0 m	0.9	8	20	120	45	1	10	NA	NA	NA	480	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	46.0
	A 2273/82	-	<0.1	5	15	430	25	X	240	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A 2274/82	-	0.2	22	10	270	140	X	80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGU 27	A 19/84	-	<0.1	7	X	58	20	X	X	40	40	800	3000	X	NA	200	NA	X	X	6	X	X	X	1	NA	NA	NA
MGU 28	A 20/84	1.5 m	<0.1	13	24	155	64	1	X	100	40	200	6000	2	NA	200	NA	X	X	10	X	X	X	8	NA	NA	NA
MGU 29	A 21/84	1.5 m	<0.1	19	X	84	195	2	60	300	40	X	3000	1	NA	200	NA	X	X	6	X	X	X	6	NA	NA	NA
MGU 30	A 22/84	0.5 m	<0.1	9	X	265	92	2	85	80	20	X	1500	X	NA	150	NA	X	X	15	X	X	X	20	NA	NA	NA
MGU 31	A 23/84	1.5 m	<0.1	8	X	62	90	1	20	80	20	400	8000	1	NA	100	NA	X	X	6	X	X	X	2	NA	NA	NA
MGU 32	A 24/84	2.0 m	0.4	10	X	135	64	1	X	150	60	X	2000	2	NA	100	NA	X	X	6	X	X	X	10	NA	NA	NA
MGU 33	A 25/84	-	0.1	31	X	70	52	X	30	100	60	800	>10000	1	NA	100	NA	X	X	6	X	X	X	10	NA	NA	NA
MGU 34	A 26/84	-	<0.1	37	8	21	6	X	20	80	40	400	3000	1	NA	150	NA	X	X	3	X	X	X	X	NA	NA	NA
MGU 35	A 27/84	-	<0.1	47	X	21	16	X	X	80	60	400	2000	1	NA	150	NA	X	X	10	X	X	X	1	NA	NA	NA
MGU 36	A 28/84	2.5 m	<0.1	41	X	24	22	1	20	80	20	8000	>10000	X	NA	100	NA	X	X	3	X	X	X	1	NA	NA	NA
MGU 37	A 2967/85	0.1 m	<0.005	265	X	94	10	X	84	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGU 38	A 2968/85	0.3 m	0.055	20	X	72	62	X	72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes

Detection Limits shown in brackets.
NA = Not Analysed.
X = Not detected at the limits quoted.
Samples A 613/82 - A 616/82 AMDEL Report AC 373/83
Samples A 1242/82 - A 1250/82 AMDEL Report AC 1346/83
Samples A 858/83 - A 859/83 AMDEL Report AC 4466/83
Samples A 2273/82 - A 2274/82 AMDEL Report AC 2315/83
Samples A 19/84 - A 28/84 AMDEL Report AC 3838/84
Samples A 2967/85 - A 2968/85 AMDEL Report AC 2449/86
Results in ppm unless otherwise stated.

U (4)	Th (4)	Hg (3)	Ti (100)	Y (10)	Sc (3)	Sr (50)	Comments
NA	NA	NA	NA	NA	NA	NA	
NA	NA	NA	NA	NA	NA	NA	
NA	NA	NA	NA	NA	NA	NA	
NA	NA	NA	NA	NA	NA	NA	
NA	NA	NA	NA	NA	NA	NA	ferruginous quartz breccia? at North end of drive - sample across back.
NA	NA	NA	NA	NA	NA	NA	ferruginous quartz vein and kaolinised zone - wall sample.
NA	NA	NA	NA	NA	NA	NA	ferruginous quartz vein with sericitic alteration.
NA	NA	NA	NA	NA	NA	NA	Arkose with ferruginous quartz veining - sericitic alteration.
NA	NA	NA	NA	NA	NA	NA	ferruginous quartz veining in arkose.
NA	NA	NA	NA	NA	NA	NA	ferruginous H.W. quartz vein.
NA	NA	NA	NA	NA	NA	NA	ferruginous and manganese quartz vein in F.W. of H.W. vein - in stope.
NA	NA	NA	NA	NA	NA	NA	ferruginous quartz veining in arkose - black manganiferous.
NA	NA	NA	NA	NA	NA	NA	ferruginous quartz veining with sericitic alteration near FW contact.
NA	NA	NA	NA	NA	NA	NA	ferruginous and sericitic alteration - back of old stope.
NA	NA	NA	NA	NA	NA	NA	Manganiferous ironstone - sericitic alteration - top of old stope.
NA	NA	NA	NA	NA	NA	NA	Alteration in Stope above DDH 2.
NA	NA	NA	NA	NA	NA	NA	Intersection of H.W. vein and X cutting leaders.
4	X	X	2000	10	20	50	ferruginous quartz veins in arkose - north drive - wall sample.
6	X	X	2000	30	15	X	ferruginous quartz veinlets in quartzite - pinkish brown colour.
4	6	X	2500	20	25	X	ferruginous quartz veinlets in arkose/sandstone.
14	4	X	1000	10	10	X	ironstone quartz and sericitic alteration.
6	X	X	1500	10	10	50	ferruginous quartz veins and ironstone.
4	12	X	4000	30	6	X	ferruginous quartz veins in arkose.
4	6	X	3000	20	15	X	ferruginous quartz veinlets in arkose - south end main chamber.
X	8	X	2500	20	10	50	Quartz vein in Tillite - north end of X cut in hanging wall.
4	16	X	3000	10	10	X	Boulder Tillite - chips across face of X cut north.
6	X	X	1500	30	20	150	ferruginous shear in Tillite - 29 m along X cut north.
NA	NA	NA	NA	NA	NA	NA	ferruginous (pyritic) vein 4 cm wide in spotted shale - X cut north.
NA	NA	NA	NA	NA	NA	NA	ferruginous H.W. quartz vein next to main shaft.

TABLE 36

Mt. Grainger Mine - Underground Samples

Sample Number	Assay Number	Sample Interval	Au (0.1)	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Ni (5)	Cr (10)	Ba (1)	Mn (5)
	A 617/82		6.6	15	4	X	300	0.6	X	1000	80	X	1500
MGU 10	A 1251/82	0.1 m	0.2	10	5	110	75	1	20	55	10	300	6500
MGU 11	A 1252/82	0.1 m	0.2	16	15	180	80	2	20	80	10	600	2.20%
MGU 12	A 1253/82	1.0 m	4.9	70	15	140	840	3	90	440	20	300	7500
MGU 13	A 1254/82	0.15 m	4.0	210	15	100	890	3	240	710	10	100	1.50%
MGU 14	A 6/84	0.5 m	0.4	20	10	76	44	X	25	100	80	200	8000
MGU 15	A 7/84	2.5 m	0.2	8	26	48	8	X	20	60	80	200	2000
MGU 16	A 8/84	1.0 m	X	8	18	54	12	1	20	60	80	X	2000
MGU 17	A 9/84	1.5 m	10.9	22	14	155	155	2	40	200	60	X	1000
MGU 18	A 10/84	1.0 m	13.2	28	8	35	365	4	50	300	40	X	150
MGU 19	A 11/84	1.0 m	0.6	28	8	39	54	2	X	150	80	400	1.00%
MGM 20	A 12/84	1.0 m	X	14	6	66	22	X	X	100	60	200	3000
MGM 21	A 13/84	1.5 m	X	12	10	72	32	1	20	60	40	X	2000
MGM 22	A 14/84	1.5 m	0.2	11	X	120	8	X	20	60	60	400	8000
MGM 23	A 15/84	2.0 m	X	5	X	105	8	X	X	100	40	X	4000
MGM 24	A 16/84	1.5 m	0.1	22	6	125	24	1	X	80	40	600	6000
MGM 25	A 17/84	1.0 m	0.1	80	6	140	190	1	50	200	40	800	>10000
MGM 26	A 18/84	0.5 m	X	295	X	160	290	1	70	300	60	600	>10000
	A 5919/82		2.6										
	A 5920/82		1.3										
	A 5921/82		X										
	A 5922/82		1.5										
	A 5923/82		5.3										
	A 5924/82		X										
	A 5925/82		X										
	A 5926/82		X										
	A 5927/82		0.25										

Assay Number	Be (1)	Mo (3)	V (1)	W (50)	Cd (1)	Bi (10)	Fe (5)	Hg (3)	% S -	Tl (10)	U (4)	Th (4)	Y (10)
A 617/82	1	3	200	X	X	NA	NA	NA	NA	NA	NA	NA	NA
A 1251/82	NA	NA	30	NA	1	X	12.5%	NA	0.19	X	NA	NA	NA
A 1252/82	NA	NA	30	NA	2	10	22.3%	NA	0.29	X	NA	NA	NA
A 1253/82	NA	NA	20	NA	2	10	28.6%	NA	0.13	X	NA	NA	NA
A 1254/82	NA	NA	30	NA	1	40	30.2%	NA	0.10	X	NA	NA	NA
A 6/84	2	NA	150	NA	X	X	NA	X	NA	NA	8	14	20
A 7/84	1	NA	100	NA	X	X	NA	X	NA	NA	4	4	30
A 8/84	1	NA	150	NA	X	X	NA	X	NA	NA	X	X	20
A 9/84	1	NA	150	NA	X	40	NA	X	NA	NA	4	8	30
A 10/84	X	NA	80	NA	X	15	NA	X	NA	NA	16	6	10
A 11/84	X	NA	150	NA	X	10	NA	X	NA	NA	4	6	40
A 12/84	1	NA	150	NA	X	X	NA	X	NA	NA	4	X	60
A 13/84	X	NA	60	NA	X	X	NA	X	NA	NA	4	X	10
A 14/84	X	NA	150	NA	X	X	NA	X	NA	NA	4	X	40
A 15/84	X	NA	100	NA	X	X	NA	X	NA	NA	6	X	20
A 16/84	1	NA	100	NA	X	X	NA	X	NA	NA	10	4	30
A 17/84	1	NA	150	NA	X	X	NA	X	NA	NA	6	4	40
A 18/84	1	NA	300	NA	X	X	NA	X	NA	NA	8	14	40

Detection Limits shown in brackets.
NA = Not analysed.
X = Not detected at the limits quoted.
Results in ppm unless otherwise stated.

Sample A 617/82 AMDEL Report AC 373/83
Sample A 1251/82 - A 1254/82 AMDEL Report AC 1346/83
Sample A 6/84 - A 18/84 AMDEL Report AC 3008/84 and AC 3838/84

No. 1 Level and Main Stope

Sc (3)	Sr (50)	Ge (1)	Ti (100)	Sb (30)	Sn (1)	In (10)	Ga (1)	Comments
NA	NA	NA	NA	NA	NA	NA	NA	
NA	NA	NA	NA	NA	NA	NA	NA	Ferruginous and kaolinitic vein in tillite.
NA	NA	NA	NA	NA	NA	NA	NA	Ferruginous quartz vein in arkosic tillite.
NA	NA	NA	NA	NA	NA	NA	NA	Alteration - sericitic quartz in stope - N end of level.
NA	NA	NA	NA	NA	NA	NA	NA	H/W quartz vein - ferruginous ironstone.
10	X	X	4000	X	50	X	20	Alteration and ferruginous quartz - X cut below No. 1 level.
10	X	X	3000	X	4	X	10	Quartzite - pinkish brown material - narrow quartz veinlets + alteration.
6	X	X	2000	X	X	X	6	Ferruginous quartz veinlets in quartzite.
6	X	X	2000	X	8	X	6	As above.
6	X	X	1500	X	15	X	10	Sandy grit sandstone with heavy mineral (magnetite).
6	X	X	3000	X	8	X	8	Quartz veining and alteration - quartzite/pebble tillite.
25	X	X	2000	X	1	X	8	Pinkish pebble tillite/quartzite with Fe quartz veins.
15	X	X	1000	X	1	X	6	Quartz veining, ferruginous, in pebble tillite.
30	50	X	3000	X	2	X	8	Stockwork of ferruginous quartz veinlets in pebble tillite.
25	50	X	2000	X	X	X	6	Stockwork of ferruginous quartz veinlets.
25	X	X	1000	X	4	X	10	E dipping ferruginous quartz veinlets in arkose.
20	50	X	2500	X	1	X	10	Ferruginous quartz vein, Possible H.W. vein.
25	50	X	6000	X	X	X	10	Quartz veinlets parallel to bedding in laminated shale.

TABLE 37

North Medora Mine Underground Samples - Assay Results

Assay No.	Sample width (m)	Au g/t (0.1)	Ag ppm (1)	Cu ppm (2)	Pb ppm (5)	Zn ppm (2)	Co ppm (5)	Ni ppm (5)	Cr ppm (10)	As ppm (20)	Fe % (5)	Cd ppm (1)	Bi ppm (10)	V ppm (20)	Mn % (5)	S % (0.01)	Tl ppm (10)	Ba ppm (1)
A 1231/82	0.98	2.4	1	110	5	170	280	200	110	90	11.8	1	10	20	0.07	0.46	X	800
A 1232/82	0.90	2.7	1	120	X	120	160	320	10	20	3.1	X	X	20	1.80	0.20	X	600
A 1233/82	1.45	12.3	1	16	5	44	50	35	10	30	5.9	1	X	20	0.07	0.55	X	300
A 1234/82	0.80	2.4	1	150	5	170	260	380	20	40	21.6	1	10	30	2.60	0.26	X	300
A 1235/82	1.70	0.6	X	210	X	140	570	180	X	20	1.9	X	X	X	3.60	0.10	X	1500
A 1236/82	1.40	35.1	3	970	170	340	910	730	40	180	37.5	2	90	60	6.10	0.10	X	400
A 1237/82	0.40	1.2	1	65	5	32	110	50	10	70	8.2	1	X	20	0.88	0.26	X	400
A 1238/82	0.45	0.4	X	26	5	24	150	55	20	20	6.4	1	X	20	0.29	0.15	X	200
A 1239/82	1.80	2.6	1	34	X	34	65	25	10	X	5.0	X	X	20	1.30	0.64	X	400
A 1240/82	1.30	0.2	1	50	X	20	55	20	X	X	2.2	1	X	X	1.00	0.23	X	1000
A 1241/82	1.40	0.8	1	20	5	18	35	15	10	X	2.3	X	X	20	0.06	0.09	X	1500
HIGH		35.10	3	970	170	340	910	730	110	180	37.2	2	90	60	6.10	0.64	X	1500
LOW		0.20	X	16	X	18	35	15	X	X	1.9	X	X	X	0.06	0.09	X	200
AVERAGE		5.52	1	161	19	101	240	182	23	46	9.6	1	14	23	1.62	0.28	X	827

Gold By - Fire Assay Code K4/1
Barium - Emission Spectroscopy - Code A.8.
Other Elements - Atomic Absorption Spectroscopy.
X = Not Detected at Limit Quoted.
Detection Limits shown in brackets.
AMDEL Report AC 1346/83

Eleven samples were collected from North Medora underground workings (Fig. 12). Assay results are listed in Table 37. Highest gold value was 35.10 g/t Au (A 1236/82) consisting of ferruginous quartz veins over 1.4 m width in the back of the underlay shaft below No. 1 level. Lowest value was 0.2 g/t Au over 1.3 m width and occurred in a breccia fault zone in No. 1 level drive south (Fig. 12). Average grade of samples from North Medora underground workings was 5.52 g/t Au. Copper, lead, zinc, cobalt, arsenic and bismuth values are anomalous and correlate with high gold values. Silver values are low, except for sample A 1236/82 which contained 3.0 g/t Ag.

Three samples were collected from South Medora underground workings and assay results are listed in Table 38. Detailed sampling underground was not undertaken because of previous sampling by Gold Copper Exploration and difficult access. Figure 33 shows the location of Gold Copper and SADME samples. Results of Gold Copper Samples are listed in Table 39.

TABLE 38

South Medora Underground Samples Assay Results

		Au	Cu	Pb	Zn	Co	Ag	As	
SM1	A 1514/82	0.7	100	5	70	260	<1	30	Flat lying quartz vein along fault.
SM2	A 1515/82	0.1	80	<5	44	220	1	30	Channel across arkose for 4 metres from the H.W.V.
SM3	A 1516/82	19.2	260	10	65	510	2	20	Thin vertical cross-cutting quartz veins in arkose.
Detection Limit		(0.1)	(2)	(5)	(2)	(5)	(1)	(20)	

Notes

Results in ppm
Gold by Fire Assay
Other Elements - Atomic Absorption Spectroscopy
AMDEL Report AC 1505/83

TABLE 39

Assay Results of Gold Copper Samples South Medora Underground

Sample No.	Au g/t
88086	1.22
88087	1.22
88088	<0.30
88089	<0.30
88090	<0.30
88091	<0.30
88092	<0.30
88093	2.75
88094	<0.30
88095	1.56
88096	<0.30

Twelve samples were collected from narrow ferruginous quartz veins in Burra Group shales from Jones Shaft workings (Fig. 32). Assay results and sample descriptions are listed in Table 40. Highest gold value was 30.0 g/t over 1.0 m width. Anomalous Zinc, Cobalt, Arsenic and Silver correlate with this sample (A 2201/82). Higher gold values generally have anomalous Zn, Co and As values. Average grade of the veins which are all less than 0.3 m wide was 3.43 g/t Au, but they are not considered to be economically workable.

TABLE 40

Mount Grainger - Jones Shaft, Underground Sample - Assay Results

Assay No.	Plan Location No.	Sample Width (m)	Au gm/t	Cu ppm	Pb ppm	Zn ppm	Ag ppm	As ppm	Co ppm	Comment
A 2194/82	1	0.1	1.0	8	15	190	1	180	290	Ferruginous quartz vein.
A 2195/82	2	1.5	3.9	8	5	120	<1	190	520	Ferruginous quartz vein + alteration.
A 2196/82	3	0.3	0.2	20	5	170	<1	60	95	Quartz stringer - ferruginous.
A 2197/82	4	0.1	4.0	8	20	65	<1	30	230	Quartz stringer - ferruginous.
A 2198/82	5	0.1	0.8	4	10	14	<1	20	20	Ferruginous quartz pod.
A 2199/82	6	0.1	0.2	20	5	38	<1	40	50	Flat lying ferruginous quartz stringer.
A 2200/82	7	0.1	1.4	10	10	70	<1	80	360	Ferruginous quartz vein dips @ 60° to S.
A 2201/82	8	0.1	30.0	6	10	110	2	200	960	Ferruginous quartz vein.
A 2202/82	9	0.1	0.1	18	10	34	<1	20	30	Ferruginous quartz vein.
A 2203/82	10	0.2	0.2	70	5	46	<1	30	55	Ferruginous quartz vein dip 35° S.
A 2204/82	11	0.3	0.2	8	5	60	<1	70	130	Ferruginous quartz vein.
A 2205/82	12	0.3	<0.1	20	10	26	<1	20	30	Ferruginous quartz vein.
	HIGH		30.0	70	20	190	2	200	960	
	LOW		<0.1	4	5	14	<1	20	20	
	AVERAGE		3.43	16.7	8.5	78.5	<1	78.3	230	
Detection Limit			(0.1)	(2)	(5)	(2)	(1)	(20)	(5)	

Gold By Fire Assay
Other Elements - Atomic Absorption Spectroscopy.
AMDEL Report AC 2315/83.

Surface Sampling

Fairburn and Nixon (1966) collected fifty six samples from surface workings and outcrops, fourteen of which assayed above 0.30 g/t Au with two above 1.0 g/t Au. Sample A 2800/65 at the entrance to Main Underlay shaft assayed 1.22 g/t Au and a channel sample (A 2806/65) on the north wall of the cut, around the Main Underlay shaft, assayed 2.45 g/t Au.

During excavation of open cuts and bulk sampling by the current lessee samples of quartz veining and ferruginous, pyritic and altered arkose/sandstone were submitted for geochemical analysis. Samples of surface outcrops were also collected for both petrographic and geochemical analyses. Table 41 tabulates assay data and descriptions of all surface samples including those collected from around the Mount Grainger anticline. One hundred and sixty two rock chip and channel samples were collected from outcrop, open cuts and dumps. Eighty three channel samples were cut from the walls of backhoe trenches. Sixteen 10 kg bulk samples were crushed and split and each of four sub-samples (total 64) were assayed. One of each of the sub-samples was sieved andsize fractions analysed for gold (Table 15.) In addition, one hundred and ninety one samples representing head, tails and various trough samples were collected from parcels 1571 and 1572 treated at Peterborough. A further one hundred and forty samples of head, tails and strake concentrates were also collected from parcels 1592 to 1598 treated at Peterborough.

No. 1 Open Cut (Fig. 6)

Seven samples and a 10 kg bulk sample were collected (Table 42). Two samples of tailings from bulk samples at Peterbrough are reported as well as sample splits from the 10 kg bulk sample. Average grade of all samples, excluding battery tailings and panned conentrates was 0.43 g/t Au.

TABLE 41

Assay Results of Surface Samples - Mount Grainger & Medora Mine Area and Environs

Assay Number	Au (0.1)	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Sample Interval (m)	Comments
A 1200/82	0.2	180	5	48	80	X	150	-	Ironstone from Trench 10, N. Medora (Fig. 7).
A 1201/82	0.2	140	5	30	95	X	60	1.0	Quartz veins in Arkose Trench 10, N. Medora (Fig. 7).
A 1222/82	0.2	24	5	38	130	X	X	0.1	H.W. vein? ferruginous quartz No. 3 open cut.
A 1223/82	0.1	10	55	18	15	X	X	2.0	Silicified arkose quartz veins No. 3 open cut.
A 1224/83	0.2	70	5	42	360	X	X	2.0	Silicified arkose quartz veins No. 3 open cut.
A 1225/82	0.1	30	5	60	30	X	100	-	Minor quartz veins in limonitic tillite - Trench 16 (Fig. 8).
A 1226/82	0.1	30	5	55	20	X	60	0.5	Limonitic spotted? shale - Trench 16.
A 1227/82	0.2	12	5	18	15	X	X	2.7	Arkose with quartz veins - Trench 16.
A 1228/82	0.7	6	5	18	60	X	60	Chips	Silicified arkose, micaceous hematite & limonite Trench 16.
A 1229/82	0.2	2	5	20	40	X	X	2.0	Arkose silicified Trench 16.
A 1230/82	1.3	16	5	34	210	X	X	Chips	Quartz breccia with hematite and limonite boxwork - Golden Junction.
A 2206/82	0.6	85	5	60	340	X	30	Grab	Quartz ironstone dump material underlay pit 15 m S of South Medora.
A 2207/82	0.4	55	10	34	120	X	20	Grab	Arkose - Dump material - southside South Medora.
A 2208/82	0.1	32	10	18	75	X	30	Grab	Arkose - Dump material - northside South Medora.
A 2209/82	0.1	30	10	30	60	X	30	Grab	Screened Dump material (fines) South Medora.
A 2210/82	0.1	28	10	28	55	X	20	Grab	Fines washed from screened stockpile - South Medora.
A 2224/82	2.8	140	10	95	640	3	580	Handpicked	Fe/Mn stained Quartz from dump around Main Underlay Shaft.
A 2225/82	0.8	60	10	42	150	X	30	Grab	Arkose with alteration and iron oxides - dump around Main Underlay Shaft.
A 2226/82	1.2	85	10	55	200	X	30	Grab	As Above.
A 2227/82	0.2	18	5	14	25	X	20	Grab	Arkose from dump at entrance to Magazine Underlay.
A 2228/82	1.4	48	10	65	80	3	30	Grab	Dump material north side of Old Main Shaft.
A 840/83	<0.1	380	10	300	720	X	20	Chips	Quartz vein abundant limonitic - Face of No. 2 open cut - Dips 20° to E.
A 841/83	<0.1	330	10	250	670	X	30	Channel	Vertical Quartz ironstone stringer 2 cm S.W. corner No. 2 Open Cut.
A 842/83	0.2	280	15	180	900	X	30	Chips	Limonitic quartz vein No. 1 Open Cut.
A 843/83	0.1	36	10	28	90	X	50	Chips	Limonitic quartz vein with sericite No. 1 Open cut.
A 844/83	1.5	42	15	75	40	X	80	0.5	Pinkish Sandstone quartz ironstone veinlets H.W. of Arkose No. 2 open cut.
A 845/83	0.6	200	10	200	410	X	70	0.5	As Above.
A 846/83	0.2	170	5	190	95	X	20	Grab	Ore for parcel 1541 Quartz ironstone No. 1 open cut.
A 847/83	0.1	100	5	100	85	X	20	Grab	As Above.
A 848/83	1.5	350	15	420	410	X	50	Grab	Fe/Mn and quartz Parcel 1546 No. 2 open cut.
A 849/83	<0.1	650	15	790	480	X	40	Grab	As above - more quartz material.

on Limits in Brackets
detected at limits quoted.

Sample Number	Assay Number	Au	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ni (5)	Cr (10)	Ag (1)	As (20)	% S	Ba (1)	V (20)	Bi (1)	% Mn (5)	% Fe (5)	Tl (10)	Cd (1)	Mo (1)	U (4)	Th (4)	Be (1)	Sc (3)	Sr (50)
MGS 20	A 1145/85	1.5	350	10	210	670	470	50	1	80	0.06	1500	20	10	4.60	16.4	20	X	NA	NA	NA	NA	NA	NA
MGS 21	A 1146/83	1.0	55	X	85	120	65	30	1	80	0.21	600	X	10	0.35	14.10	10	X	NA	NA	NA	NA	NA	NA
MGS 22	A 1147/83	X	90	5	50	270	25	X	X	20	0.01	>10000	20	X	16.70	6.1	70	1	NA	NA	NA	NA	NA	NA
MGS 23	A 1148/83	X	26	5	80	65	25	10	X	50	0.01	1000	X	10	3.10	11.6	20	X	NA	NA	NA	NA	NA	NA
MGS 24	A 1149/83	X	50	5	50	60	75	X	X	20	0.01	600	X	X	0.74	2.8	20	X	NA	NA	NA	NA	NA	NA
MGS 25	A 1206/83	0.7	65	5	30	75	NA	NA			70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 26	A 1207/83	1.1	100	5	30	90	NA	NA	2	110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 27	A 1208/83	1.6	85	5	28	90	NA	NA	1	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 28	A 1209/83	0.3	60	X	30	270	NA	NA	X	30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 29	A 984/84	0.34	10	X	12	6	16	10	X	X	NA	X	150	X	0.01	2.30	X	X	1	12	14	X	10	X
MGS 30	A 985/84	0.03	12	X	6	6	10	10	X	X	NA	X	10	X	0.07	0.87	X	X	X	8	X	X	X	X
MGS 31	A 986/84	0.42	24	X	50	6	10	20	X	X	NA	X	20	X	0.03	7.40	X	X	1	12	X	X	3	X
MGS 32	A 987/84	0.22	15	X	14	16	20	20	X	X	NA	200	40	X	0.03	3.80	X	X	1	10	4	1	6	X
MGS 33	A 988/84	0.03	6	10	6	6	16	10	X	X	NA	X	40	X	0.13	3.20	X	X	1	4	6	X	3	50
MGS 34	A 989/84	0.01	100	X	12	16	20	10	X	X	NA	600	100	X	0.10	3.20	X	X	2	X	76	2	10	100
MGS 35	A 1611/83	X	125	15	8	20	NA	NA	X	X	NA	NA	NA	NA	NA	NA	15	NA	NA	NA	NA	NA	NA	NA
MGS 36	A 990/84	0.41	6	X	4	X	6	10	X	X	NA	X	60	X	0.01	1.90	X	X	1	X	X	X	X	X
MGS 37	A 991/84	0.97	60	X	18	30	30	10	X	X	NA	1500	200	X	0.14	1.90	X	X	X	6	18	3	30	X
MGS 38	A 992/84	0.07	8	X	2	6	10	10	X	X	NA	X	30	X	0.01	1.10	X	X	1	6	X	X	X	X
MGS 39	A 993/84	0.07	18	X	12	40	20	10	X	X	NA	400	100	X	0.12	1.70	X	X	2	6	6	1	6	X
MGS 40	A 994/84	0.01	120	X	8	6	16	10	X	X	NA	800	100	X	0.02	1.80	X	X	X	10	24	2	15	X
MGS 41	A 995/84	0.02	760	X	1000	4700	2000	60	X	40	NA	4000	40	X	21.80	28.60	X	X	3	18	X	2	15	100
MGS 42	A 996/84	0.04	970	X	970	6200	1500	40	X	X	NA	8000	40	1	27.30	13.90	X	X	3	18	X	1	10	50
MGS 42(a)	A 1612/83	0.3	1400	35	1450	7400	NA	NA	3	50	NA	NA	NA	NA	NA	NA	65	NA	NA	NA	NA	NA	NA	NA
MGS 43	A 997/84	0.01	36	X	36	46	30	10	X	X	NA	600	80	X	0.26	3.30	X	X	1	6	8	1	10	X
MGS 44	A 998/84	0.01	32	X	16	10	10	10	X	X	NA	800	200	X	0.04	3.30	X	X	X	6	20	2	25	X
MGS 45	A 4609/83	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 46	A 4610/83	1.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 47	A 4611/83	0.34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 48	A 4612/83	1.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 49	A 4613/83	0.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES

Detection Limit in Brackets
X = Not detected at limit quoted
NA = Not analysed

Ti (10)	Ga (1)	Ge (1)	Zr (10)	Y (1)	Sn (1)	In (10)	Te (20)	Sample Interval (m)	Comments
NA	NA	NA	NA	NA	NA	NA	NA	0.1	Quartz vein Fe/Mn in face Open Cut No. 2.
NA	NA	NA	NA	NA	NA	NA	NA	0.1	As above but vein below - plus pyrite.
NA	NA	NA	NA	NA	NA	NA	NA	Chips	Arkose - Track east from Wegunna HS.
NA	NA	NA	NA	NA	NA	NA	NA	Chips	As Above - 50 m N of last sample
NA	NA	NA	NA	NA	NA	NA	NA	Chips	Quartz veining mica alteration Trench 3 (Fig. 7).
NA		NA	NA	NA	NA	NA	NA	Chips	Quartz and limonite - visible pyrite No. 3 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	Chips	As Above.
NA	NA	NA	NA	NA	NA	NA	NA	2.0	Arkose with ferruginous quartz veins - face No. 3 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	2.0	As Above.
4000	10	X	300	30	1	X	X	Rock	Pinkish sandstone quartz veinlets No. 2 Open Cut (RS 41).
400	1	X	60	X	X	X	X	Rock	White quartz feldspar sandstone 0.6 m above MGS 29 (RS 42).
800	X	X	150	X	3	X	X	Rock	Quartz ironstone - limonitic boxwork face No. 2 Open Cut (RS 43).
2000	3	X	100	X	X	X	X	Rock	Quartzite, mica alteration - S. wall No. 3 Open Cut (RS 44).
1000	1	X	80	10	1	X	X	Rock	Quartzite, S. Medora (Fig. 6) Boulder Tillite (RS 45).
3000	10	X	300	60	X	X	X	Rock	Granodiorite boulder in Tillite (Fig. 6) (RS 46).
NA	NA	NA	NA	NA	NA	NA	NA	Rock	Granitic boulder in Tillite (Fig. 6) (RS 47).
2000	6	X	100	X	3	X	X	Rock	Greenish sericitic quartzite (Fig. 6) (RS 48).
10000	15	X	250	50	1	X	X	Rock	Spotted shale in H.W. Tillite (Fig. 6) (RS 49).
1500	10	X	40	X	1	X	X	Rock	Altered Sandstone in No. 1 Open Cut - sericitic (RS 50).
4000	10	X	100	20	6	X	X	Rock	Arkose - sericitic alteration No. 3 Open Cut (RS 51).
3000	3	X	100	30	X	X	X	Rock	Spotted Shale - North Medora area (Fig. 7) (RS 52).
200	X	X	80	40	X	X	X	Rock	Quartz, Mn/Fe pyrite - South Wall No. 3 Open Cut (RS 53).
300	X	X	40	30	X	X	X	Rock	As above - gossan - South Wall No. 3 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	Rock	Pebble Tillite, collar at Old Main Shaft (RS 54).
6000	15	X	150	40	1	X	X	Rock	Spotted Shale - Collar at Old Main Shaft (RS 55).
6000	10	X	100	20	1	X	X	Rock	Quartz gossan Mn/Fe and pyrite - S. Wall No. 3 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	0.1	Clayey Ironstone vein 5 cm wide - cuts across arkose - No. 6 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	2.0	Quartz and ironstone North wall - 1.0 m from face - No. 6 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	0.3	Quartz ironstone vein dips 45° to E-N Wall No. 6 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	2.5	Quartz veining ferruginous - sandstone - North Wall No. 6 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	0.6	F.W. contact - clayey with quartz veinlets - No. 6 Open Cut.

NOTES

Detection Limit in Brackets.
X = Not detected in Limit quoted.
NA - Not analysed.

Sample Number	Assay Number	Au	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ni (5)	Cr (10)	Ag (1)	As (20)	Ba (1)	V (10)	Bi (1)	Mn (10)	Cd (1)	Mo (1)	U (4)	Th (4)	Be (1)	Sc (3)	Sr (50)	Ti (100)	Ga (1)	Ge (1)
MGS 50	A 4614/83	0.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 51	A 4615/83	1.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 52	A 4616/83	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 53	A 4617/83	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 54	A 4618/83	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A 4619/83	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A 4620/83	0.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 55	A 4867/83	0.16	110	28	45	12	NA	NA	3	230	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 56	A 4868/83	0.05	10	22	7	<5	10	20	<1	<20	NA	NA	NA	170	X	1	4	14	NA	NA	NA	NA	NA	NA
MGS 57	A 4869/83	0.03	9	18	5	<5	5	20	<1	<20	NA	NA	NA	190	X	3	4	X	NA	NA	NA	NA	NA	NA
MGS 58	A 4870/83	<0.01	2	6	12	<5	70	50	1	<20	NA	NA	NA	380	X	1	X	4	NA	NA	NA	NA	NA	NA
MGS 59	A 4871/83	<0.01	4	8	49	20	26	80	1	<20	NA	NA	NA	840	X	X	6	4	NA	NA	NA	NA	NA	NA
MGS 60	A 4872/83	0.04	465	6	125	60	NA	NA	4	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 61	A 4873/83	<0.01	6	<5	5	<5	<5	10	<1	<20	NA	NA	NA	60	X	X	6	6	NA	NA	NA	NA	NA	NA
MGS 62	A 4874/83	0.06	33	8	20	6	16	10	<1	<20	NA	NA	NA	190	X	2	4	12	NA	NA	NA	NA	NA	NA
MGS 63	A 4875/83	<0.01	145	<5	540	110	NA	NA	3	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 64	A 4876/83	<0.01	145	8	1060	48	90	20	3	20	NA	NA	NA	1300	X	2	6	4	NA	NA	NA	NA	NA	NA
MGS 65	A 4877/83	<0.01	155	14	29	<5	16	20	2	20	NA	NA	NA	120	X	4	X	X	NA	NA	NA	NA	NA	NA
MGS 66	A 4878/83	<0.01	6	6	4	<5	6	20	<1	<20	NA	NA	NA	180	X	1	4	X	NA	NA	NA	NA	NA	NA
MGS 67	A 4879/83	<0.01	2	<5	6	<5	NA	NA	<1	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 68	A 4880/83	<0.01	115	24	14	10	NA	NA	<1	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 69	A 4881/83	<0.01	22	<5	27	310	NA	NA	<1	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 70	A 4882/83	28.00	4	<5	16	62	NA	NA	<1	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 71	A 4883/83	0.09	44	6	22	96	NA	NA	<1	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 72	A 4884/83	0.05	235	6	84	490	NA	NA	1	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 73	A 4885/83	0.50	295	12	195	580	NA	NA	4	30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 74	A 4886/83	<0.01	76	<5	16	20	NA	NA	<1	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGS 75	A 29/84	<0.1	62	6	100	180	200	20	2	50	1000	200	1	>10000	X	NA	6	X	X	15	1000	100	3	X
MGS 76	A 30/84	<0.1	20	<5	17	6	80	20	<1	20	200	150	X	3000	X	NA	X	X	X	6	X	1000	6	X
MGS 77	A 31/84	<0.1	22	<5	20	<5	100	20	<1	<20	<200	1200	X	6000	X	NA	4	4	X	X	X	1000	10	X
MGS 78	A 32/84	1.7	16	<5	22	8	100	20	<1	<20	<200	100	X	400	X	NA	X	X	1	3	X	1000	8	X

NOTE

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Y (10)	Sn (1)	In (10)	Hg (3)	Sb (30)	Sample Interval (m)	Comments
NA	NA	NA	NA	NA	3.0	Arkose Sandstone with buck veins - South Wall 2 m from face No. 6 Open Cut.
NA	NA	NA	NA	NA	2.0	Arkose and quartz veinlets - Fe/Mn oxides - North Wall H.W. ctct - No. 2 Open Cut.
NA	NA	NA	NA	NA	1.0	Quartz veinlets in arkose Fe/Mn oxides - South Wall 1 m from face - No. 2 Open Cut.
NA	NA	NA	NA	NA	0.1	Vertical fault - Iron oxides - strikes 304° - Face No. 7 Open Cut.
NA	NA	NA	NA	NA	1.0	Silicified Arkose - 2 m from FW contact - South Wall No. 7 Open Cut.
NA	NA	NA	NA	NA	Grab	Ore Stockpile - No. 7 Open Cut.
NA	NA	NA	NA	NA	Grab	Ore Stockpile - No. 7 Open Cut.
NA	NA	NA	NA	NA	Rock	Quartz ironstone - quartzite south of Cooks Blow.
NA	NA	NA	NA	NA	Rock	White fine grained siltstone with yellow spots - South of Cooks Blow.
NA	NA	NA	NA	NA	Rock	Quartzite - Greenish grey - south of Cooks Blow.
NA	NA	NA	NA	NA	Rock	Diorite (Intrusive) green brown with biotite.
NA	NA	NA	NA	NA	Rock	Andesite - Whitish grey with biotite.
NA	NA	NA	NA	NA	Rock	Ironstone in Tillite near Wegunna H.S. Wegunna H.S.
NA	NA	NA	NA	NA	Rock	Arkose in Tillite with minor quartz veins - near Wegunna.
NA	NA	NA	NA	NA	Rock	Tillite with quartz clasts - Cavities - East of Wegunna H.S.
NA	NA	NA	NA	NA	Rock	Ironstone - from face of southern flux quarry.
NA	NA	NA	NA	NA	Rock	Siliceous ironstone gossan? Hill above flux quarry.
NA	NA	NA	NA	NA	Rock	Quartz ironstone - in Flux Quarry.
NA	NA	NA	NA	NA	Rock	Quartzite - S.W. of Flux Quarry.
NA	NA	NA	NA	NA	Rock	Pinkish quartz veins in creek along track East from Wegunna.
NA	NA	NA	NA	NA	Rock	Quartz veins in Ferruginous brecciated shales - East of Wegunna.
NA	NA	NA	NA	NA	1.4	H.W. shale arkose contact - north wall Orroroo Treasure Underlay
NA	NA	NA	NA	NA	Grab	From dump material adjacent to Orroroo Treasure Underlay.
NA	NA	NA	NA	NA	0.3	Arkose quartz veins - Underlay South of main South Medora underlay.
NA	NA	NA	NA	NA	0.6	Quartz ironstone veins - Underlay South of main South Medora underlay.
NA	NA	NA	NA	NA	Grab	Quartz ironstone sandstone - surface dump - South Medora.
NA	NA	NA	NA	NA	Rock	Spotted shale immediately above Tillite - On track to Main Shaft.
10	X	X	X	<30	Chips	Quartz and ironstone veins.
X	1	X	X	<30	1.5	Rock chip sample of quartzite - (Fig. 6) RS 68.
X	3	X	X	<30	1.5	Rock chip sample of quartzite - (Fig. 6) RS 69.
X	2	X	X	<30	3.0	Rock chip sample of quartzite in pit South of station C (Fig. 6) RS 70.

Sample Number	Assay Number	Au	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ni (5)	Cr (10)	Ag (1)	As (20)	Total S %	Ba (1)	V (20)	Bi (1)	Mn (5)	% Fe (5)	Tl (10)	Cd (1)	Mo (1)	U (4)	Th (4)	Be (1)	Sc (3)	Sr (50)
MGS 82	A 1101/84	0.09	76	X	38	10	36	20	X	20	NA	<200	10	6	310	46.5	NA	X	3	18	8	X	10	<50
MGS 83	A 1102/84	0.04	550	6	200	890	280	X	X	X	NA	1500	80	X	5.70%	2.0	NA	X	3	12	4	1	3	100
MGS 84	A 1103/84	0.02	70	X	50	90	100	X	X	80	NA	200	100	X	4200	1.9	NA	X	2	10	16	X	3	<50
MGS 85	A 1104/84	0.02	12	6	14	6	16	10	X	X	NA	<200	20	X	980	1.8	NA	X	1	4	8	X	3	<50
MGS 86	A 1105/84	0.02	250	6	20	96	220	10	X	X	NA	<200	10	X	230	17.1	NA	X	1	8	4	X	X	50
MGS 87	A 1106/84	1.70	20	6	50	76	56	20	X	130	NA	<200	20	6	920	19.6	NA	X	3	14	6	1	3	<50
MGS 88	A 1107/84	0.02	10	X	10	16	20	X	X	X	NA	<200	40	X	2900	2.4	NA	X	2	14	10	X	6	50
MGS 89	A 1108/84	10.80	100	10	120	430	300	50	X	80	NA	<200	40	3	5200	32.9	NA	X	2	36	<4	1	10	<50
MGS 90	A 1109/84	0.08	38	X	30	90	56	X	X	410	NA	<200	20	100	4100	11.7	NA	X	1	4	4	1	6	50
MGS 91	A 1110/84	0.19	130	X	100	440	250	20	X	230	NA	600	30	X	1.10%	12.8	NA	X	2	10	<4	X	10	<50
MGS 92	A 1111/84	0.08	96	6	40	40	40	10	X	460	NA	<200	20	1	260	12.8	NA	X	2	4	<4	X	3	<50
MGS 93	A 1112/84	0.01	28	X	32	10	30	10	X	X	NA	400	100	X	280	10.9	NA	X	1	8	18	1	15	<50
MGS 94	A 1113/84	0.02	100	X	26	160	36	X	X	120	NA	<200	10	X	280	4.4	NA	X	1	14	8	X	X	<50
MGS 95	A 1114/84	0.02	50	X	20	6	16	10	X	X	NA	1000	200	X	140	2.6	NA	X	1	14	20	2	25	<50
MGS 96	A 1115/84	0.02	30	X	20	10	16	10	X	X	NA	600	150	X	270	3.1	NA	X	1	8	18	3	20	<50
	A 38/83	0.1	55	5	110	50	240	NA	X	X	0.02	NA	20	NA	NA	1.9	NA	X	NA	NA	NA	NA	NA	NA
	A 39/83	0.1	370	5	400	510	670	NA	X	30	0.03	NA	20	NA	NA	3.6	NA	X	NA	NA	NA	NA	NA	NA
	A 40/83	0.1	250	5	200	490	190	NA	X	X	0.01	NA	20	NA	NA	4.3	NA	X	NA	NA	NA	NA	NA	NA
	A 41/83	0.9	350	5	230	1000	320	NA	X	40	0.04	NA	20	NA	NA	15.1	NA	X	NA	NA	NA	NA	NA	NA
	A 42/83	0.5	290	5	240	1000	390	NA	X	50	0.01	NA	30	NA	NA	25.8	NA	X	NA	NA	NA	NA	NA	NA
MGM 100	A 2388/83	1.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MGM 101	A 2389/83	0.87	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2/1	A 1595/83	0.7	130	5	150	280	NA	NA	1	50	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
2/8	A 1596/83	0.7	180	10	95	120	NA	NA	1	100	NA	NA	NA	NA	NA	NA	10	NA	NA	NA	NA	NA	NA	NA
2/15	A 1597/83	0.1	120	5	140	210	NA	NA	X	20	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
2/22	A 1598/83	<0.1	110	5	150	90	NA	NA	X	20	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
2/29	A 1599/83	<0.1	55	5	50	120	NA	NA	X	20	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
2/36	A 1600/82	0.2	140	5	120	290	NA	NA	X	X	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
3/1	A 1601/83	3.4	50	5	42	85	NA	NA	X	60	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
4/1	A 1602/83	0.1	30	X	38	80	NA	NA	X	X	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
5/1	A 1603/83	4.6	20	X	24	90	NA	NA	X	20	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA

NOTES

Detection Limits in Brackets.
X = Not detected in limits quoted.
NA = Not analysed.

Ti (100)	Ga (1)	Zr (10)	Y (10)	Sn (1)	In (10)	Se (1)	Hg (0.05)	Sample Interval (m)	Comments
<100	1	100	X	X	X	NA	NA	Chips	Ironstone vein with boxwork in quartzite (Fig. 6).
800	X	30	X	X	X	NA	NA	Chips	Brecciated upper quartzite unit - Mn & Fe oxides (Fig. 6).
1000	X	20	X	X	X	NA	NA	Chips	Spotted siltstone in Tillite (Fig. 6).
2000	X	200	20	X	X	NA	NA	Chips	Quartzite outcrop near corner peg ML 5178 (Fig. 6).
200	X	200	X	X	X	NA	NA	Chips	Quartz vein - ferruginous boxwork ML 5178 (Fig. 6).
600	1	100	10	6	X	NA	NA	Chips	Quartz vein - ferruginous boxwork ML 5178 (Fig. 6).
2000	X	100	X	X	X	NA	NA	6.0	Fe quartz veinlets in arkose - Trench 45 m south of No. 6 Open Cut (Fig. 6).
200	3	100	10	X	X	NA	NA	Grab	Fe quartz and ironstone - Dump - underlay north of No. 7 Open Cut (Fig. 6).
1000	3	100	10	X	X	NA	NA	0.1	3 cm quartz ironstone vein in Tillite - Creek draining Main shaft (Fig. 7).
300	X	80	20	X	X	NA	NA	0.3	Channel of quartz with Mn and Fe oxides - H.W. Vein - (Fig. 8).
400	X	100	X	1	X	NA	NA	0.1	H.W. quartz vein - Fe boxwork - In Arkose - Pit near SE corner of ML 5011.
4000	10	250	20	X	X	NA	NA	Chips	Fe quartz veinlets 1 cm wide in Tillite - Cut at Main Shaft.
2000	X	100	10	X	X	NA	NA	0.1	5 cm sandstone band with magnetite/pyrite - Main Shaft.
8000	10	400	60	X	X	NA	NA	1.0	Tillite immediately above sandstone in MGS 94 above.
8000	6	250	40	X	X	NA	NA	Rock	Spotted siltstone @ road junction Main Shaft and Old Main Shaft.
NA	NA	NA	NA	NA	NA	X	<0.05	Chips	Fe quartz vein in floor of No. 4 Open Cut (Fig. 7).
NA	NA	NA	NA	NA	NA	X	0.35	Chips	Fe quartz vein - north wall No. 4 Open Cut - 3 m from corner
NA	NA	NA	NA	NA	NA	NA	0.15	Chips	Fe quartz vein - south wall No. 4 Open Cut - 1 m from corner.
NA	NA	NA	NA	NA	NA	X	0.60	Handpicked	Pinkish Fe quartz with pyrite - No. 1 Open Cut (Fig. 6).
NA	NA	NA	NA	NA	NA	6	0.15	Chips	Fe clayey alteration and quartz vein - No. 1 Open Cut.
NA	NA	NA	NA	NA	NA	NA	NA	2.0	Pinkish Arkose quartz veining No. 3 Open Cut (Parcel 1552).
NA	NA	NA	NA	NA	NA	NA	NA	2.0	As Above.
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Quartz Ironstone pinkish sandstone - Face No. 2 Open Cut (Fig. 34)
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Fe quartz limonite boxwork - Loc. 2 No. 2 Open Cut (Fig. 34).
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Arkose with quartz veinlets - Loc. 3 No. 2 Open Cut (Fig. 34).
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Vertical Channel - E wall, sandstone Fe/Mn - No. 2 Open Cut (Fig. 34).
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Quartz vein with Fe/Mn oxides in Sandstone - Loc. 5 No. 2 Open Cut (Fig. 34).
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Bleached sandstone - sericitic and clayey - Loc. 6 No. 2 Open Cut (Fig. 34).
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Quartz in Arkose Mn/Fe oxides - Bulldozer Scrape - Orroroo Treasure.
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Quartz vein - Bulldozer scrape south of South Medora Underlay.
NA	NA	NA	NA	NA	NA	NA	NA	10 kg Bulk	Quartz ironstone vein in arkose - U/G @ South Medora Underlay.

NOTES

Detection Limits in Brackets.
X = Not detected at limits quoted.
NA = Not analysed.

Sample Number	Assay Number	Au	Cu (2)	Pb (5)	Zn (2)	Co (5)	Tl (10)	Ag (1)	As (20)	Mn (5)	Fe (50)	Check Au Assays	Sample Interval (m)	Comments
6/1	A 1604/83	<0.1	830	20	1200	4300	20	1	70	NA	NA	NA	10 kg Bulk	Quartz vein, alteration and arkose - No. 3 Open Cut (Fig. 35).
7/1	A 1605/83	<0.1	100	5	60	430	X	X	X	NA	NA	NA	10 kg Bulk	Arkose with quartz veins - Trench 11 South Medora (Fig. 6).
8/1	A 1606/83	0.3	65	5	44	270	X	X	30	NA	NA	NA	10 kg Bulk	Ferruginous quartz vein - No. 1 Open Cut Shattered Dream (Fig. 6).
9/1	A 1607/83	<0.1	10	X	22	10	X	X	X	NA	NA	NA	10 kg Bulk	Arkose with quartz veins - Trench 8 North Medora (Fig. 7).
10/1	A 1608/83	0.2	350	5	330	110	X	X	X	NA	NA	NA	10 kg Bulk	Arkose with quartz veins - Trench 7 North Medora (Fig. 7).
11/1	A 1609/83	4.3	410	15	540	490	X	1	70	NA	NA	NA	10 kg Bulk	Qtz ironstone vein in Burra Group Shale - South Underlay Jones Shaft (Fig. 32).
12/1	A 1610/83	2.3	20	5	22	45	X	X	X	NA	NA	NA	10 kg Bulk	Arkose with quartz veins - Trench 14 South Medora (Fig. 6).
MGP 1	A 160/84	0.22	150	X	180	NA	NA	X	30	2.10%	6.5%	NA	1.5	Quartz veinlets in Arkose - Face of No. 2 Open Cut.
MGP 2	A 161/84	0.03	48	X	50	NA	NA	X	X	6900	2.4%	NA	1.5	Arkose with quartz veins and limonite - Trench in No. 2 Open Cut.
MGP 3	A 162/84	0.14	34	X	46	NA	NA	X	X	4100	2.2%	0.16	1.5	Arkose with ferruginous quartz veins - Trench in No. 2 Open Cut.
MGP 4	A 163/84	0.03	70	X	100	NA	NA	X	X	7700	2.1%	NA	1.5	Arkose with ferruginous quartz veins - Trench in No. 2 Open Cut.
MGP 5	A 164/84	0.01	22	X	66	NA	NA	X	X	2500	3.7%	0.04	1.5	Abundant qtz veining in sandstone - Fe/Mn oxides - Trench in No. 2 O/C.
MGP 6	A 165/84	0.04	20	X	86	NA	NA	X	20	2200	5.2%	NA	1.5	Coarser grained sandstone - less qtz veining - Trench in No. 2 Open Cut.
MGP 7	A 166/84	0.18	12	X	24	NA	NA	X	X	3900	3.2%	0.12	1.5	Arkose minor qtz veining plus limonite - Trench in No. 3 Open Cut.
MGP 8	A 167/84	0.49	60	6	48	NA	NA	2	90	870	17.5%	0.46	1.5	Strongly limonitic qtz veining in arkose - pyrite? - Trench in No. 3 O/C.
MGP 9	A 168/84	0.03	38	X	32	NA	NA	X	X	5700	2.3%	0.04	1.5	White qtz veins - Mn oxides - coarse pinkish arkose - Trench in No. 3 O/C.
MGP 10	A 169/84	0.07	86	X	90	NA	NA	X	X	1.40%	4.4%	NA	1.5	Less quartz veining in arkose - Trench in No. 3 O/C.
MGP 11	A 170/84	0.32	28	X	32	NA	NA	X	X	650	6.7%	0.26	1.5	Qtz veining in coarse grained arkose-Fe/Mn boxworks-Trench in No. 3 O/C.
MGS 97	A 2947/83	0.110	125	X	120	235	NA	1	72	NA	NA	NA	0.5	Qtz veining in FW of HW vein + HW vein intersection No. 4 O/C.
MGS 98	A 2948/85	0.050	62	X	40	94	NA	X	47	NA	NA	NA	0.2	HW Qtz vein 1 m from stringers - No. 4 Open Cut.
MGS 99	A 2949/84	0.040	49	X	40	58	NA	X	37	NA	NA	NA	0.1	HW Qtz vein in face of open cut - No. 4 Open Cut.
MGS 100	A 2950/85	0.035	46	X	58	78	NA	X	15	NA	NA	NA	1.3	Vert. channel - sandstone + Fe qtz vein - NW corner No. 4 O/C.
MGS 101	A 2951/85	0.035	155	X	205	560	NA	X	23	NA	NA	NA	2.0	Horz. channel siliceous sandstone - Fe/Mn Qtz veins 2-4 m from NW corner - No. 4 Open Cut.
MGS 102	A 2952/85	0.025	27	18	49	76	NA	X	7	NA	NA	NA	2.0	Sandstone with minor Fe qtz veinlets 0-2 m from NW corner - No. 4 O/C.
MGS 103	A 2953/85	0.015	29	X	96	48	NA	X	27	NA	NA	NA	2.0	Sandstone less qtz veining-pyrite? 4-6m from NW corner of No. 4 O/C.
MGS 104	A 2954/85	<0.005	26	X	13	50	NA	X	14	NA	NA	NA	0.1	HW qtz vein + Fe oxides - SW corner old underlay shaft (Fig. 7).
MGS 105	A 2955/85	1.00	78	X	13	110	NA	X	60	NA	NA	NA	0.03	Ferruginous sandstone bed 3cm thick pyritic? 40cm above HW vein (Fig. 7).
MGS 106	A 2956/85	<0.005	11	X	5	X	NA	X	6	NA	NA	NA	1.0	Upper quartzite unit in tillite - North end of outcrop NW of Main Shaft (Fig. 7).
MGS 107	A 2957/83	0.035	17	X	5	16	NA	X	19	NA	NA	NA	1.5	Upper quartzite unit - same outcrop as MGS 106 above (Fig. 7).
MGS 108	A 2958/85	<0.005	27	X	12	20	NA	X	9	NA	NA	NA	1.4	upper quartzite unit - near corner of ML's 4830 & 5018 (Fig. 7).
MGS 109	A 2959/85	0.88	43	X	17	36	NA	X	94	NA	NA	NA	0.04	Ferruginous pyritic quartz bed 4cm thick - As for MGS 105 Trench No. 8 (Fig. 7)

NOTES

Detection Limits in Brackets.
X = Not detected at Limits quoted.
NA = Not Analysed

Sample Number	Assay Number	Au (0.1)	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Sample Interval (m)	Comments
MGS 110	A 2960/85	<0.005	74	X	22	26	X	10	Chips	Ferruginous bed in spotted shale - 30m South of No. 6 Open Cut (Fig. 6).
MGS 111	A 2961/85	<0.005	23	X	8	8	X	8	Chips	Quartzite with Fe qtz veins pyrite pseudomorphs - Orroroo Treasure Shaft (Fig. 6).
MGS 112	A 2962/85	<0.005	12	X	7	10	X	6	2.0	Upper quartzite with Fe qtz veins - 80m West of Orroroo Treasure Vert Shaft (Fig. 6).
NGS 113	A 2963/85	<0.005	19	X	10	8	X	2	2.0	Upper quartzite 80m West of No. 6 Open Cut (Fig. 6).
MGS 114	A 2964/85	<0.005	30	X	17	32	X	10	3.0	Upper quartzite 75 m West of Medora Extended Vertical Shaft (Fig. 6).
MGS 115	A 2965/85	0.60	300	X	150	1000	1	110	Grab	Fe quartz in dump from pit 45m North of No. 5 Open Cut (Fig. 6).
MGS 116	A 2966/85	0.230	23	X	22	105	1	135	Grab	Fe quartz arkose in dump from Vert. Shaft 30 m North of Trench 16 (Fig. 8).
	A 2271/82	0.3	75	10	36	50	X	350	0.2	HW quartz vein - ferruginous - Heather Bell working (Fig. 8).

NOTES

Detection Limits in Brackets
X = Not detected at Limit quoted.
NA = Not analysed.
Gold analysis by fire assay.

Samples	A 1200/82 - A 1230/82	AMDEL REPORT	AC 1346/83
Samples	A 2206/82 - A 2210/82	AMDEL REPORT	AC 2315/83
Samples	A 2224/82 - A 2228/82	AMDEL REPORT	AC 2315/83
Samples	A 38/83 - A 42/83	AMDEL REPORT	AC 3845/83 and AC 4317/83
Samples	A 840/83 - A 849/83	AMDEL REPORT	AC 4316/83
Samples	A 1145/83 - A 1149/83	AMDEL REPORT	AC 4614/83
Samples	A 1206/83 - A 1209/83	AMDEL REPORT	AC 5078/83
Samples	A 29/84 - A 32/84	AMDEL REPORT	AC 3008/84 and AC 3838/84
Samples	A 160/84 - A 170/84	AMDEL REPORT	AC 3414/84
Samples	A 1595/83 - A 1612/83	AMDEL REPORT	AC 5226/83
Samples	A 2388/83 - A 2389/83	AMDEL REPORT	AC 6468/83
Samples	A 984/84 - A 998/84	AMDEL REPORT	AC 4989/84
Samples	A 4609/83 - A 4620/83	AMDEL REPORT	AC 808/84
Samples	A 4867/83 - A 4886/83	AMDEL REPORT	AC 1485/84
Samples	A 1101/84 - A 1115/84	AMDEL REPORT	AC 136/85
Samples	A 2947/85 - A 2966/85	AMDEL REPORT	AC 2449/86

TABLE 42

Assay Results of Samples from No. 1 Open Cut - Shattered Dream

Assay Number	Au (0.1)	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Ti (10)	Comments
A 612/82	0.1	30	1	X	80	X	X	NA	Quartz - limonitic with pyrite.
A 842/83	0.2	280	15	180	900	X	30	NA	Limonitic quartz vein.
A 843/83	0.1	36	10	28	90	X	50	NA	As above with sulphur in cavities.
A 846/83	0.2	170	5	190	95	X	20	NA	Grab of ore stockpile at Battery.
A 847/83	0.1	100	5	100	85	X	20	NA	As Above.
A 850/83	0.2	85	20	85	140	X	20	X	Composite of Tailings - No. 1 & No. 2 Open Cuts.
A 851/83	0.4	75	25	90	140	X	X	X	Battery Tailings Sample.
A 41/83	0.9	350	5	230	1000	X	40	NA	Handpicked pinkish ferruginous quartz with pyrite.
A 42/83	0.5	290	5	250	1000	X	50	NA	Ferruginous clayey material with qtz & alteration.
A 1606/83	0.8	65	5	44	270	X	30	X	1st split of crushed 10 kg bulk.
A 1650/83	0.8	260	10	150	660	1	20	20	2nd split of crushed 10 kg bulk.
A 1651/83	0.9	260	10	180	680	1	30	20	3rd split of crushed 10 kg bulk.
A 1652/83	0.6	270	10	150	690	1	30	20	4th split of crushed 10 kg bulk.
A 1693/83	0.4	310	15	200	960	1	40	20	Panned Concentrate from split of 10 kg bulk.

Detection Limits in brackets.
NA = not analysed.
X = not detected at limits quoted.
Gold analyses by fire assay.
Other analyses by Atomic Absorption Spectroscopy.

Samples A 842/83 - A 851/83 AMDEL Report AC 4316/83
Samples A 41/83 - A 54/83 AMDEL Report AC 3845/83 and 4317/83
Samples A 1606/83 AMDEL Report AC 5226/83
Samples A 1650/83 - A 1693/83 AMDEL Report AC 5226/83

TABLE 43

Assay Results of Samples from No. 2 Open Cut - North Medora

Assay Number	Au (0.1)	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Comments
A 840/83	<0.1	380	10	300	720	X	20	Qtz vein abundant limonite - Dips 20° to E.
A 841/83	<0.1	330	10	250	670	X	30	Vertical Qtz ironstone stringer 2 cm wide.
A 844/83	1.5	42	15	75	40	X	80	Pinkish sandstone - qtz ironstone veinlets - hanging wall.
A 845/83	0.6	200	10	200	410	X	70	As above.
A 848/83	1.5	350	15	420	410	X	50	Qtz veining Fe/Mn Oxides - Parcel 1546.
A 849/83	<0.1	650	15	790	480	X	40	As above with more quartz.
A 850/83	0.2	85	20	85	140	X	20	Composite of battery tailings No. 1 & No. 2 open cuts.
A 852/83	1.0	110	40	70	250	1	40	Tailings from parcel 1541.
A 853/83	0.2	80	20	85	140	X	20	Tailings from parcel 1546.
A 1145/83	1.5	350	10	210	670	1	80	Quartz vein Fe/Mn oxides in face.
A 1146/83	1.0	55	X	85	120	1	80	As above + pyrite.
A 4615/83	1.2	NA	NA	NA	NA	NA	NA	Arkose & quartz veinlets - Fe/Mn oxides - HW contact.
A 4616/83	0.1	NA	NA	NA	NA	NA	NA	Qtz veinlets in arkose - Fe/Mn oxides - south wall.
A 160/84	0.22	150	X	180	NA	X	30	Quartz veinlets in face in arkose.
A 161/84	0.03	48	X	50	NA	X	X	Arkose with limonitic qtz veins - Trench for bulk sample.
A 162/84	0.14	34	X	46	NA	X	X	Arkose with limonitic qtz veins - Trench for bulk sample.
A 163/84	0.03	70	X	100	NA	X	X	Qtz veining in sandstone Fe/Mn oxides - Trench for bulk sample.
A 164/84	0.01	22	X	66	NA	X	X	less qtz veining - Trench for bulk sample.
A 165/84	0.04	20	X	86	NA	X	20	Coarser grained sandstone less qtz veins - Trench for bulk sample.
A 1595/83	0.7	130	5	150	280	1	50	10 kg bulk qtz ironstone pinkish sandstone.
A 1596/83	0.7	180	10	95	120	1	100	10 kg bulk Fe qtz limonitic boxwork.
A 1597/83	0.1	120	5	140	210	X	20	10 kg bulk arkose with qtz veinlets.
A 1598/83	<0.1	110	5	150	90	X	20	10 kg bulk sandstone Fe/Mn qtz veinlets.
A 1599/83	<0.1	55	5	50	120	X	20	10 kg bulk qtz vein with Fe/Mn oxides in Sandstone.
A 1600/83	0.2	140	5	120	290	X	X	10 kg bulk sample sercitic bleached sandstone.

Detection limits in brackets
X = Not detected at limits
NA = Not analysed.

Samples A 1595/83 - A 1600/83 AMDEL Report AC 5226/83
Samples A 840/83 - A 853/83 AMDEL Report AC 4316/83
Samples A 1145/83 - A 1146/83 AMDEL Report AC 4614/83
Samples A 4615/83 - A 4616/83 AMDEL Report AC 808/84

TABLE 44

Assay Results of Samples from No. 3 Open Cut - North Medora

Sample Number	Assay Number	Au	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Ni (5)	Comments
MED 45	A 1222/82	0.2	24	5	38	130	X	X	NA	HW vein? Fe qtz.
MED 46	A 1223/82	0.1	10	55	18	15	X	X	NA	Silicified arkose Fe qtz.
MED 47	A 1224/82	0.2	70	5	42	360	X	X	NA	Silicified arkose Fe qtz.
MGS 25	A 1206/83	0.7	65	5	30	75	1	70	NA	Qtz veining limonite pyrite.
MGS 26	A 1207/83	1.1	100	5	30	90	2	110	NA	As above.
MGS 27	A 1208/83	1.6	85	5	28	90	1	40	NA	Arkose Fe qtz veins in face.
MGS 28	A 1209/83	0.3	60	X	30	270	X	30	NA	As above.
MGS 32	A 987/84	0.22	16	X	14	16	X	X	20	Quartzite - mica alteration.
MGS 39	A 993/84	0.07	18	X	12	40	X	X	20	Arkose - sericitic alteration.
MGS 41	A 995/84	0.02	760	X	1000	4700	X	40	2000	Qtz Mn/Fe and pyrite.
MGS 42	A 996/84	0.04	970	X	970	6200	X	X	1500	Gossan - Ironstone Fe/Mn rich.
6/1	A 1612/83	0.3	1400	35	1450	7400	3	50	NA	Qtz gossan - Mn/Fe and pyrite.
	A 1604/83	<0.1	830	20	1200	4300	1	70	NA	1st split 10 kg bulk.
	A 1643/83	0.2	270	15	240	1300	1	60	NA	2nd split 10 kg bulk.
	A 1644/83	10.2	280	15	230	1600	1	60	NA	3rd split 10 kg bulk.
	A 1645	0.3	330	15	280	1500	1	50	NA	4th split 10 kg bulk.
MGM 100	A 2388/83	1.2	NA	NA	NA	NA	NA	NA	NA	South Wall - Channel - Parcel 1552.
MGM 101	A 2389/83	0.87	NA	NA	NA	NA	NA	NA	NA	South Wall - Channel.
	A 2598/83	0.4	15	15	50	90	X	X	NA	Tailings - Parcel 1552.
MGP 7	A 166/84	0.18	12	X	24	NA	X	X	NA	Channel in Trench Bulk MG 2.
MGP 8	A 167/84	0.48	60	6	48	NA	2	90	NA	Channel in Trench Bulk MG 2.
MGP 9	A 168/84	0.03	38	X	32	NA	X	X	NA	Channel in Trench Bulk MG 2.
MGP 10	A 169/84	0.07	86	X	90	NA	X	X	NA	Channel in Trench Bulk MG 2.
MGP 11	A 170/84	0.21	28	X	32	NA	X	X	NA	Channel in Trench Bulk MG 2.

Detection limits in brackets.
X = Not detected at level quoted.
NA = Not analysed.

A 1222/82 - A 1224/82 AMDEL Report AC 1346/83
A 1206/83 - A 1209/83 AMDEL Report AC 5078/83
A 987/84 - A 996/84 AMDEL Report AC 4989/84
A 1612/83 - A 1645/83 AMDEL Report AC 5225/83
A 2388/83 - A 2389/83 AMDEL Report AC 6468/83
A 2598/83 AMDEL Report AC 113/84

No. 2 Open Cut (Fig. 34)

Sixteen channel samples and six 10 kg bulk samples were collected (Table 43). Three samples of tailings from ore parcel treated at Peterbrough are also included.

Average grade of all channel samples was 0.50 g/t Au while average grade of channel samples from the backhoe trench (from which bulk parcel MG1 was excavated) was 0.05 g/t Au. Six of the channel samples from the open cut assayed between 1.0 and 1.5 g/t Au.

No. 3 Open Cut (Fig. 35)

Fourteen channel samples in the cut averaged 0.52 g/t Au and three of the samples assayed between 1.1 and 1.6 g/t Au, (Table 44). Five channel samples were collected from the backhoe trench cut by Abignano Limited to obtain bulk parcel MG 2 and these averaged 0.20 g/t Au.

A 10 kg bulk sample assayed <0.1 g/t Au and three sub-samples assayed 0.2, 10.2 and 0.3 g/t Au. Check analyses by Comlabs gave 0.1 g/t Au by fire assay and 0.15 g/t Au by Atomic Absorption Spectroscopy (AAS). Coarse gold particles in sub sample A 1644/83 may explain the anomalously high result.

No. 4 Open Cut (Fig. 36)

Seven channel samples average 0.05 g/t Au and three grab samples of ferruginous quartz veining averaged 0.1 g/t Au (Table 45).

No. 5 Open Cut (Fig. 6)

No channel samples were collected. A 10 kg bulk sample assayed 4.6 g/t Au and check analyses by Comlabs assayed 1.0 g/t Au by fire assay and 1.20 g/t Au by AAS. Three subsamples of the bulk assayed 1.3, 0.7 and 1.0 g/t Au. Specks of free gold were noted in the sample. The specimen in Plate 32 was collected from the ore stockpile.

Five grab samples of dump material and screened fines averaged 0.24 g/t Au (Table 46).

No. 6 Open Cut (Fig. 37)

Five channel samples average 0.77 g/t Au. Two of these, A 4610/83 and A 4612/83 assayed 1.30 and 1.20 g/t Au respectively (Table 47).

No. 7 Open Cut (Fig. 6)

Two samples from the open cut averaged 0.08 g/t Au and two samples of stockpiled material, later treated as parcel 1598 at Peterborough, averaged 0.39 g/t Au (Table 48).

Miscellaneous

Grab samples of dump material around the main underlay shaft averaged 1.6 g/t Au. However, sample A 2224/82 which was handpicked assayed a high 2.8 g/t Au. A chip sample of quartz breccia with abundant hematite and limonitic boxwork taken 150 m north east of Golden Junction shaft assayed 1.3 g/t Au.

Rock chip samples from the upper quartzite unit returned low gold values, generally less than 0.1 g/t Au. Two samples, (A 32/84, A 1106/84) however, assayed 1.7 g/t Au.

TABLE 45

Assay Results of Samples from No. 4 Open Cut - North Medora

Sample Number	Assay Number	Au	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Comments
MGS 97	A 2947/85	0.11	125	X	120	235	1	72	Qtz veins in FW of HW vein.
MGS 98	A 2948/84	0.05	62	X	40	94	X	47	HW qtz vein.
MGS 99	A 2949/84	0.04	49	X	40	58	X	37	HW qtz vein.
MGS 100	A 2950/85	0.04	46	X	58	78	X	15	Sandstone + Fe qtz veins.
MGS 101	A 2951/85	0.04	155	X	205	560	X	23	Siliceous sandstone Fe qtz veins.
MGS 102	A 2952/83	0.03	27	18	49	76	X	7	Sandstone - minor Fe qtz veins.
MGS 103	A 2953/85	0.02	29	X	96	48	X	27	Sandstone less qtz veining.
	A 38/83	0.1	55	5	110	50	X	X	Qtz vein in floor of cut.
	A 39/83	0.1	370	5	400	510	X	30	Fe qtz vein - North wall.
	A 40/83	0.1	250	5	200	490	X	X	Fe qtz vein - South wall.

Detection Limits in brackets.
X = Not detected at Limits quoted.

Samples A 2947/85 - A 2953/85 AMDEL Report AC 2449/86
Samples A 38/83 - A 40/85 AMDEL Report AC 3845/83 and AC 4317/83

TABLE 46

Assay Results of Samples from No. 5 Open Cut South Medora

Sample Number	Assay Number	Au	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Comments
SMG 2	A 2207/82	0.4	55	10	34	120	X	20	Grab - Arkose Dump material.
SMG 3	A 2208/82	0.1	32	10	18	75	X	30	Grab - Arkose dump material.
SMG 4	A 2209/82	0.1	30	10	30	60	X	30	Screened dump material (fines).
SMG 5	A 2210/82	0.1	28	10	28	55	X	20	Washed fines - screened material.
	A 1603/83	4.6	22	X	24	90	X	20	Ore stockpile, 10 kg Bulk.
MGS 73	A 4885/83	0.5	295	12	195	580	4	30	Qtz ironstone sandstone - dump.

Detection Limits in Brackets
NA = Not analysed.
X = Not detected at Limits Quoted.

Samples A 2207/82 - A 2210/82 AMDEL Report AC 2315/83

TABLE 47

Assay Results of Samples from No. 6 Open Cut Orroroo Treasure

Sample Number	Assay Number	Au (0.1)	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Ni (5)	Comments
MGS 45	A 4609/83	0.26	NA	NA	NA	NA	NA	NA	NA	Ironstone vein in face strikes 309° vertical cuts across strike of Arkose.
MGS 46	A 4610/83	1.30	NA	NA	NA	NA	NA	NA	NA	Qtz + ironstone - North wall 1 m from face.
MGS 47	A 4611/83	0.34	NA	NA	NA	NA	NA	NA	NA	Qtz + ironstone vein dips 45° to E-N wall.
MGS 48	A 4612/83	1.20	NA	NA	NA	NA	NA	NA	NA	Qtz veining ferruginous - in sandstone - North wall.
MGS 49	A 4613/83	0.46	NA	NA	NA	NA	NA	NA	NA	F/Wall contact clayey with qtz veinlets.
MGS 50	A 4614/83	0.30	NA	NA	NA	NA	NA	NA	NA	Ironstone with boxwork in quartzite.

Detection Limits in brackets.
NA = Not Analysed.

Samples A 4609/83 - A 4614/83 AMDEL Report AC 808/84

TABLE 48

Assay Results of Samples from No. 7 Open Cut Medora Extended

Sample Number	Assay Number	Au	Cu (2)	Pb (5)	Zn (2)	Co (5)	Ag (1)	As (20)	Ni (5)	Comments
	A 4619/83	0.05	NA	NA	NA	NA	NA	NA		Ore stockpile (Parcel 1598)
	A 4620/83	0.72	NA	NA	NA	NA	NA	NA		Ore stockpile (Parcel 1598)
MGS 53	A 4617/83	0.09	NA	NA	NA	NA	NA	NA		Vertical Quartz vein + iron oxides.
MGS 54	A 4618/83	0.07	NA	NA	NA	NA	NA	NA		Silicified arkose.

Detection Limits in brackets.
NA = Not analysed.

Samples A 4617/83 - A 4620/83 AMDEL Report AC 808/84

Geochemistry

One hundred and sixty two rock chip and channel samples were collected from surface outcrops and open cuts, location of which are shown on Fig. 6, 7 and 8 and results listed in Table 41. These samples have been analysed for Au, Cu, Pb, Zn, Co, As, Ag and in some cased elements such as Ni, Cr, Ba, Bi, V, Mn, Fe, Cd, Tl, Ti, Th, U, Be, Sc, Sr, Sb, Sn, Y, Hg, S, Ga, Ge, In, Te and Se have been analysed.

Seventy seven channel samples were collected from backhoe costeans across the strike of the basal arkose unit, Appila Tillite (Figs. 13-27) and results are listed in table 14. These samples were analysed for Au, Cu, Pb, Zn, Ag, As and Co.

Eighty six rock chip and channel samples collected from underground workings were analysed for Au, Cu, Pb, Zn, Ag, As, Co and in some cases a scan of elements listed above.

Sixteen 10 kg bulk samples were crushed and split with three sub-samples being analysed for Au, Cu, Pb, Zn, Ag and As. One split was panned and the concentrate assayed for gold and another split was sieved into size fractions and each fraction assayed for gold. The final split was submitted to Comlabs Pty. Ltd. for comparison of gold assays.

Results for host rock, quartz vein, regional and spotted shale surface samples are compared with average values of elements from Quartz Pebble Conglomerate (QPC) and deposits at Mongolata, Waukaringa (Townsend, 1986) and Orama Hill, in Table 49. There is a remarkable similarity in the trace element geochemistry of Mount Grainger samples and QPC gold deposits. Included in Table 49 is data for Carlin gold deposit in Nevada, U.S.A., a disseminated gold-silver deposit in chemically favourable, carbonate-bearing sedimentary host rocks with associated silicification, chloritization and pyritization. Carlin deposit has concentrations of Ba, Tl, Hg, As, Sb, Pb, Zn, Cu, W, Mo and Te with the gold ore, (Boyle, 1979) and is included for comparison of a deposit with a similar host lithology but different genesis.

Silver A constant associate of gold in all deposits as silver minerals and/or trace amounts in sulphides. Silver values range from <1 - 4 ppm in all samples from Mount Grainger and do not correlate with high gold values.

Arsenic In most hypogene gold deposits arsenic is enriched and there is a general correlation between gold and arsenic during both hypogene and supergene processes (Boyle, 1979). According to Boyle, auriferous quartz-pebble conglomerates contain relatively high amounts of arsenic.

At Mount Grainger arsenic values range from <20 - 460 ppm and anomalous values generally correlate with elevated gold values, and often correlate with anomalous copper values.

During underground sampling at Waukaringa highest arsenic value (516 ppm) was found to correlate with highest gold value and an east-west enrichment of arsenic, up to 9 000 ppm, associated with water table, was found to correlate with parallel zones of copper and gold enrichment (Townsend, 1986). At Orama Hill anomalous arsenic values do not correlate with gold (Scott, et. al, 1985).

Barium Barite occurs as a minor gangue mineral in some gold deposits, mainly low and medium temperature types and tends to follow potassium and calcium in hypogene gold deposits being concentrated in feldspar, sericite and carbonate in the wall rock alteration zones, (Boyle, 1979). Barium ranges from <50-1050 ppm in quartz pebble conglomerate gold deposits. Disseminated gold ores of Carlin are enriched in barium and average 2 200 and 2 300 ppm in primary and oxidised ores respectively, (Boyle, 1979).

Host rock (arkose) at Mount Grainger has a range of barium values from <200 to >10000 ppm and quartz veins in the arkose unit range from <200 to 8 000 ppm Ba. High barium values do not correlate with high gold values and barium values are higher than the average in quartz-pebble conglomerate gold deposits.

Beryllium Average content of beryllium in sandstone is <1-3 ppm and in shales 1-6 ppm (Hawkes and Webb, 1962). At Mount Grainger beryllium values in the arkose range from <1-2 ppm and in the spotted shale from 2-3 ppm. This compares with quartz pebble conglomerate gold deposits which generally contain less than 3 ppm.

A slight enrichment in the alteration zones of some types of gold deposits, particularly where abundant sericite and tourmaline are developed in quartz veins. Tourmaline in sandstone and shale at Mount Grainger is considered to be detrital.

Bismuth In most ores bismuth is generally present in amounts <5 ppm but it may be a common associate of gold in some hypogene deposits due to the existence of gold bismuthide (Au_2Bi) in nature (Boyle, 1979). Analyses show that bismuth content of Witwatersrand ores range from not detected to 2.2 ppm.

At Mount Grainger bismuth values in underground samples range from <10-40 ppm. Values for samples A 32/83 and A 33/83 were 20 ppm and correspond to gold values of 20.6 and 19.3 g/t respectively. Samples A 9/84 and A 10/84 assayed 10.9 and 13.2 g/t Au respectively and 40 ppm and 15 ppm Bi respectively suggesting high gold values correlate with anomalous bismuth. In the North Medora mine sample A 1236/2 of the hanging wall vein and quartz ironstone stringers assayed 35.1 g/t Au and 90 ppm Bi.

Cadmium Gold ores rarely contain more than 500 ppm cadmium although it follows zinc closely in hypogene gold deposits mainly in sphalerite and zinc - bearing sulphosalts (Boyle, 1979). Quartz pebble conglomerates contain <0.5 to 2 ppm cadmium.

Two analytical methods for cadmium were used at Mount Grainger with two different detection limits (1 ppm and 3 ppm). In general no samples assayed above 3 ppm. However, sample A 1236/82 which assayed 35.1 g/t Au had a cadmium value of 2 ppm using the lower detection limit.

In oxidized zones of gold deposits gold and cadmium separate, cadmium being removed in oxidising meteoric waters and the gold remaining in the gossans (Boyle, 1979). This could explain low cadmium values at Mount Grainger as zinc values up to 1450 ppm were obtained suggesting some sphalerite is present in the ore.

Cobalt Present in most types of gold deposits up to 150 ppm and is a component of pyrite, pyrrhotite, pentlandite, magnetite, chalcopyrite, arsenopyrite and tennantite-tetrahedrite. Cobalt sulphides such as smaltite and cobaltite are relatively rare in gold deposits (Boyle, 1979). Cobalt content of Witwatersrand ores range from 37-102 ppm and at Carlin primary ore contains <2-50 ppm while oxidised ore contents range from <2-150 ppm (Boyle, 1979).

At Mount Grainger cobalt values in arkose range from <5-1100 ppm and in quartz veins in the arkose from 6-7400 ppm. High gold values correlate with anomalous cobalt e.g. sample A 1236/82 from North Medora underlay assayed 35.1 g/t Au and 910 ppm Co. Samples A 32/83 and A 33/83 from the sub level below water table assayed 20.6 and 19.8 g/t Au respectively and 190 and 210 ppm Co respectively. Samples A 1253/82 and A 1254/82 from the main stope assayed 4.9 and 4.0 g/t Au respectively and 840 and 890 ppm Co respectively indicating enrichment in the oxidised zone. The mineral Asbolite, a hydrated oxide of manganese, often contains a variable percentage of cobalt oxide and Boyle suggests that gold and cobalt may be concentrated together under certain conditions in gossans, particularly those containing abundant wad.

Values ranging from below detection to 800 ppm Co were assayed in samples from Orama Hill but anomalous values do not correspond to high gold values (Scott et. al., 1985).

At Waukaringa cobalt values in Alma-Victoria mine range from 6-350 ppm and average 104 ppm. Anomalous values correlate with high gold values in both soil samples and ore samples, (Townsend, 1986).

<u>Chromium</u> Found as a trace element in a variety of gold deposits. Quartz-pebble conglomerate deposits have a range of chromium values from 585-710 ppm and chromium is present in micas (sericite), pyrite and as traces of resistate minerals such as chromite, (Boyle, 1979). Disseminated gold deposits of Carlin have chromium contents between 7 and 200 ppm.

At Mount Grainger chromium values in arkose host rock range from <10-20 ppm and for mineralised quartz veins from <10-80 ppm. Higher chromium values do not correlate with higher gold values.

<u>Copper</u> The element is a constant associate of gold in all types of deposits and occurs as sulphide mineralisation such as covellite, chalcopyrite or chalcocite. Quartz-pebble conglomerate deposits copper contents range from 10-137 ppm usually as chalcopyrite. Disseminated gold deposits (Carlin) may contain up to 200 ppm copper, (Boyle, 1979).

At Mount Grainger anomalous copper values generally correlate with high gold content in the channel samples taken from the surface costeans. Underground, copper values are lower and where anomalous correlate with elevated gold values. Arkose host rock samples have copper values in the range 2-550 ppm and mineralised quartz veins have copper contents between 2 and 1400 ppm. No copper sulphide minerals have been observed at Mount Grainger mine but copper occurs at Medina and Penn mines elsewhere in the Anticline.

Highest copper values were found to correlate with high gold values at Waukaringa (Townsend, 1986). Average copper values for ferruginous zones at Orama Hill are 1070 ppm and in samples of quartz veins is 336 ppm, (Scott, et. al., 1985).

Gallium Only a few samples were analysed for gallium and contents for arkose host rock and quartz veins at Mount Grainger range from <1-10 ppm, although values as high as 20 ppm were encountered.

Gallium content of quartz pebble conglomerates rarely exceeds 5 ppm and in disseminated gold deposits (Carlin) ranges from <2 to 30 ppm in oxidised ores, (Boyle, 1979).

Germanium Gold deposits containing chalcopyrite and magnetite minerals commonly contain 5-50 ppm Ge. Quartz - pebble conglomerate deposits contain <2 ppm Ge, (Boyle, 1979) and at Waukaringa and Orama Hill germanium values were all <1 ppm (Townsend, 1986 and Scott, et. al., 1985). All values at Mount Grainger are less than 1 ppm Ge.

Indium Where gold ores contain sphalerite, galena, chalcopyrite, tetrahedrite - tennantite and tourmaline indium is present in the parts per million range but where sulphides are minimal indium contents are invariably less than 1 ppm. Quartz-pebble conglomerate deposits contain <1 ppm indiium, (Boyle, 1979).

At Mount Grainger, Indium values are all <10 ppm.

Molybdenum Commonly associated with gold in most types of its deposits, but in small amounts, molybdenum content in quartz-pebble conglomerates ranges from 2.5-3 ppm, (Boyle, 1979) and in disseminated gold deposits (Carlin) ranges from <2-100 ppm.

At Mount Grainger only a few samples were analysed for molybdenum. Arkose host rock samples and mineralised quartz vein samples range from <1-3 ppm. Sample A 612/82 collected by B.J. Morris from the No. 1 Open Cut (Fig. 6) assayed 6 ppm Mo but only 0.1 g/t Au and generally there is no correlation between high gold contents and anomalous molybdenum although insufficient samples have been analysed to be conclusive.

Nickel Most types of gold deposits contain trace amounts of nickel. Witwatersrand ores contain nickel in the range 106-158 ppm and Carlin disseminated oxidised ores contain 1.5-500 ppm Ni, (Boyle, 1979).

At Waukaringa values ranged from <5-160 ppm and anomalous values tended to correlate with high gold values, (Townsend, 1969) unlike Orama Hill where there is no correlation between nickel and gold (Scott, et. al., 1985).

Samples of arkose host rock at Mount Grainger range from <5-280 ppm Ni. Quartz vein samples range from <5-2000 ppm Ni and anomalous nickel correlate with high gold values. Sample A 1254/82 of the hanging wall quartz vein assayed 4.0 g/t Au and 710 ppm Ni. Samples A 32/83 and A 33/83 from below water level assayed 20.6 and 19.8 g/t respectively and 190 and 210 ppm Ni respectively.

Lead All types of gold deposits contain lead. In the Carlin deposit, oxidised ores contain<7-200 ppm lead, whereas quartz-pebble conglomerates have an overall lead content of 50 to 450 ppm, (Boyle, 1979).

At Mount Grainger lead values are low with arkose host rock containing <5-55 ppm and quartz veins from <5-35 ppm lead. Average lead content of all underground samples is 10.8 ppm. There is no apparent correlation of anomalous lead values with high gold although sample A 1236/82 from the hangingwall vein in North Medora underlay shaft assayed 35.1 g/t Au and 170 ppm Pb.

Antimony Detection limit of the analytical technique used was 30 ppm and all samples assayed less than 30 ppm Sb. Pyritiferous conglomerate ores of the Rand average 3 ppm antimony. Correlation of results is inconclusive because of the high detection limit.

Scandium

Quartz-pebble conglomerates of the Witwatersrand contain 0.7 to 16 ppm Sc and oxidised ore at Carlin averages 10 ppm Sc, (Boyle, 1979).

At Mount Grainger arkose host rock contain <3-10 ppm and quartz veins contain <3-15 ppm scandium. Highest scandium values show no correlation with high gold values.

Tin Deposits enriched in gold seldom contain appreciable amount of tin and vice versa. Reefs on the Witwatersrand contain 3-6 ppm tin, (Boyle, 1979).

Samples at Mount Grainger generally range from <1-6 ppm tin although two samples from No. 2 level main shaft assayed 10 ppm and one assayed 20 ppm. Sample, A 6/84, in a sublevel below the mainstope assayed 50 ppm Sn with a corresponding gold value of 0.4 g/t Au.

Thorium

Quartz-pebble conglomerate deposits are characterized by enrichments in thorium and reefs in the Witwatersrand contain from 2-130 ppm Th, (Boyle, 1979).

At Mount Grainger only a few samples were checked for Thorium content. Arkose host rock contains <4-14 ppm and quartz veins from <4-18 ppm Thorium. Spotted shale samples ranged from 18-24 ppm Th.

Titanium Quartz-pebble conglomerates contain trace amounts of leucoxene, rutile, sphene, ilmenite and brannerite. Titanium values range from 629 to 2847 ppm in Witwatersrand ores, (Boyle, 1979). Primary ores at Carlin contain from 200-5 000 ppm Ti with no enrichment in oxidised ores.

Mount Grainger arkose host rock samples range from 400-4 000 ppm Ti and quartz vein samples from 200-4 000 ppm Ti and are more akin to disseminated Carlin type replacement deposits than quartz-pebble conglomerate type deposits in the case of this element.

Titanium values for oxidized samples from Alma-Victora mine, Waukaringa, range from 100-4 000 ppm and average 1 765 ppm, (Townsend, 1986). A similar range of values was found in samples at Orama Hill, (Scott, et. al).

Uranium Boyle found uranium values in Witwatersrand reefs ranged from 0.6-1 500 ppm. In Tarkwa, Ghana, quartzites average 0.7 ppm and Elliot Lake, Ontario, ores contain up to 2 000 ppm uranium, (Boyle, 1979).

Uranium was not analysed for at Orama Hill or Waukaringa and values at Mount Grainger ranged from <4-12 and 4-36 for arkose host rock and quartz veins respectively. An insufficient number of samples were collected to be conclusive about any correlation with elevated gold values.

Vanadium

In the quartz-pebble conglomerates of the Rand, vanadium ranges from 15 to 96 ppm apparently mainly in the pyrite and micas (sericite). Oxidised ores such as Carlin average 140 ppm and values range from 50-1 500 ppm V.

Mount Grainger quartz veins contain <20-100 ppm vanadium and arkose host rock samples range from <20-150 ppm vanadium. Spotted shale samples have a slightly higher vanadium content, 100-200 ppm. Anomalous vanadium does not correlate with high gold values.

Yttrium Enrichments of yttrium are common in all types of gold deposits and in Quartz-pebble and associaed quartzite gold deposiits of the Witwatersrand yttrium values range from 10-25 ppm.

Yttrium averages 38 ppm in Alma-Victoria mine and 30 ppm in Balakalva West mine at Waukaringa but does not correlate with high gold values, (Townsend, 1986). Yttrium values range from <10-60 ppm at Orama Hill, (Scott, et. al., 1985).

Mount Grainger samples range from <1-30 ppm for arkose host rock and <1-40 ppm for quartz veins. Higher values were recorded in samples of spotted shale (30-60 ppm Y).

Zinc In Quartz-pebble conglomerates zinc is present in minor amounts ranging from 10-330 ppm but is associated with gold in all types of hypogene deposits occurring as sphalerite.

Zinc values at Mount Grainger range from 2-205 for arkose host rock and 2-1450 for quartz vein samples. Content of the spotted shale is considerably lower, 8-55 ppm Zn. Anomalous zinc values correlate with high gold values, e.g. samples A 32/83 and

A 36/83 assayed 20.6 g/t Au and 8.1 g/t Au respectively and 220 ppm and 180 ppm zinc respectively. A sample of the hanging wall quartz vein in No. 1 level stope, A 1254/82, assayed 4.0 g/t Au, 210 ppm Cu, 100 ppm Zn, 890 ppm Co, 240 ppm As and 3 ppm Ag.

Selenium Quartz-pebble conglomerates of the Rand contain from 1-2 ppm Se and oxidised ores from Carlin, Nevada, contain <1-40 ppm Se. Selenium follows sulphur closely in nature and most types of gold deposits contain selenium values. Several samples of ore from below the water level at Mount Grainger were analysed for selenium and values range from <1-5 ppm the highest value corresponding with a high gold value, 20.6 g/t.

Mercury In all types of hypogene gold deposits mercury is a common associate but is usually present in amounts less than 1 ppm. Witwatersrand ores show an enrichment in mercury ranging from 0.130 to 3.28 ppm. Mercury content of oxidised ore from Carlin range from 0.2-130 ppm and primary ores range from 0.4-453 ppm, (Boyle, 1979).

At Mount Grainger, samples were submitted for mercury analysis. Eight samples from below water level, A 30/83 - A 37/83 ranged from <0.05-0.50 ppm Hg and are considered anomalous. Highest mercury values did not correlate with the highest gold values, (Table 34).

Thallium

Most gold deposits containing sulphides and sulphosalts also contain thallium as a trace element. Quartz-pebble conglomerates of the Witwatersrand contain less than 1 ppm Tl. Samples collected by Dr R. Marjoribanks were analysed for Titanium and mistakenly entered under Tl. Results indicated Thallium could be a useful pathfinder. However, samples from Mount Grainger all assayed less than 10 ppm, the detection limit of the analytical technique.

Water Analysis

A sample of water was collected from the main shaft after pumping for approximately one hour. Water analysis report and assay results are contained in Appendix Y.

Water from the shaft is slightly brackish, very slightly alkaline and all metals analysed are below drinking water standards, except for fluoride content at 1.40 mg/L which is slightly above recommended drinking water level of 1.0 mg/L. Quality of the water is suitable for stock drinking and is adequate for ore processing.

TABLE 49

Comparison of Elements from Quartz Pebble Conglomerate Gold Deposits with Mongolata, Waukaringa, Orama Hill and Mount Grainger

ELEMENT	GIANTS REEF WITWATERSRAND SOUTH AFRICA	SUB-NIGEL-KIMBERLEY REEF, WITWATERSRAND SOUTH AFRICA	WALKOM BASAL REEFS, WITWATERSRAND SOUTH AFRICA	TARKWA GHANA	ELLIOT LAKE ONTARIO	CARLIN - NEVADA (OXIDISED ZONE)	MONGOLATA CRA DIAMOND DRILL HOLES	WAUKARINGA ORE SAMPLES	ORAMA HILL FERRUGINOUS ZONE	ORAMA HILL QUARTZ VEIN	MT. GRAINGER HOST ROCK ARKOSE
Ag	1.6	2.7	8.6	0.2	2.3	1-2	<1-19	<1-8	<0.1-3.0	<0.1-6.0	<1-3
As	13600	108	216	3	28	40->3000	<20-370	<20-6600	<50	<50	<20-120
Au	4.35	300	98	11.0	0.090		<0.005-1.84	.03-99.0	0.02-11.7	0.02-3.54	<0.01-28.0
Ba	330	<50	<50	1050	410	2300	200-600	200-10000	<200-5000	<200-1000	<200->10000
Be	3.5	<2	<2	<2	<2	<1-3	1-3	1-2	<1-2	<1	<1-2
Bi	not found	2.2	1.7	not found	43	N.L.	<10	20-50	<1	<1	<1-10
Cd	2	0.7	0.3	<0.5	1	5-60	<1	<1	-	-	<1
Co	37	59	102	16	57	2-150	<5-56	5-600	<5-300	<5-800	<5-1100
Cr	585	710	705	29	4	7-200	<10	<10-100	<20-150	<20-80	<10-20
Cu	137	110	86	10	100	35	6-1700	12-3020	10-6800	3-8000	2-550
Ga	5	5	2	5	8	<2-30	1-15	N.A.	N.A.	N.A.	<1-10
Ge	0.8	1.3	<0.7	<0.5	<0.5	N.L.	N/D	N/D	<1-1	<1-1	<1
In	<1	<1	<1	<1	<1	N.L.	N/D	1	N.A.	N.A.	<1
Mo	3	2.5	2.5	1	11	<2-100	1-5	4-60	20	15	<1-3
Ni	111	106	158	8	45	1.5-500	6-320	<5-160	20-200	15-200	<5-280
Pb	51	96	450	7	535	<7-1500	<5-18	<5-310	21	6	<5-55
Sb	2	3	3.5	2	1	5-450	N.A.	N/D	N/D	N/D	<30
Sc	16	0.7	10	10	10	8	3-30	3-10	3-40	3-15	<3-10
Se	2	1.5	1	N/D	3	<1-40	N.A.	N.A.	N.A.	N.A.	NA
Sn	3.5	5.5	5.0	2.0	3.0	<7-20	1-4	N/D	3	1	<1-6
Te	<0.2	0.4	0.2	<0.2	0.7	0.2-0.6	N.A.	N.A.	N.A.	N.A.	<20
Th	2	15	130	27	435	N.L.	<4-16	N.A.	N.A.	N.A.	<4-14
Ti	2847	629	839	2877	1468	200-5000	700->10000	100-4000	300->10000	<100-3000	400-4000
U	0.6	167	1500	0.7	2000	N.L.	<4	N.A.	N.A.	N.A.	<4-12
V	96	18	15	22	2	50-1500	80-200	80-40	40-400	10-150	<20-150
Y	10	14	25	9	70	enriched	10-400	10-200	<10-60	<10-60	<1-30
Zn	300	330	132	11	10	N.L.	8-1400	6-1000	<20-610	<20-200	2-205

NOTES

N.L. = Not Listed.
N/D = Not detected.
N.A. = Not Analysed.

Waukaringa data (Townsend, 1986).
Orama Hill data (Scott, et. al., 1985).
Mongolata data (Dubowski - not reported).
Mount Grainger data (Horn, 1987).
Other gold deposit data (Boyle, 1979).
Shale and Sandstone Average Values (Hawkes and Webb, 1962).

MT. GRAINGER QUARTZ VEINS	MT. GRAINGER REGIONAL	MT. GRAINGER SPOTTED SHALES	AVERAGE VALUES SANDSTONE	AVERAGE VALUES SHALES
<1-4	<1-4	<1	0.4	N.L.
<20-460	<20-80	<20-80	<50-200	4
<0.01-10.8	<20-20	<0.01-0.1	0.03	0.01-1.0
<200-8000	<200-1000	200-1500	100-500	300-600
<1-2	N.A.	2-3	<1-3	<1-6
<1-100	N.A.	<1	<1-2	0.3-1
<1-1	<1	<1	N/D	0.3
6-7400	<5-110	6-90	1-10	10-50
<10-60	<10-80	<10-10	10-100	100-400
2-1400	2-465	30-120	10-40	30-150
<1-10	N.A.	<1-15	N.L.	N.L.
<1	N.A.	<1	N.L.	N.L.
<1	N.A.	<1	N.L.	N.L.
<1-3	<1-4	<1-3	0.50-80	1.0
<5-2000	10-90	10-100	2-10	20-100
<5-170	<5-14	<5-22	<1-255	10-40
<30	<30	<30	<30	<30
<3-15	N.A.	2-20	N.L.	N.L.
<1-6	N.A.	N.A.	1.0	0.5-1
<1-6	N.A.	<1-1	<1-10	40
<4-18	<4-76	18-24	N.L.	N.L.
<20	<20	<20	N.L.	N.L.
200-4000	N.A.	200-1000	3000	4400
4-36	<4-6	6-10	0.45	4.1
<20-100	N.A.	100-200	10-60	50-300
<1-40	N.A.	30-60	N.L.	N.L.
2-1450	6-1060	8.55	5-20	50-300

DRILLING

Between 11.7.84 and 19.7.84 Abignano Limited drilled 537 metres in ten reverse circulation percussion drillholes. Drillhole line spacing was approximately 180 metres and two holes, one vertical and one at 60°, were drilled at each of five location (Figs. 6, 7 and 8).

Field logs of these holes are contained in Appendix Z and sample weights and gold assays in Appendix AA. Figures 38 to 42 show sections through the drillholes.

Best Intersections obtained were:

TABLE 50

Summary of Best Mineralised Reverse Circulation Drillhole Intersections

Hole No.	Interval (m)	Assay g/t Au
2	29-30	0.16
2	35-36	0.20
4	40-46	0.21
7	16-19	0.12
8	25-27	0.18
9	31-33	0.23
10	19-20	0.16
10	39-40	0.10

Abignano Limited requested AMDEL to carry out a bulk cyanide leach on selected assay sample remnants because of an apparent lack of consistency in gold values. Procedure and results are outlined in Appendix BB. Gold assays of gravity concentrate, cyanide leach residue and cyanide solution were used to calculate a head assay of 0.12 g/t Au for the bulk sample. This compared with 0.04 g/t Au for the weighted average of all samples included in the bulk.

P. Capps (AMDEL) who carried out the bulk cyanide leach and assays suggested that if a large proportion of gold was present as coarse grains there could be significant assay discrepencies, a point emphasized by Burn (1984). However, gravity concentrate from the bulk of the reverse circulation drillhole samples contained only 0.3% of the gold at a grade of 5.1 g/t, indicating that a small proportion of the gold occurred as coarse grains.

EXPLORATION POTENTIAL

The potential for an economic, epigenetic stratabound ore deposit at Mount Grainger mine has been significantly downgraded.

Further mapping and sampling may delineate zones of more intense fracturing or alteration, which could represent small discrete ore shoots similar to those previously mined.

Sampling of quartz vein sets for gold, arsenic, copper and cobalt would be useful in determining mineralised and barren sets and assist in delineating ore zones which may be amenable to mining and treatment by a small syndicate.

Additional bulk sampling is required to resolve the apparent lack of correlation between channel samples and bulk samples. However, it is considered unlikely that a large, low-grade, orebody amenable to open cut operations exists within Mineral Leases 4830, 5011, 5017 and 5018 at Mount Grainger.

Potential does exist at Dustholes mine for an economic, stratabound orebody and a program of bulk sampling is recommended. Sandstone-quartzite beds in Appila Tillite elsewhere in the eastern margin of the Adelaide Geosyncline are considered favourable for gold mineralisation, particularly where the unit is traversed by deep seated, penetrative fracture zones.

CONCLUSIONS

Channel sampling of trenches and open cuts excavated by the lessee and sampling of holes drilled by Abignano Limited have failed to establish any mineable ore reserves. Sampling has confirmed that anomalous gold values occur throughout the sandstone/arkose unit at the base of Appila tillite and within sandstone and quartzitic units throughout the tillite.

Although ore grade values encountered in channel samples were infrequent and sporadically distributed, bulk samples tested at Peterborough State Battery indicated that recovery of 1.0 to 2.0 g.t gold bullion from sandstone at the base of Appila tillite is possible. Clearly the best grades are obtained in material 1 to 2 m below the hanging wall quartz vein (1.0 to 2.0 g/t Au). Overall the arkose unit is of a lower grade (0.2 to 1.0 g/t Au).

Sub-economic mineralisation has been deomonstrated over a strike length of 700 m, down dip for 66 m and over a width of 10 m. Drillhole and open cut spacing effectively eliminates the possibility of locating a sizeable ore deposit amendable to open pit mining.

Small, discrete alteration zones and ore shoots containing a few thousand tonnes of moderate to low grade ore could be delineated but would require an intensive drilling program, surface trenching and costly underground exploration and development.

Bimodal distribution of gold particles was originally thought to be the main factor contributing to discrepancies between channel samples and bulk samples treated at Peterborough Battery. Apparent lack of correlation between channel samples and bulk sample results could possibly be due to the "nugget" effect caused by supergene enrichment of native gold on fractures and in cavities (Plates 31 and 32). However, the author firmly believes battery contamination is responsible.

Contamination of bulk parcels treated at Peterborough is evident from sampling of feed material to, and discharge from the battery box. Further sampling showed reduction in grade as successive parcels were treated. Considerable discrepancy between AMDEL sub-sampling and testing at Peterborough of bulk samples also supports battery contamination. Further bulk sampling is required if necessary to confirm the encouraging results obtained between 1961-1983.

Bullion from bulk sampling rarely contains more than 85% Au and can be as low as 34%. Bullion weights recorded in the battery book for parcels 1592 to 1598 are incorrect as the weights were significantly reduced after the buttons had been quenched in acid.

Analytical errors are not considered to be a problem. AMDEL results are considered to be reliable. Check samples sent to Comlabs showed good correlation as did check samples re-submitted to AMDEL.

Important features of the Mount Grainger gold mineralisation are:

- Fluid influx appears to have been via major deep seated fractures adjacent to the gold occurrence and epithermal feeder veins may exist at depth.
- Fracturing of the competent host rock during folding permitted access of auriferous bearing fluids and emplacement of veins in joints and folds.
- Fluid inclusion studies indicate that moderate to high temperature, high salinity and CO_2 rich fluids introduced the mineralisation.
- Alteration of host rock (sandstone) is widespread and consists of kaolinisation and silicification, and the presence of hematite, pyrite and biotite or sericitie. Carbonate is also present but not abundant in the specimens examined petrographically.
- Gold occurs as inclusions in pyrite and chalcopyrite, as coarse free-milling gold and in secondary iron oxides.
- Analyses of the gold contents in various size fractions indicates a bimodal distribution of gold with one population in the 75 micron range and a second population in the 1 000 to 2 500 micron range.
- Anomalous gold values correlate with anomalous copper, zinc and cobalt. Arsenic is generally low but becomes slightly elevated in the presence of gold. Silver is usually <1.0 ppm but may be elevated where higher gold values occur.

- Gold content appears to be highest where hydrothermal alteration (silicification and sericitization) is most intense and shows a strong spatial relationship with the more pyritic zones.
- Variations in thickness of the basal sandstone unit is evident along its entire exposure and could be due to infilling of channels and scours on the unconformable contact with the Burra Group sedimentary sequence.
- Drag folding or a possible fault zone occurs in the creek south of North Medora Underlay where displacement of the sandstone unit is up to 50 m. Silicification and sericitic alteration suggests this area warrants further exploration.
- While quartz vein sets in the stockwork are numerous, not all are gold bearing. Veins are both concordant with and perpendicular to bedding and there appears to be no preferred orientation of mineralised veins. Further investigation is required.
- A possible ore shoot 20 m below No. 2 level has been indicated by underground sampling in a sub-level. Alteration in the stope on No. 2 level drive north is not considered to be the same ore shoot as mined in the Main Stope. It is possibly linked with the high gold values occurring in the sub-level below No. 2 level.

RECOMMENDATIONS

Additional bulk sampling is recommended to further test the basal sandstone unit of Appila Tillite without the apparent contamination effects at Peterborough Battery.

Trenching and bulk sampling is recommended at the following locations:

Figure 6:-

- 45 m north of Orroroo Treasure Underlay - zone of silicification adjacent to a fault.
- 55 m north of South Medora Underlay - zone of ferruginous quartz and silicification.
- 15 m north of Survey Station MG 3 - zone of silicification alteration and ferruginous quartz.

Figure 7:-

- 20 m north of Trench 1, old trench to be re-excavated and extended.
- 60 m along strike toward old main shaft from No. 3 Open Cut, adjacent to collapsed underlay.

Figure 8:-

- Heather Bell workings - N.E. corner of ML 4830, near sample A 2271/82.
- 15 m north of Trench 16 - zone of silicification in arkose.
- 85 m north along strike from Main Underlay shaft - adjacent to old trench and shallow, collapsed underlay.
- 170 m north along strike from Main Underlay Shaft - adjacent to old open cut.

Bulk samples should not be less than ten tonnes and to reduce possible contamination a bulk of twenty tonnes of totally unmineralised material, e.g. creek gravel, should first be run through the battery.

As a further check on contamination the following is recommended:

- Regular collection of head samples including separate samples *fed to and dishcarged from* the battery box.

- Collection of a 20 kg grab sample of ore feed for bulk cyanide leach.
- Use fresh clean mercury on the plates and in the box.
- Mill and amalgamate strake concentrates and include amalgam in the smelt.

Underground exploration development is recommended by driving No. 2 level south toward North Medora Shaft, maintaining the drive in the middle of the sandstone unit, with appropriately spaced cross-cuts to expose the footwall and hanging wall. This would provide bulk samples for testing and could possibly locate en-echelon ore shoots similar to that mined in Main Stope.

An angled diamond drillhole sited to test for a possible down plunge ore shoot extending from No. 2 sub-level is recommended and should be planned to intersect the sandstone unit and ore shoot at No. 3 level. Core obtained could be useful for sulphur isotope, fluid inclusion and trace element geochemistry studies.

Sampling of quartz veins for Au, Cu, Co and As to distinguish between mineralised and barren sets is recommended.

Additional particle sizing analyses are required to confirm or disprove the bi-modal nature of gold particles.

Prospecting of other quartzite/sandstone fluvioglacial units adjacent to identified deep seated fractures or lineaments in the Adelaide Geosyncline is recommended.

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DEPARTMENT OF MINES AND ENERGY
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REPT.BK.NO. 87/109
GEOLOGICAL INVESTIGATIONS AND EXPLORATION ACTIVITIES 1982-1986 AT MOUNT GRAINGER GOLDMINE, HUNDRED COGLIN, COUNTY HERBERT

GEOLOGICAL SURVEY

VOLUME 2 (OF 2)

by

C.M. HORN
MINERAL RESOURCES

SEPTEMBER, 1987

DME.265/82

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Secs 180 and 183 Hd. Coglin
Section Through Reverse Circulation
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43. Mount Grainger Goldfield Nackara Arc Landsat Photo Lineaments and Geology. 87-448

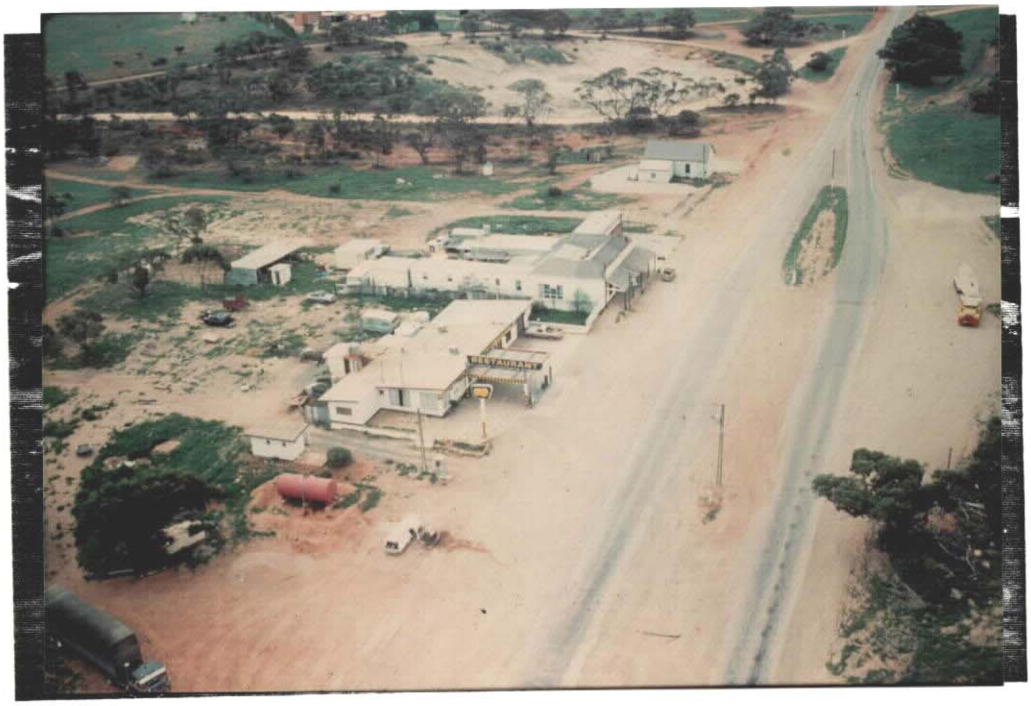

PLATE 1. Township of Oodlawirra, Located on the Barrier Highway 260 km north north-east of Adelaide. Slide No. 36055

PLATE 2. Aerial View of Mount Grainger Mine. (a) Main Shaft (b) Cooks Blow (c) South Medora Mine (d) Buttermuck Well (e) golden Junction Mine. View Looking South Towards Oodlawirra.

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PLATE 3 Aerial View of Mount Grainger Main Shaft, Old Battery Site and Tailings Dumps. Slide No. 36057

PLATE 4. Aerial view of Backhoe Trenches excavated near North Medora Shaft, located just off left hand side of photo. No. 3 Open Cut can be seen at centre right. Slide No. 36058

PLATE 5. Excavating Trenches for Sampling at North Medora.
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PLATE 6. Screening bulk sample from No. 2 Open Cut at North Medora prior to treatment at Peterborough State Battery.
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PLATE 8. No. 2 Open Cut. Channel sampling quartz veins using a Kango Hammer. Slide No. 36062

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PLATE 14. Boulder tillite beds in wall of cut around the main shaft exhibit a good sequence of graded rhythms.

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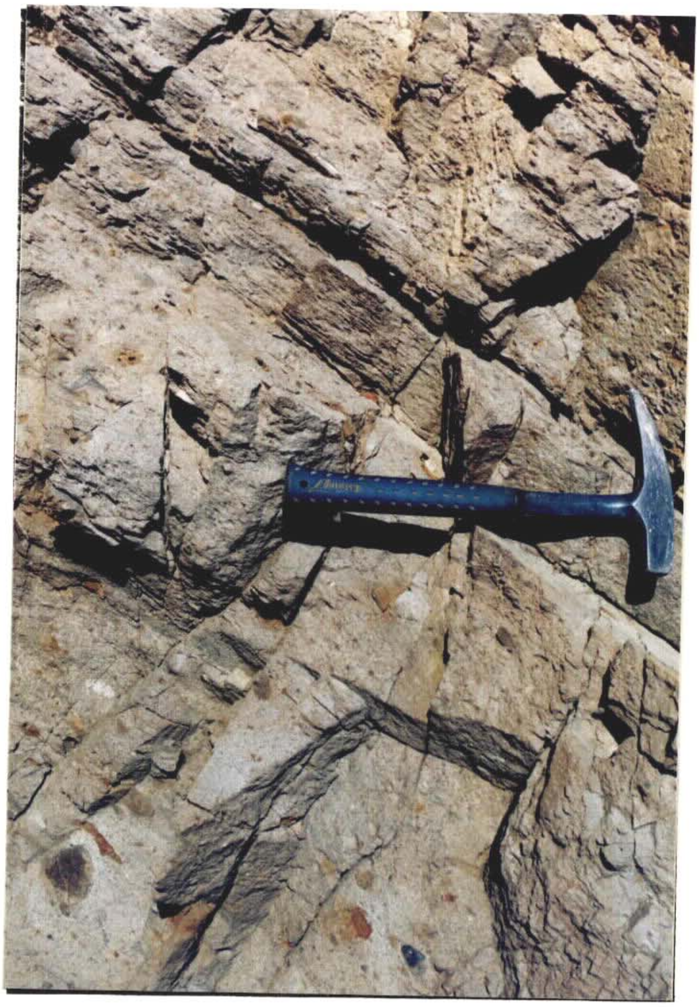

PLATE 15. Boulder tillite exhibits graded rhythms.

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PLATE 16. 'Spotted' Siltstone with spots after carbonate and/or pyrite. Beside track to Old Main shaft.

Slide 36070

PLATE 17. North East wall of No. 2 Open Cut showing main quartz vein sets in arkose unit. Slide No. 36071

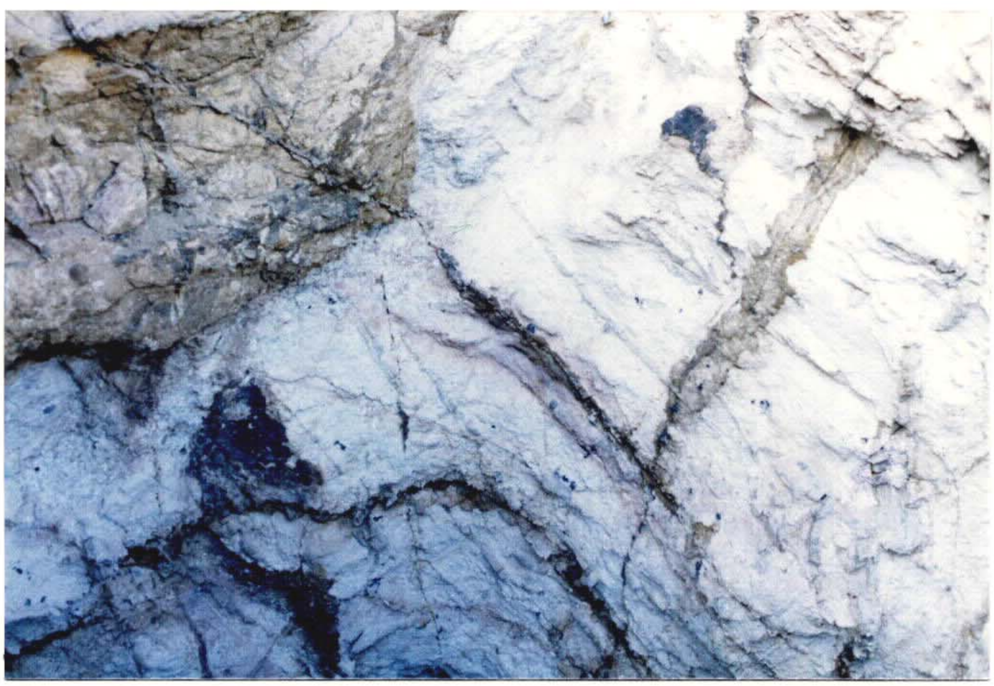

PLATE 18. Quartz vein stockwork in bleached arkose and pinkish sandstone. Note irregular displacing joints, fractures and stringers with iron oxides penetrating into the overlying siltstone. No. 2 Open Cut. Slide No. 36072

PLATE 19. Transgressive quartz veins in Burra group Siltstones have been mined in the Main Jones Shaft Underlay. Location of quartzite outlined by dashed line. Slide No. 36073

PLATE 20. Vertical quartz-ironstone veins cutting Burra group shales at Jones Shaft South workings. Slide No. 36074

PLATE 21. 'spotted' Micaceous Siltstone with minor ferruginous quartz veinlets. Immediately above hanging wall contact of arkose, No. 2 Level Main Shaft. Petrographic specimen RS 40 (Appendix N). Slide No. 36075

PLATE 22. Silicification and sericitic alteration and iron oxides in arkose No. 2 Level Main Shaft. Parcel 1594 of 7.0 tonnes treated at Peterborough State Bettery consisted of this material. Slide No. 36076

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PLATE 26. Quartz vein stockwork in basal arkose of Appila tillite. Anastomosing of vein sets and irregular disruptive cross fractures is evident. North Medora Underlay Shaft.

Slide No. 36080

PLATE 27. Unconformable contact between Burra Group shale (RHS) and basal arkose Appila tillite. No. 2 Level Main Shaft.

Slide No. 36081

PLATE 28. Wedge of basal arkose, Appila Tillite, into Burra Group Shale, evidence for an unconformable contact. No. 2 Level Main Shaft.

Slide No. 36082

PLATE 29. Hanging Wall contact between arkose and siltstone in North Medora Underlay Shaft. Note apparent displacement of HW vein by veining in the Arkose.

Slide No. 36083

PLATE 30. Entrance to South Medora Underlay shaft. Hanging Wall contact between Arkose and Siltstone is shown by the dashed line. A steeply dipping fault or joint is evident on the RHS of the shaft together with minor jointing and veining.

Slide No. 36084

PLATE 31. Free Gold (circled) in limonite in sericitic sandstone. Slide No. 36055

PLATE 32. Sample of quartz ironstone vein from South Medora shaft showing free gold (circuled). Supergene enrichment.

Slide No. 36056

APPENDIX A

Analytical, Petrographic and Mineragraphic Data for Twelves Samples Collected by B. Morris, SADME, 1976. Extracted from AMDEL Report GS 1/1/176 by Dr K.J. Henley.

APPENDIX A

Petrographic, Mineragraphic, Analytical and Fluid Inclusions Data from Twelve Samples collected by B. Morris, SADME, 1976. Extracted from AMDEL Report GS 1/1/176 by Dr. K.J. Henley.

Introduction

Twelve samples were collected by Mr Morris from the Mount Grainger Gold Mine (P1824/76 - 1835/76). Most of these were from the 220 ft level (P1824/76 - P1832/76), one was from the 120 ft level (P1883/76) and two were from the entrance to Mount Grainger stope on the eastern side of the hill (P1834/76, P1835/76).

The ore veins are quartz intergrown with secondary iron oxides and these occur in poorly sorted micaceous/argillaceous quartzite (described by Mr Morris as an arkosic sandstone). Tillite is also stated to be present. Some hydrothermal alteration of the country rock has possibly taken place, with the development of muscovite aggregates, and such aggregates also occur in the veins.

On the 220 ft level Mr Morris notes that the ore zone appears to lie between 10 m and 21 m along the level, and between 19.5 m and 21 m the drive has been stoped on both sides. Tillite is stated to start at 10 m and change to arkosic sandstone at 25 m.

On the 120 ft level Mr Morris notes that the bedding strikes at 50° and dips 67° west; the ore zone is in tillite and contains veins of quartz and iron oxides mainly striking 65° and dipping 35° south.

At the entrance to the Mount Grainger vertical shaft (on the west side of the hill) the country rock is stated to be tillite striking 20° and dipping 55° west. At the entrance to the Mount Grainger stope on the eastern side of the hill the country rock is stated to be arkose, striking 220° and dipping 68° west. Several quartz veins 1 - 2 cm wide occur here, striking 264° and dipping 54° south along a joint direction.

Analytical Data

Analytical data on the Mount Grainger vein samples are given below. These show that none of the vein samples collected contain more than 0.3 ppm gold and most contain less than 0.1 ppm gold. Silver is present to the extent of <1 ppm in all samples and copper and lead occur in traces (≤70 ppm) only. zinc ranges up to 1500 ppm, barium up to 800 ppm and manganese up to 3000 ppm in different samples. Arsenic is <50 ppm in all samples.

ANALYTICAL DATA (ppm) ON HAND SPECIMENS FROM
THE MT. GRAINGER GOLD MINE (P1824/76-P1834/76)

ment	Detection Limit	P1824 /76	P1826 /76	P1827 /76	P1828 /76	P1829 /76	P1831 /76	P1833 /76	P1834 /76
u *	(0.005)	0.015	0.070	0.2	0.090	0.020	0.015	0.060	0.3
g *	(1)	X	X	X	X	X	X	X	X
g	(0.1)	X	X	0.2	X	0.1	0.3	X	0.8
s	(50)	X	X	X	X	X	X	X	50
a	(200)	300	X	800	X	X	X	500	700
i	(1)	X	X	X	X	X	X	X	3
d	(3)	X	X	X	X	X	X	X	X
r	(20)	80	50	70	50	50	50	70	50
u	(1)	30	10	5	30	30	50	30	70
n	(10)	3000	200	2000	200	150	300	1000	200
o	(3)	X	X	X	X	X	X	X	X
i	(5)	50	X	50	100	10	100	100	100
b	(1)	30	10	3	10	3	1	3	10
b	(30)	X	X	X	X	X	X	X	X
	(10)	80	30	100	70	70	50	70	70
n	(20)	100	1500	100	700	100	30	300	X

X = Not detected at detection limit quoted.

* = By fire assay; all other determinations by emission spectrography.

Petrographic and Mineragraphic Descriptions

Sample: P1824/76, Y1 (0.015 ppm Au)

Description:

220' level, 5 m along drive. A major set of quartz veins strikes at 262^o and dips 35^o south; this is also a major jointing direction. Quartz vein with iron oxides.

Hand Specimen:

This sample consists of fragments up to 5 cm in size of vein quartz coated and intergrown with iron oxides. Some fragments of country rock are also present. The quartz shows some evidence of fracturing and iron oxide coated vugs are locally present where the pre-existing mineral has been leached out (?pyrite or carbonate).

Thin Section: (TS37625)

This section consists almost entirely of coarse-grained vein quartz, the individual crystals of which range from 2 to 5 mm in length and many of which show variable density of inclusions. Fracturing is evident in the quartz and locally there are areas which are relatively free of fluid inclusions. The quartz shows strained extinction but, apart from this, there is no evidence of marked deformation. About 5% of the area of the section is occupied by what was originally a carbonate patch up to 3 mm in size but which has been altered to goethite and replaced by silica, such that it now consists of fine-grained silica in between a meshwork of goethite. However, the outline and form is very typical of pseudomorphs after carbonate .

Sample: P1825/76, Y2 (not analysed)

Description:

220' level, 5 m along drive. Country rock with quartzite on lower side of vein Y1 for 15 cm.

Hand Specimen:

This sample consists of several fragments of country rock up to 10 cm in size, one of which has a narrow selvedge of quartz vein. The country rock appears to be a pinkish-white quartzite and shows evidence of iron staining and local segregations of quartz-rich material. The thin section was cut to show the junction between the quartz vein (Y1) and the quartz-rich country rock.

Thin Section: (TS37626)

This section contains the junction between quartz vein and country rock . The quartz vein contains quartz crystals up to 1-2 mm in size. The country rock consists of a poorly-sorted sandstone to siltstone, the grain size of the detrital fragments varying in different bands and, in some cases, ranging up to quite coarse. The average size of the detrital grains in the sandy parts is 0.1 - 0.2 mm but one grain up to 1 mm in size is present; these grains are surrounded by a matrix of very fine-grained silica-clay. Elsewhere much finer-grained siltstone is present, with the average size of the detrital grains being around 50µm. The section also contains a large, irregular ?fragment of coarsely intergrown quartz and sericitized plagioclase feldspar; this possibly represents a fragment of leucocratic igneous rock. Narrow quartz veins transect both the leucocratic rock and the siltstone.

Sample: P1826/76, Y3 (0.070 ppm Au)

Description:

220' level, 5 m along drive. Other dominant set of quartz veins, strike 10°, dip 36° east. Quartz vein plus iron oxide and arkosic country rock.

Hand Specimen:

This sample consists of fragments up to 15 cm in size composed of pinkish arkose which is transected by several quartz veins which range in thickness up to 5 cm and which pinch and swell. The quartz is white in colour and contains vugs now filled with friable porous iron oxides. There is some indication of the quartz crystals composing the vein growing perpendicularly from the vein wall.

Thin Section (two thin sections were cut across the veins):

TS37627A:

This section contains a junction between a coarse vein and the country rock. The vein quartz forms elongate crystals up to 2-3 mm long which grow perpendicular to the junction with the country rock and which show abundant evidence of strained extinction and deformation lamellae . A minor amount of carbonate (?dolomite) is intergrown with the quartz in the vein.

The country rock is a poorly-sorted sandstone, consisting of sub-angular to sub-rounded grains of quartz, feldspar and lithic fragments in a fine-grained matrix of quartz, carbonate, goethite and sericite. The detrital grains range up to several millimetres in size and show evidence of dissolution by the matrix, with serrated and irregular margins.

TS37627B:

This section resembles TS37627A, and consists of country rock transected by veins of quartz intergrown with minor carbonate.

Sample: P1827/76, Y4 (0.2 ppm Au)

Description:

220' level, 12 m along drive. Quartz veins in southerly dipping set; quartz and iron oxide.

Hand Specimen:

This sample consists mainly of one fragment of about 20 cm in size which is composed largely of pinkish arkosic country rock and shows iron staining on the surface. Along one margin of this fragment is a quartz vein with porous friable iron oxide filled cavities and vugs. Thin sections were cut across the vein/country rock contact and also across the vein.

Thin Section (two thin sections were cut from this sample):

TS37628A:

This section contains vein quartz in which the quartz crystals show elongate intergrowths, the individual crystals being up to several millimetres long. The quartz shows considerable evidence of deformation with strained extinction, local development of serrated margins and deformation lamellae. Minute inclusions are finely disseminated through much of the quartz in an irregular fashion, in places related to sub-grain boundaries.

TS37628B:

This sample of country rock consists essentially of subrounded, subangular and angular quartz grains up to 0.4 mm in size, in a matrix of fine-grained silica and sericite. There is some evidence of reaction of the matrix with the quartz grains. A minor proportion of rock fragments are present; sericite occurs in aggregates of radiating flakes, ranging in size up to several millimetres. Locally goethite staining is present and forms part of the matrix cemented to the quartz grains.

<u>Sample: P1828/76, Y5 (0.090 ppm Au)</u>

Description:

220' level, 20 m along drive. Quartz plus iron oxide plus manganese oxide pods with hydrothermally altered country rock (sericitic?).

Hand Specimen:

This sample consists of irregular pods up to 10 cm in size of dark reddish-brown iron oxide rich material or brownish-black ?manganese oxide rich material in a friable matrix of micaceous country rock (?hydrothermally altered). The thin section was cut from one of the larger brownish-red pods.

Thin Section: (TS37629)

This section was cut from one of the dark brown nodules and appears to consist essentially of goethite intergrown with micaceous minerals; the individual aggregates of goethite are up to several millimetres in size. The mica forms radiating aggregates of flakes (rosettes) surrounded by goethite.

<u>Sample: P1829/76, Y6 (0.020 ppm Au)</u>

Description:

220' level, 21 m along drive. Vein quartz plus iron oxide with some sericitization.

Hand Specimen:

This sample consists of irregular fragments up to 7 cm in size of vein quartz which varies from massive to vuggy and in places shows textures suggestive of dissolution of pre-existing ?carbonate minerals. A small amount of country rock is present and the contact between the quartz and the country rock is sharp.

Thin Section (two thin sections were cut from this sample):

TS37630A:

This section consists almost wholly of coarse vein quartz. The quartz crystals are up to several millimetres in size and do not display marked elongation. However, they commonly show strained extinction and in places have recrystallized to a fine-grained mosaic due to deformation. Fluid inclusions are abundant but irregularly distributed. A minor amount of muscovite is present as sheaves and radiating aggregates intergrown with the quartz in cavities and locally with goethite pseudomorphs after pyrite up to 2 mm in size. Such muscovite also coats one surface of the quartz. It appears likely that this muscovite is of hydrothermal origin and was deposited with or slightly later than the quartz.

TS37630B:
This section contains vein quartz which shows abundant evidence of strain, with the development of strained extinction and deformation lamellae . Fluid inclusions are common but irregularly distributed. One corner of the section consists of an intergrowth of randomly-oriented muscovite flakes and quartz, but it is not clear whether this represents part of the vein system or an inclusion of country rock, although the former interpretation seems more likely.

Sample: P1830/76, Y7 (not analysed)

Description:
220' level, 21 m along drive. Country rock up to 15 cm below vein (Y6); ?tillite, ?arkosic. Ore zone appears to be between 10 and 21 m; between 19.5 m and 21 m the area has been stoped both sides of the drive. The tillite starts at 10 m and changes into an arkosic sandstone at 25 m along the drive.

Hand Specimen:
This sample consists of several fragments up to 15 cm in size of a variably brownish stained sandstone or arkose. A quartz vein up to 0.3 cm in width transects the country rock and there are also a small number of thinner quartz veins transecting the country rock.

Thin Section: (TS37631)
This section consists of a poorly-sorted sandstone composed of subrounded, subangular and angular grains of quartz in a matrix of clay, fine-grained quartz, muscovite and goethite. The size of most of the quartz grains is in the range 0.2 to 0.5 mm, but grains up to 1 mm in size are present. Aggregates of randomly-oriented muscovite flakes are present, as observed in other samples in this suite. There is no obvious preferred orientation of any of the components. Opaque grains are distributed sporadically through the rock.

Sample: P1831/76, Y8 (0.015 ppm Au)

Description:
220'level, 32 m along drive. Quartz and ironstone veins 2 cm wide. Strike 140°, dip 75° north.

Hand Specimen:

This sample is composed of fragments up to 5 cm in size of vein quartz with intergrown iron oxides. In most fragments iron oxides are in the minority but in some they constitute up to half of the fragments. The iron oxides range from hard massive brownish-black material to porous friable goethitic material.

Thin Section (two thin sections were cut from this sample):

TS37632A:

This section consists almost entirely of vein quartz. The quartz forms elongate and equant crystals which commonly show strained extinction and recrystallization due to deformation. Fluid inclusions are abundant but irregularly distributed. Traces of muscovite are intergrown with the quartz as radiating aggregates and are commonly associated with goethite.

TS37632B:

This section resembles TS37632A in consisting almost entirely of vein quartz; however, it does also contain goethite pseudomorphs after pyrite intergrown with the quartz and these are up to 4 mm in size . Some of the quartz crystals in this section show very little evidence of strained extinction but most commonly they are strained and in part recrystallized.

Polished Section: (PS25484)

The polished section consists of about 95% quartz with 5% goethite/hematite and less than 1% pyrite. The quartz shows irregular fractures and the goethite/hematite occurs as pseudomorphs after pyrite up to 1 mm in size mainly in one stringer. Pyrite shows partial to complete alteration to goethite/hematite. No native gold was observed.

Sample: P1832/76, Y9 (not analysed)

Description:

220'level, 32 m along drive. Country rock 0-15 cm below vein; arkosic sandstone.

Hand Specimen:

This sample consists of several fragments up to 20 cm in size of massive to slightly fissile arkosic sandstone which ranges in colour from white through to brown due to irregular iron staining.

Thin Section: (TS37633)

This sample is a poorly-sorted sandstone consisting of about 60% detrital grains and 40% matrix. The detrital grains are predominantly quartz but minor proportions of micaceous fragments, chert and quartzite are also present. The grains are angular, subangular and subrounded, and are commonly in the size range 0.2 to 0.6 mm with some grains up to 1.2 mm in size. The matrix consists mainly of clay with subsidiary muscovite, fine-grained quartz and goethite. A vein of goethite transects the rock and shows well-developed banded growth textures reminiscent of carbonate and it is possible that this represents replaced original carbonate. The vein is about 0.4 mm wide.

<u>Sample: P1833/76, Y10 (0.060 ppm Au)</u>

Description:

120' level; bedding strike 50°, dip 67° north. Ore zone in tillite containing quartz and iron oxide veins mainly striking 65° and dipping 35° south. Quartz and iron oxide.

Hand Specimen:

This sample consists of fragments up to 5 cm in size of quartz vein containing vugs filled with porous limonitic iron oxide locally showing textures suggestive of dissolution of pre-existing carbonates. The quartz locally contains cavities. Some fragments of iron oxide-rich material are present also.

Thin Section: (TS37634)

This section consists entirely of vein quartz with the quartz crystals ranging up to about 5 mm in size. The quartz contains abundant but irregularly distributed fluid inclusions and shows strained extinction and local recrystallization due to deformation, together with deformation lamellae.

NOTE:

At entrance to Mount Grainger vertical shaft country rock is tillite with strike of 20°, dip 55° west, i.e. on western side of hill.

<u>Sample: P1834/76, Y11 (0.3 ppm Au)</u>

Description:

Entrance to Mount Grainger stope on eastern side of hill. Vein quartz parallel to country rock (5 cm wide). Country rock is arkose striking 220° and dipping 68° west.

Hand Specimen:

This sample consists of fragments up to 8 cm in size of white to colourless vein quartz which is locally intergrown with massive goethite (?pseudomorphs after pyrite) and more porous limonitic material

Thin Section (two thin sections were cut from this sample):

TS37635A:

This section consists of about 70% vein quartz, 30% goethite pseudomorphs after pyrite, and traces of muscovite. The quartz shows marked evidence of deformation with development of strained extinction, mortar texture and granulation/recrystallization. In places it is intergrown with aggregates of randomly oriented muscovite flakes. Muscovite also occurs intergrown locally with the goethite pseudomorphs after pyrite. Also in the section are small patches of goethite-stained quartz, commonly in association with cavities.

TS37635B:

This section resembles TS37635A except that goethite pseudomorphs after pyrite are more abundant and there is a higher proportion of vein quartz which shows only strained extinction and not development of mortar texture and recrystallization. In both samples the vein quartz contains abundant but irregularly distributed fluid inclusions.

Polished Section (three polished sections were cut from this sample):

PS25503 - 25505:

These polished sections are all fairly similar and consist essentially of quartz and goethite/hematite pseudomorphs after pyrite. The quartz forms small crystal intergrowths and the pseudomorphs after pyrite range from less than 1 mm up to about 7 mm and may be concentrated in subparallel bands or stringers. The proportions of quartz and goethite/hematite range from 65:35 to 85:15. No native gold was observed in any of the polished sections.

Sample: P1835/76, Y12 (not analysed)

Description:

Entrance to Mount Grainger stope on eastern side of hill. Arkose 0-15 cm under vein; also present are several quartz veins 1-2 cm wide striking 264^{o} and dipping 54^{o} south along a joint direction.

Hand Specimen:

This sample consists of pinkish-white weathered arkose which locally shows greenish layers and some coarser irregular clay-rich ?fragments.

Thin Section: (TS37636)

This sample is banded on the scale of the thin section and consists of, at the one extreme, layers composed almost entirely of fine-grained subparallel sericite, ranging to layers which consist predominantly of fine-grained quartz intergrown with sericite and layers of sparsely dispersed coarse detrital quartz grains up to 0.2 mm in size distributed through a fine-grained matrix of sericite and goethite . Goethite is also widely distributed through the micaceous-rich layers as irregular disseminations. This rock may be termed a poorly-sorted, banded, sandstone. It contains little or no feldspar and is not an arkose.

Summary of Petrographic and Mineragraphic Data

The country rocks which host the veins at Mt. Grainger are sedimentary in origin and range from poorly sorted sandstones to micaceous and argillaceous sandstones. The detrital fragments are predominantly quartz but some feldspar, quartzite, chert and other rock types are present. The rocks are better termed sandstones than arkoses in view of the predominance of quartz over feldspar.

The ore veins at Mt. Grainger consist predominantly of hydrothermal quartz, with subsidiary sulphides(which are now largely altered to secondary goethite/hematite) and traces of muscovite and carbonate. Vugs and cavities are common and often lined with secondary iron oxides. The quartz in the veins shows a variety of textures ranging from coarse, elongate, unstrained crystals to finely granular material which has recrystallized as a result of deformation. Other deformation features, such as strained extinction and development of lamellar patterns, are common. Fluid inclusions are genrally abundant but tend to be much rarer in the recrystallized quartz. Muscovite occurs in irregular aggregates and rosettes intergrown with the quartz and iron oxides. Similar aggregates of muscovite occur in some of the country rock specimens and are possibly of hydrothermal origin. The gold contents of all the samples analyses are very low (the highest value being 0.3 ppm in sample P1834/76) and no native gold was observed.

APPENDIX B

Fluid Inclusion Data from Six Samples collected by B. Morris, SADME, 1976. Extracted from AMDEL Report GS 1/1/176 by Dr K.J. Henley.

FLUID INCLUSION DESCRIPTIONS

P1824/76:

Although numerous tiny inclusions accounted for the cloudy appearance of the quartz, virtually none with gas bubbles suitable for homogenisation studies was found. Attempts to freeze selected areas with inclusions were unsuccessful.

P1826/76:

This sample, too, was generally cloudy, though with limited clearer areas. The many small inclusions had a tendency to common alignement with the slight elongation of crystal domains, which was roughly perpendicular to a vestigial banding (from the country rock). Some bands of inclusions appeared, in contrast, to be parallel to this lithological banding, probably indicating more than one generation of fluid inclusions. The well-dispersed and possibly primary inclusions gave low readings, from 152°C up to at least 178°C. As with the previous sample, however, attempts to freeze inclusions were not successful.

P1829/76:

This sample was very cloudy, and again the smaller inclusions tended to show common orientation, with well-disperesed, larger varieties (mostly 5-10 μm) resembling those of the previous sample. Some of the latter type and outlines consistent in part with negative crystal shape, but apparently grading to the smaller, rounder varieties. Also, in some of the larger ones a solid phase could be recognised, its roughly square outline being suggestive of halite (salt). In rare cases a second, birefringent solid accompanied the other. The lowest homogenisation temperature recorded upon heating was 140°C, but whether primary or secondary remained uncertain. Some inclusions, especially the largest and usually least regular, looked as if they had previously decrepitated. Other possible primary types started to decrepitate at about 230°C, though more widespread decrepitation did not become apparent until above 350°C by which stage some of the salt? cubes had dissolved. The birefringent solids did not dissolve below 430°C, while some inclusions had very high hyomogenisation temperatures, up to and possibly in excess of 500°C. Very small inclusions, elongated and aligned in secondary(?) planes, gave values around 220°C, the range probably extending from 145° to 278°C. Freezing experiments caused the outlines of some bubbles to appear "heavier" than normal, but in only one case was a "double bubble", probably representing CO_2 liquid + gas, recognised, this becoming a single phase once more on being warmed to -26°C. In one or two cases the solid phases, which had disappeared on cooling, reformed with rise of temperature, the birefringent mineral at -18°C and the halite(?) at around +10°C. What appeared to be ice in two inclusions were too small for precise melting-point data to be obtained.

The evidence as a whole indicates variable but generally very high temperatures of quartz crystallisation from solutions rich in carbon dioxide and sodium chloride, at least.

P1831/76:

This sample was generally less clouded with inclusions. Where abundant, the inclusions tended to be small and in places two rough alignments were detectable, one agreeing with the elongation of strain shadows in the quartz; but the more-individual inclusions also tended to show a local alignment. Subsequent re-examination indicated that some inclusions resulted from the annealing of fractures (i.e. secondary), but although others may be more consistent with growth bands (i.e. primary), the majority remain uncertain. The lowest reading recorded on a possibly primary fluid inclusion was about 110°C, but as this is so out of character, it may in fact be a secondary inclusion. all other inclusions were much higher, starting at 247°C, the smaller inclusions ranging up to at least 465°C and probably reaching to in excess of 530°C. One such group of nevertheless individual occurrences displayed negative crystal outline and ranged in homogenisation temperature from around 400°C to in excess of 530°C, when heating stopped. However, the inclusions in this section were regarded as being not large enough to warrant freezing experiments to be carried out.

P1833/76:

This sample showed some concentrations of inclusions, with indications of possible growth bands, but size limitations precluded homogenisation tests on such inclusions. Some areas had a network of inclusions, also unsuitable for use, which tended to "follow" strain-shadows and may therefore represent zones of recrystallisation rather than fracture- or shear-planes. Inclusions of a coarser and more isolated nature, some with negative crysal outline and possibly also containing a solid phase were presumed to be of primary origin. Most of the temperatures obtained were fairly high to very high with decrepitation tending to confirm the range. The lowest recorded was 205°C. In an area selected for freezing tests, several larger and less regular inclusions contained bubbles and two solids - one resembling halite, the other with moderate birefringence. On heating up after freezing by cooling to -170°C, the salt-like solid dissolved at about -36°C. The melting point of "ice" appeared to occur at about -29°C, which, though theoretically slightly low for a pure $NaCl-H_2O$ saturated solution,* nevertheless tends to confirm the evidence of the salt-like solid in being consistent with a solution saturated with respect to NaCl. On further warming the solid phase (presumably halite) reappeared at about +5°C. With further heating the biregringent mineral in one inclusion seemed to have dissolved by about 235°C, another inclusion had partially decrepitated, while several others were close to homogenisation by about 250°C. Although limited, the evidence again is suggestive of moderate to very high temperatures of formation from highly saline solutions.

P1834/76:

Similar to P1833/76 and generally sieved with inclusions, this sample provided little evidence of the nature of these inclusions. In the absence of distinct planar features (such as

---

NB* A genuine depression of the melting point of ice to -29°C implies the presence of another component, since a saturated solution should melt at -21°C. The presence of CO_2 would have little effect, but the presence of, for instance, $CaCl_2$ could account for such a discrepancy.

fractures) or strong alignments, most of the inclusions large enough to be measured were assumed to be primary. Two ranges may be present (168°-228°C and 392°-509°C or possibly higher); insufficient readings were obtained to be certain of this, but no doubt exists that, as with the previous sample, some of the temperatures obtained were very high. Again, too, a moderate percentage of fluid inclusions contain cube-like solids, probably of halite (salt). Rarely, the presence of a birefringent solid was noted. Freezing tests gave possible indication of the presence of CO_2 in a solid phase, melting at about -60°C.

Cooling and reheating appeared to show the disappearance of the salt(?) phase very approximately at -40°C and its reformation between -18°C and +5°C as has been found before. Further heating of such inclusions indicated that the salt(?) cubes in some started to dissolve at about +170°C, possibly also with homogenisation of gas and liquid phases, but higher temperatures for the homogenisation of the gas and cubic solid phases were also obtained.

SUMMARY OF FLUID INCLUSION DATA

Sample No.	Nature of Quartz	Homogenisation Temperature, °C ?Primary Inclusions	?Secondary Inclusions	Decrepitation Temp., °C	Freezing Data	Comments
P1824/76	Coarse, slightly strained; finer, granular. Numerous tiny inclusions.	-	Unsuitable	-	-	Inclusions mostly single-phase large ones decrepitated.
P1825/76	Medium to coarse, slightly strained. Preserved sedimentary structures in places.	152 to 178 (to 192?)	?		Unsuitable	Inclusions did not appear to freeze.
P1829/76	Coarse, strained; finer, granular areas. Numerous small inclusions.	232 to <300; >364 to 528+	145 to 278	364 to 440	Ice, etc. still frozen to -29°C.	Limited CO_2. Solid NaCl? up to 340°C. Rare birefringent solid.
P1831/76	Very coarse, rel.unstrained; loc. granular.	110? 247 to 530+	110?	>400	Unsuitable	-
P1833/76	Coarse, strained. Concentrations of inclusions.	205 to 350; >500		241 to 345; 425	Ice, etc. melts -29°C.	Solid NaCl + birefringent solid
P1834/76	Coarse, strained. Sived with inclusions.	168 to 228; 392 to 509+		228-258	Uncertain	Solid NaCl dissolved 170°C to >330°C. Birefringent solid.

APPENDIX C

Results of Samples Collected by J. Simnovec for Hamlyn Mining Pty. Ltd., (1978).

A.C.S. Laboratories Pty. Ltd.
50 MARY STREET
UNLEY, S.A. 5061
P.O. BOX 3
UNLEY, S.A. 5061
PHONE: 272 5733.

ANALYTICAL RESULTS

Samples from: Hamlyn Mining.

Area:

Samples of: Rocks.

Preparation: Crushed and pulverised.

Sheet No.: 1.

Batch No.: A 2310.

Date: 22nd February 1973.

SAMPLES WILL BE DISPOSED OF AFTER TWO MONTHS UNLESS WE ARE OTHERWISE ADVISED

Sample Description	Au g/mt
Middle (2 Bags)	25.9
Wings (3 Bags)	8.0
320 Level	1.0

APPENDIX D

Results of samples taken by Dr. R. Marjoribanks of Anaconda Australia Inc., June 1981.

SAMPLE NO.	LOCATION	DESCRIPTION
902530032	800 m approx south of Medora North Shaft.	Outcrop of intense sericite altered arkosic sandstone.
33	South Medora Mine Dump by underly shaft.	Kaolinised arkosic sandstone.
34 35 36	Samples 34-36 are 2 m channel samples starting at hanging wall vein and going across strike to east. South Medora shaft.	Kaolinised arkosic sandstone.
37	Small shaft sth of South Medora Mine. Dump sample.	Kaolinised, in part sericite altered arkosic sandstone.
38	Medora North Mine. Underly shaft dump.	Kaolinised arkosic sandstone. Small limonite spots.
39 40 41 42	100 m north Medora North Shaft Small cross cut E from H.W. vein. 2 m channel samples from W. to E.	Ditto
43 44 45	Mount Grainger Mine underly shaft 3 m channel samples going E from H.W. vein.	Sericite altered arkosic sandstone. Small limonite spots after sulphide.
46	100 m Sth Golden Junction Mine Dump sample by small pits.	Kaolinitic sandstone with patches of green sericite alteration.
902530047	Dustholes Mine X cut by old Steam engine. 6 m channel across strike.	Intense fractures, quartz-veined Kaolinitic sandstone.
48	Dustholes. Samples from dump at mouth adit (100 m north old steam engine (collected by J. Simnovec).	Kaolinitic arkosic sandstone.

APPENDIX D

Results of Samples Taken by Dr R. Marjoribanks of Anaconda Australia Inc., June 1981

Sample Number	Au ppm	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	As ppm	Ag ppm	Ba ppm	Mn ppm	Mo ppm	V ppm	Ti ppm	Sr ppm	Fe %	U ppm	Ca ppm	Mg ppm	Al %
Detection Limit	(0.01)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(1)	(5)	(5)	(10)	(5)	(5)	(5)	(5)	(15)	(5)	(5)	(5)
9025332	<0.01	16	45	11	67	41	390	5	X	53	410	X	120	1540	27	7.15	X	5300	2800	2.28
902533	0.80	X	75	10	40	53	310	12	X	230	1420	X	170	2790	16	4.71	X	580	4530	4.68
9025334	0.07	200	93	82	450	180	240	11	X	2470	2.63%	X	140	3590	82	4.10	X	260	2290	5.21
9025335	0.06	38	99	16	99	81	210	11	X	1240	8510	X	220	5040	91	4.27	X	960	6240	6.41
9025336	<0.01	8	49	5	19	49	160	8	X	200	1560	X	140	2590	380	2.12	X	1.89%	1.62%	4.06
9025337	0.22	33	87	45	140	130	290	17	X	360	4320	X	170	2800	14	6.83	X	550	2300	5.14
9025338	3.76	56	100	40	160	110	340	19	X	700	4860	X	130	2070	110	8.61	X	9000	5130	5.13
9025339	0.98	93	64	82	120	82	530	33	X	360	2510	X	150	2390	40	17.45	X	290	3480	2.42
9025340	0.41	28	55	46	75	55	400	40	X	330	2360	X	110	1410	25	12.90	X	170	2500	1.90
9025341	0.10	12	67	7	25	33	250	16	X	380	2400	X	130	2520	93	4.70	X	5620	4070	3.83
9025342	0.08	26	79	17	120	58	170	15	X	480	5000	X	120	2670	93	3.50	X	1.05%	3560	5.08
9025343									Sample Not Received											
9025344	0.14	6	57	X	30	22	230	11	X	160	280	X	100	1380	33	3.52	X	450	1970	3.40
9025345	0.05	X	68	X	6	32	210	9	X	110	170	X	150	2690	36	2.53	X	760	4670	4.90
9025346	0.69	X	53	X	10	22	260	9	X	130	200	X	130	1860	10	3.16	X	490	2920	3.58
HIGH	3.76	200	100	82	450	180	530	40	<1	2470	2.63%	<10	220	5040	380	17.45%	<15	1.89%	1.62%	6.41%
LOW	<0.01	<5	45	<5	6	22	160	5	X	53	170	X	100	1380	10	2.12%	X	170	1970	1.90%
AVERAGE	0.53	37	71	26	97	68	285	15	<1	515	4307	<10	141	2525	75	6.11%	<5	3845	4475	4.14%

X Indicates <0.0005
Except for Ag <0.0001
Mo <0.0010
U <0.0010

APPENDIX E

Description and Assay Results of Samples Collected by P.F. Bull, Amax Australia Limited, 1983

APPENDIX E

Description and Assay Results of Samples Collected by P.F. Bull, Amax Australia Limited, 1983.

Sample Number	Cu	Au	As	Location and Description
A5919	-	2.6	-	Mt. Grainger 5 m from surface down open stope.
A5920	-	1.3	-	Mr. Grainger 20 m from surface down open stope.
A5921	-	<0.05	-	Mt. Grainger 25 m from surfacew down open stope.
A5922	-	1.50	-	Mt. Grainger 30 m from surface down open stope.
A5923	-	5.3	-	Mt. Grainger 35 m from surface down open stope.
A5924	-	<0.05	-	Mt. Grainger 40 m from surface down open stope.
A5925	-	<0.05	-	Mt. Grainger 120 m level.
A5926	-	<0.05	-	Mt. Grainger 120 m level.
A5927	-	0.25	-	Mt. Gringer 240 m level.
A5928	190	5.3	85	Mt. Grainger, Dusthole workings - quartz limonite vein from Black Cut.
A5930	200	0.40	42	Mt. Grainger, Dusthole workings - quartzite with minor limonite adjacent to A5928.
A5933	24	0.30	3	Mt. Grainger - quartz veins.
A5934	8	0.10	4	Mt. Grainger - pink material interstitial to quartz veins.
A5935	46	<0.05	18	Mt. Grainger - oxidised shale host rock.

Note: Samples 5933-5935 were collected from No. 3 Open Cut (Fig. 7).
Samples 5919-5924 were grab samples.
Samples 5925-5926 were channel samples along the south east wall of the 120 level drive between the first and second survey points (Fig. 30).
Sample 5927 was a channel sample across the back of the mineralised stope on 220 level (Fig. 31).

APPENDIX F

Procedure and Results of Sub-Sampling Bulk Samples MG1 and MG2, AMDEL Reports OD 6507/84 and OD 6991/84

The Australian Mineral Development Laboratories
Flemington Street, Frewville
South Australia 5063
Phone Adelaide 79 1662
Telex AA82520

Please address all correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

16 April 1984

OD 3/0/0

Hannes, Walpole & Barlow Pty Ltd
Suite 808, Plaza Building
87-95 Pitt Street
SYDNEY NSW 2000

Attention: Dr Walpole

REPORT: OD 6507/84

YOUR REFERENCE: Letter from Mr B. Thomson, 1 March 1984

MATERIAL: Bulk ore samples

LOCALITY: Mt Grainger, South Australia

IDENTIFICATION: MG1 and MG2

WORK REQUIRED: Crushing, sub-sampling and gold assays

Investigation and Report by: P.G. Capps

Acting Manager, Operations Division: I.W. McPheat

I.W. McPheat

for Brian S. Hickman,
Managing Director

cc. Mr B. Thomson
4B Myrtle Avenue
MYRTLE BANK SA 5064

rp

Head Office:
Flemington Street, Frewville
South Australia 5063
Telephone (08) 79 1662
Telex: Amdel AA82520
Pilot Plant:
Osman Place
Thebarton, S.A.
Telephone (08) 43 5733
Branch Laboratories:
Melbourne, Vic.
Telephone (03) 645 3093
Perth, W.A.
Telephone (09) 325 7311
Telex: Amdel AA94893
Townsville
Queensland 4814
Telephone (077) 75 1377

1. INTRODUCTION

Areas of the Mt Grainger gold field of South Australia are being investigated, with a view to re-assessing the economic potential of the reefs, by Hannes, Walpole and Barlow Pty Ltd.

Considerable variations are apparent between gold assays of samples taken over the years and the amounts of gold recorded by the Government battery at Peterborough after processing several ten tonne parcels of Mt Grainger ore. In an attempt to clarify these differences, two five tonne bulk samples were taken from trenches immediately adjacent to areas from which battery feed samples were taken.

AMDEL was requested to crush and sub-sample the two bulk samples to obtain accurate and reliable gold assays.

2. PROCEDURE AND RESULTS

The bulk samples were received in 200 litre drums and weighed 4.48 tonnes and 4.32 tonnes for samples MG1 and MG2 respectively. Although a moisture content was not determined, the 'as received' samples contained a significant quantity of water, making them difficult to handle through the crushing and riffling stages.

Each of the bulk samples were sampled using the procedure described below.

'As received' ore was jaw crushed in closed circuit to 100% minus 10 mm and riffled into two equal and representative portions. Drums of riffled material for each portion were taken from alternate sides of the riffle in order to counteract any bias of the splitting process. One half was again riffled to produce two quarter portions, and $\frac{3}{4}$ of the original sample was then set aside as Balance A.

The remaining quarter was gyratory crushed to minus 4 mm and riffled to provide $\frac{3}{4}$ as Balance B. The remaining portion ($\frac{1}{16}$ of the original sample) was riffled to provide two portions of approximately 70 kg each and a balance labelled as Balance C.

All processing, to this stage, was carried out on undried ore. The 70 kg portions were therefore dried prior to approximately 20 kg being riffled from each one. Balances from this step were labelled D and E. The two 20 kg portions were screened at 2 mm and the oversize reduced to minus 2 mm through a disc grinder and blended back in with the undersize fractions. Final assay samples were riffled from the 20 kg portions, with approximately eight samples of 1 to 1.5 kg and four samples of 2 to 2.5 kg being produced from each.

Throughout the crushing and sub-sampling process, care was taken at all times to ensure a minimal loss of sample by handling. Drums were emptied thoroughly each time to avoid a build-up of fine material, and riffling was carried out in stages of half splits with crossing of receiving containers to aid representivity.

Fig. 1 sets out the sampling procedure schematically.

A total of four one kilogram samples from each of MG1 and MG2 were submitted for assay. The samples were chosen to examine the agreement between duplicate samples from parallel preparation streams (see Fig. 1).

Gold contents were determined by the screen/fire assay technique. Each sub-sample was disc ground until there was approximately 50 g of plus 200 µm (80 mesh BSS). The total oversize fraction (including screen cloth) was fire assayed, while duplicate fire assays were carried out on the undersize fraction. Actual gold contents were calculated from the two sets of assay figures.

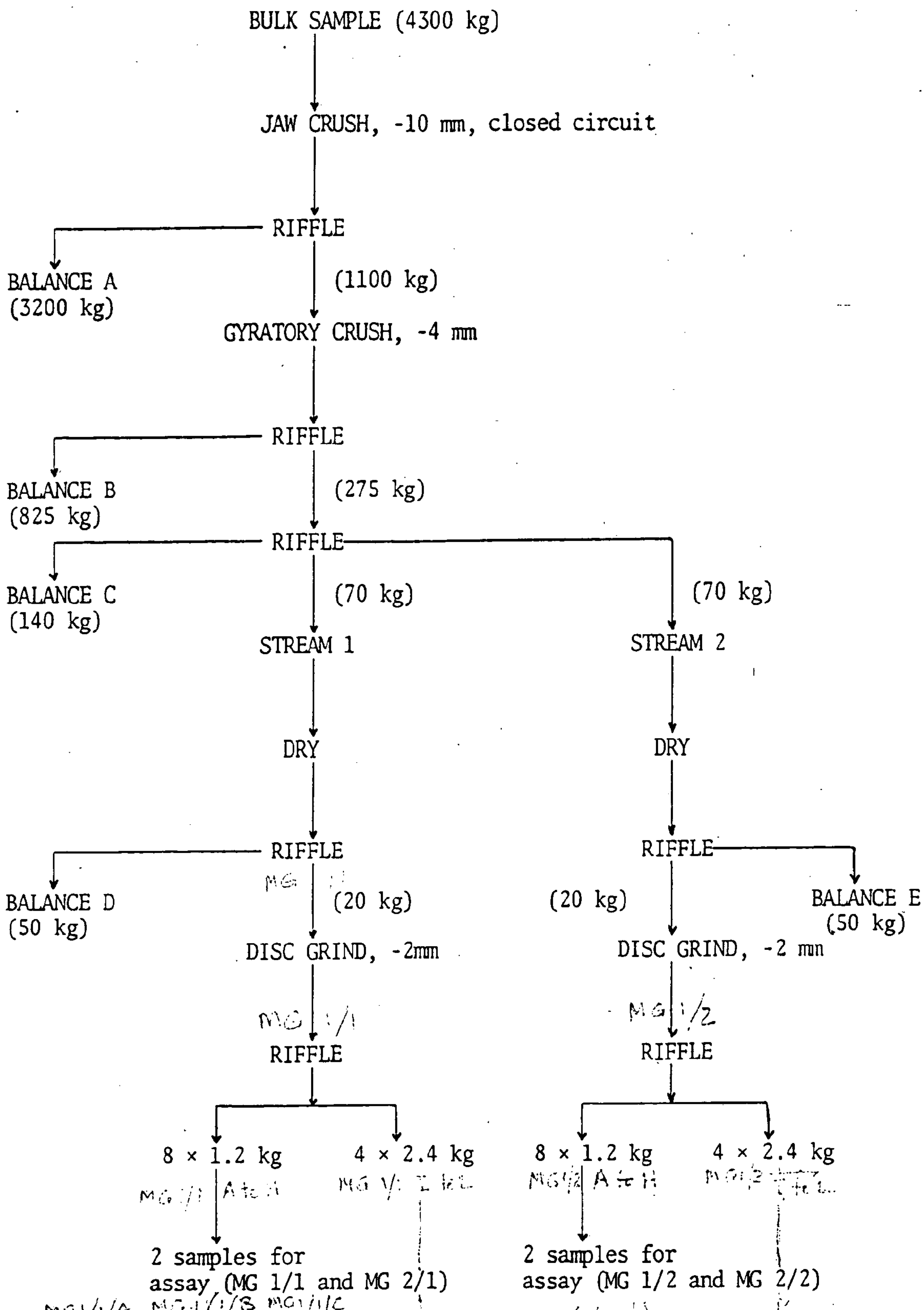
The assay results, including individual fraction assays and calculated totals, are shown in Table 1. All the samples reported low gold contents, of the order of 0.1 g/t. One of the duplicate MG1/2 samples gave a low result of 0.06 g/t, although no large variations in the assays of the minus 200 µm fraction are apparent.

Although generally good agreement between sample assays was obtained, some variations were observed, both between assays of coarse fractions and between assays of fine fractions. Whereas these variations are significant in relative terms (for instance 0.15 and 0.06 g/t for minus 200 µm, Sample MG1/2), they are low in absolute terms. This indicates some sampling difficulties might be encountered with higher grade samples.

(Note. Assaying method was Amdel modified K41. 50g charges were used similar to K42 2½ concentration then AAS for gold, probably accurate to 0.01 g/t) BJ.

TABLE 1: GOLD ASSAYS

Sample	+200 µm		-200 µm		Head Assay Au (g/t)
	Weight (g)	Au (g/t)	Weight (g)	Au (g/t)	
MG 1/1	45.15	0.26	1016	0.11/0.07/0.11	0.11
MG 1/1	46.75	0.10	1012	0.12/0.07	0.095
MG 1/2	40.60	0.17	1028	0.05/0.07/0.07	0.06
MG 1/2	44.10	0.28	1081	0.15/0.06	0.11
MG 2/1	31.15	0.10	1206	0.09/0.05/0.06	0.07
MG 2/1	39.20	0.16	1115	0.07/0.08	0.08
MG 2/2	33.80	0.14	966	0.10/0.07/0.05	0.07
MG 2/2	49.35	0.07	911	0.13/0.07	0.10



Note: Nominal weights shown in brackets.

FIG. 1: SAMPLE PREPARATION PROCEDURE

The Australian Mineral Development Laboratories

Flemington Street, Frewville, South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all correspondence to
P.O. Box 114 Eastwood SA 5063
In reply quote:

amdel

16 July 1984

OD 3/0/0

Mr G.B. Brink
Exploration and Mining Manager
Abignano Limited
19-21 Bridge Street
PYMBLE NSW 2073

REPORT: OD 6991/84

YOUR REFERENCE:	Your letter dated, 18 June 1984.
MATERIAL:	Bulk ore samples.
LOCALITY:	Mount Grainger, South Australia.
IDENTIFICATION:	MG-1 and MG-2
WORK REQUIRED:	Crushing, sampling, gold assays.

Investigation and Report by: P.G. Capps

for Brian S. Hickman
Managing Director

ha

Pilot Plant: Osman Place
Thebarton S.A.,
Telephone 43 8053
Branch Laboratories:
Perth W.A.
Telephone 325 7311
Melbourne Vic.
Telephone 645 3093

1. INTRODUCTION

Abignano Limited are currently investigating the grade and reserves of the Mount Grainger gold field in South Australia. Previous records show considerable variations between gold assays of samples taken on site and gold recoveries from treating parcels of ore in the Government battery at Peterborough. ✓

During May 1984, AMDEL carried out a sampling and assaying exercise on two 5 tonne samples from Mount Grainger (Report OD 6507/84). Both samples were found to contain approximately 0.1 g/t Au. ✓

Subsequent to this work, Abignano Limited requested AMDEL to re-sample the bulk samples, using a revised procedure in order to provide a further check on the gold grade. The procedures used and results of this repeat programme are contained in the Report. ✓

2. PROCEDURE AND RESULTS

Sample balances from the initial sampling exercise (Report OD 6507/84) comprised material crushed to minus 10 mm (jaw crushed) and minus 4 mm (gyratory crusher). Both size fractions were recombined, for each sample MG-1 and MG-2, prior to sampling.

For each of the bulk samples the reconstituted sample was riffled into two equal and representative portions. Drums of riffled material were taken from alternate sides of the riffle splitter to counteract any bias of the splitting process. One portion was set aside for treatment at the Government battery, while the second portion was again riffled into two equal portions, each representing one quarter of the original and weighing approximately 1.1 tonnes.

Each of the quarter portions were then treated in parallel by identical procedures. The samples were riffled into two equal portions, one of which was gyratory crushed to minus 4 mm, and a 15 kg sub-sample riffled out and dried. The dry 15 kg of minus 4 mm sample was dry ground in a disc grinder to minus 0.5 mm, and two 1 kg assay charges riffled out.

In this way, two 1 kg assay charges were obtained from each of the two quarter portions of the bulk samples, resulting in four charges from MG-1 and four from MG-2. Each assay charge was ground to approximately 30 g plus 200 μm. Oversize fractions were fired in total, while undersize samples were sub-sampled and assayed in triplicate.

The sampling procedure is shown schematically in Figure 1 and assay results are shown in Table 1.

Assays ranged from 0.10 to 0.16 g/t Au for MG-1 and 0.08 to 0.11 g/t Au for MG-2. There was no concentration of gold in the oversize fractions, indicating an absence of coarse free gold in the samples assayed.

In general, assay values are in close agreement with the values previously obtained (0.06 to 0.11 g/t Au for MG-1 and 0.07 to 0.10 g/t Au for MG-2).

TABLE 1: GOLD ASSAYS

Sample	+200 µm Weight (g)	+200 µm Au (g/t)	-200 µm Weight (g)	-200 µm Au (g/t)	Head Assay Au (g/t)
MG1A-1	35.1	0.04	959.0	0.14/0.12/0.21	0.16
MG1A-2	33.3	0.04	958.5	0.07/0.10/0.13	0.10
MG1B-1	18.1	0.10	968.3	0.13/0.19/0.13	0.15
MG1B-2	18.8	0.07	972.3	0.10/0.11/0.12	0.11
MG2A-1	31.6	0.04	958.5	0.09/0.09/0.16	0.11
MG2A-2	22.5	0.07	971.3	0.09/0.08/0.09	0.09
MG2B-1	28.3	0.04	968.8	0.12/0.08/0.07	0.09
MG2B-2	19.3	0.04	973.6	0.07/0.07/0.10	0.08

0.13

Note: 9.25 tonnes of each sample stored at Amdel. Could take it to Peterborough and run it through the battery too. ($300 + labour)

QMB

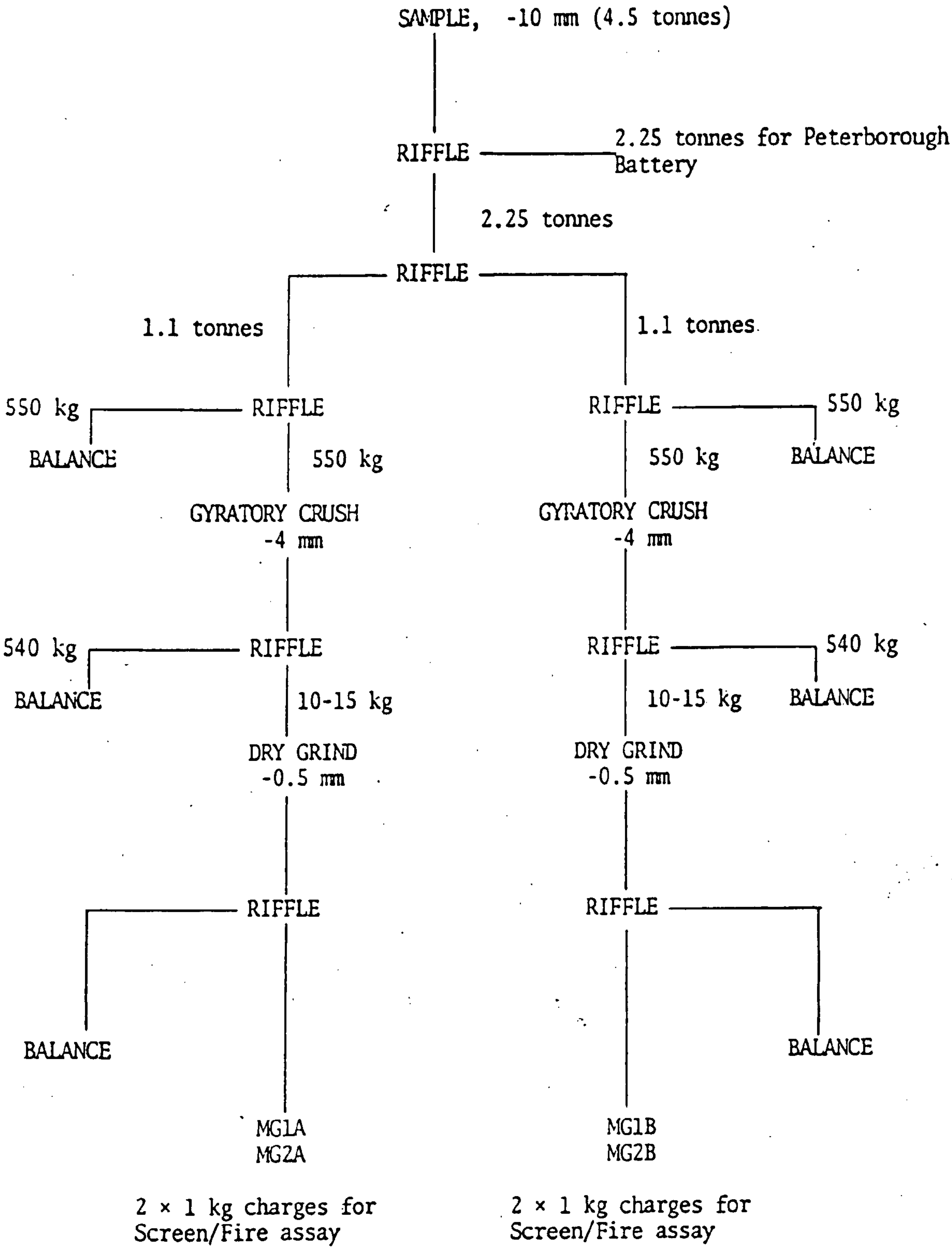


FIG 1: SAMPLING PROCEDURE

APPENDIX G

Sampling Analytical and Management Services Pty. Ltd.
Results of Assays from +36, +72 and -72 Fractions
of Sub Samples from Bulk Samples MG1 and MG2.

SAMPLING ANALYTICAL AND MANAGEMENT SERVICES PTY. LTD. (Inc in S.A.)

Address: 5 Bishop's Place, Kensington, South Australia
Phone: 318533
Telex: 89856

Date: 10th. April, 1984
Client Ref.: Nil
Batch No.: A128/84 & A140/84
Sheet No.: 1

Analytical Methods
Gold by fire assay

Certificate of Assay

Sample No.		Fraction Weight	Gold gm/MT	
MG-1-1A	+36	42.22	0.21	
	+72	61.09	0.16	
	-72	977g	0.24	0.24
MG-1-1B	+36	42.46	0.35	
	+72	59.32	0.22	
	-72	947g	0.20	0.22
MG-1-2A	+36	34.25	0.61	
	+72	65.55	0.14	
	-72	963g	0.92	~~0.30~~ 0.86
MG-1-2B	+36	35.36	0.62	
	+72	55.34	0.20	
	-72	1025g	0.20	0.20
MG-2-1A	+36	37.23	0.27	
	+72	48.32	0.25	
	-72	1252.5g	0.28	0.24
MG-2-~~1~~B	+36	29.01	0.21	
	+72	62.86	0.17	
	-72	1260.5g	0.20	0.18
MG-2-2A	+36	21.02	0.71	
	+72	46.04	0.11	
	-72	997g	0.18	~~0.24~~ 0.19
MG-2-2B	+36	29.33	0.24	
	+72	53.05	0.11	
	-72	967.5g	0.16	~~0.14~~ 0.16

SAMPLING ANALYTICAL AND MANAGEMENT SERVICES PTY. LTD. (Inc. in S.A.)
Address: 5 Bishop's Place, Kensington, South Australia
Phone: 318533
Telex: 89856

Date: 10th. April, 1984
Client Ref.: Nil
Batch No.: A140/84
Sheet No.: 2

Analytical Methods
Gold by fire assay

Certificate of Assay

Sample No.	~~Total~~ TAILINGS Weight	Conc. Weight	Conc. Gold gm/MT
1.1	1019.0	124.54	0.24
1.2	1023.4	111.72	0.26
2.1	1155.1	29.88	0.47
2.2	1037.0	54.83	0.18

Pulverise 8 x 1Kg approx. samples to obtain 100g. approx. +72 mesh screen at 36 & 72 mesh. 8 hrs. @ $20/hr.

Assay +36 and +72 fractions in total and −72 fraction in duplicate 32 @ $9

Assay 4 samples up to 124g in weight
2 @ $12
2 @ $9

[signature]

APPENDIX H

Peterborough Battery Certificates on Bulk Samples MG1 and MG2.

NO1. N MG 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Peterborough Government Battery

CERTIFICATE OF GOLD BULLION SMELTED

Smelted for J. SIMNOVEC

6. grams of Gold Bullion

this 11TH day of JULY 1984

Manager

tails: 1.2 ppm

MF 152

NO. 2.

MC 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Peterborough Government Battery

CERTIFICATE OF GOLD BULLION SMELTED

Smelted for J. SIMNOVEC

3.5. grams of Gold Bullion

this 11th day of July 1984

Manager

tails: 2.4 ppm

MF 152

APPENDIX I

Reverse Circulation Drillhole Assay Results,
Sample Depth and Weight of Samples
from AMDEL Report AC 220/85.

The Australian
ineral Development
Laboratories

Fle ington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

NATA CERTIFICATE

3/0/0 - AC 220/85

10 August 1984

Mr. B. Brink,
Abignano Limited,
P.O. Box 195,
PYMBLE N.S.W. 2073

RECEIVED
15 AUG 1984
Ans'd

REPORT AC 220/85

YOUR REFERENCE:	Order Number 113059
REPORT COMPRISING:	Cover Sheet Pages 1 - 2 Pages G1 - G8
DATE RECEIVED:	16 July 1984

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ANALYSIS

ABIGNANO WEIGHTS

SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg
DH5- 1	8	DH6- 1	7½	DH1- 1	7½	DH9- 1	11½
2	13 3/4	2	20½	2	15	2	8½
3	13	3	16	3	8	3	11½
4	10	4	9	4	10	4	10 3/4
5	9	5	10	5	11	5	9
6	8½	6	7	6	13	6	10½
7	10½	7	8½	7	10½	7	13½
8	9½	8	8			8	7½
9	9½	9	10	DH2- 1	5 3/4	9	12 3/4
10	9½	10	10	2	6 3/4	10	7½
11	9½	11	8	3	7	11	5
12	8 3/4	12	9	4	5	12	5 3/4
13	11	13	9½	5	7 3/4	13	4½
14	10½	14	7½	6	10½	14	7
15	6½	15	10	7	14½	15	11½
		16	9	8	16	16	9
DH3- 5	14	17	7	9	21	17	2 3/4
6	10½	18	10	10	11	18	1½
7	9½	19	9½	11	10 3/4	19	6½
8	8	20	7½	12	9½	20	6½
9	6	21	20	13	6	21	12½
10	5½	22	8	14	6½	22	48
11	11½	23	5	15	8	23	8 3/4
12	7½	24	7½	16	5½	24	9 3/4
13	9½	25	7½	17	4	25	13 3/4
14	10½	26	10	18	13½	26	10½
15	11½	27	9½			27	9
16	7	28	7½			28	17½
17	11 3/4	29	6			29	20
18	13½	30	7				
		31	7½				

ANALYSIS

ABIGNANO WEIGHTS

SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg
DH10- 1	11½	DH10-25	6	DH8- 1	8	DH7- 1	5½
2	5½	26	5 3/4	2	8½	2	8½
3	5	27	6 3/4	3	14	3	4
4	4½	28	7	4	8	4	5½
5	2 3/4	29	6	5	11	5	4
6	5½	30	9½	6	6½	6	5 3/4
7	4	31	8½	7	8	7	5 3/4
8	4½	32	16 3/4	8	12	8	4 3/4
9	7½	33	13½	9	4½	9	7½
10	7½	34	7½	10	4½		
11	5 3/4	35	5½	11	7½	DH4- 1	15
12	5 3/4	36	12	12	4	2	27
13	4½	37	6	13	5½	3	36
14	4 3/4	38	4½	14	6	4	14
15	6 3/4	39	6 3/4	15	5		
16	6	40	4½	16	9½		
17	6	41	4½	17	10		
18	4½	42	4	18	9 3/4		
19	5½	43	3½				
20	6	44	8				
21	10	45	9½				
22	6 3/4	46	9				
23	4½	47	7½				
24	4½						

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NATA Certificate | Results in ppm

Sample	Depth (m)	Au
DH6-18	37 - 38	<0.01
DH6-19	38 - 39	<0.01
DH6-20	39 - 40	<0.01
DH6-21	40 - 41	<0.01
DH6-22	41 - 42	<0.01
DH6-23	42 - 43	<0.01
DH6-24	43 - 44	<0.01
DH6-25	44 - 45	<0.01
DH6-26	45 - 46	<0.01
DH6-27	46 - 47	<0.01
DH6-28	47 - 48	<0.01
DH6-29	48 - 49	<0.01
DH6-30	49 - 50	<0.01
DH6-31	50 - 51	<0.01
DH1-1	29 - 30	<0.01
DH1-2	30 - 31	<0.01
DH1-3	31 - 32	<0.01
DH1-4	32 - 33	<0.01
DH1-5	33 - 34	<0.01
DH1-6	34 - 35	<0.01
DH1-7	35 - 36	<0.01
DH2-1	27 - 28	<0.01
DH2-2	28 - 29	<0.01
DH2-3	29 - 30	0.16
DH2-4	30 - 31	<0.01
DH2-5	31 - 32	0.05
DH2-6	32 - 33	0.10
DH2-7	33 - 34	0.10
DH2-8	34 - 35	0.10

Detn limit (0.01)

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Analysis code C3/4 Report AC 220/85 Page G2

Results in ppm

NATA Certificate

Sample	Depth (m)	Au
DH2-9	35 - 36	0.20
DH2-10	36 - 37	<0.01
DH2-11	37 - 38	<0.01
DH2-12	38 - 39	<0.01
DH2-13	39 - 40	<0.01
DH2-14	40 - 41	<0.01
DH2-15	41 - 42	<0.01
DH2-16	42 - 43	<0.01
DH2-17	43 - 44	<0.01
DH2-18	44 - 45	<0.01
DH9-01	16 - 17	<0.01
DH9-02	17 - 18	<0.01
DH9-03	18 - 19	<0.01
DH9-04	19 - 20	<0.01
DH9-05	20 - 21	<0.01
DH9-06	21 - 22	<0.01
DH9-07	22 - 23	<0.01
DH9-08	23 - 24	<0.01
DH9-09	24 - 25	<0.01
DH9-10	25 - 27	<0.01
DH9-11	26 - 27	<0.01
DH9-12	27 - 28	<0.01
Detn limit		(0.01)

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NATA Certificate Results in ppm

Sample	Depth (m)	Au
DH9-13	28 - 29	0.05
DH9-14	29 - 30	<0.01
DH9-15	30 - 31	0.26
DH9-16	31 - 32	0.20
DH9-17	32 - 33	0.05
DH9-18	33 - 34	<0.01
DH9-19	34 - 35	<0.01
DH9-20	35 - 36	<0.01
DH9-21	36 - 37	<0.01
DH9-22	37 - 38	0.05
DH9-23	38 - 39	0.05
DH9-24	39 - 40	<0.01
DH9-25	40 - 41	<0.01
DH9-26	41 - 42	<0.01
DH9-27	42 - 43	<0.01
DH9-28	43 - 44	<0.01
DH9-29	44 - 45	<0.01
DH10-1	18 - 19	<0.01
DH10-2	19 - 20	0.16
DH10-3	20 - 21	<0.01
DH10-4	21 - 22	<0.01
DH10-5	22 - 23	<0.01
DH10-6	23 - 24	<0.01
DH10-7	24 - 25	<0.01

Detn limit (0.01)

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Analysis code C3/4 Report AC 220/85

Results in ppm

NATA Certificate

Sample	Depth (m)	Au
DH10-8	25-26	<0.01
DH10-9	26 - 27	<0.01
DH10-10	27 - 28	<0.01
DH10-11	28 - 29	<0.01
DH10-12	29 - 30	<0.01
DH10-13	30 - 31	<0.01
DH10-14	31 - 32	<0.01
DH10-15	32 - 33	<0.01
DH10-16	33 - 34	<0.01
DH10-17	34 - 35	<0.01
DH10-18	35 - 36	<0.01
DH10-19	36 - 37	<0.01
DH10-20	37 - 38	<0.01
DH10-21	38 - 39	<0.01
DH10-22	39 - 40	0.10
DH10-23	40 - 41	<0.01
DH10-24	41 - 42	<0.01
DH10-25	42 - 43	<0.01
DH10-26	43 - 44	0.05
DH10-27	44 - 45	<0.01
DH10-28	45 - 46	<0.01
DH10-29	46 - 47	<0.01
DH10-30	47 - 48	0.05
DH10-31	48 - 49	<0.01
DH10-32	49 - 50	<0.01
DH10-33	50 - 51	<0.01
DH10-34	51 - 52	0.05
DH10-35	52 - 53	0.05
DH10-36	53 - 54	<0.01
DH10-37	54 - 55	0.05
DH10-38	55 - 56	<0.01
DH10-39	56 - 57	<0.01
DH10-40	57 - 58	<0.01
DH10-41	58 -59	<0.01

Detn limit (0.01)

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NATA Certificate   Results in ppm

Sample	Depth (m)	Au
DH10-42	59-60	<0.01
DH10-43	60-61	<0.01
DH10-44	61-62	<0.01
DH10-45	62-63	<0.01
DH10-46	63-64	<0.01
DH10-47	64-65	<0.01
DH8-01	19-20	<0.01
DH8-02	20-21	<0.01
DH8-03	21-22	0.10
DH8-04	22-23	<0.01
DH8-05	23-24	0.05
DH8-06	24-25	<0.01
DH8-07	25-26	0.20
DH8-08	26-27	0.16
DH8-09	27-28	0.05
DH8-10	28-29	0.10
DH8-11	29-30	<0.01
DH8-12	30-31	<0.01
DH8-13	31-32	<0.01
DH8-14	32-33	<0.01
DH8-15	33-34	<0.01
DH8-16	34-35	<0.01
DH8-17	35-36	<0.01
DH8-18	36-37	<0.01
Detn limit		(0.01)

amdel

Analysis code C3/4

Report AC 220/85

Results in ppm

NATA Certificate

Sample	Depth (m)	Au
DH7-01	14-15	<0.01
DH7-02	15-16	<0.01
DH7-03	16-17	0.10
DH7-04	17-18	0.20
DH7-05	18-19	0.10
DH7-06	19-20	0.05
DH7-07	20-21	<0.01
DH7-08	21-22	0.05
DH7-09	22-23	<0.01
DH4-01	37-40	<0.01
DH4-02	40-43	0.26
DH4-03	43-46	0.16
DH4-04	46-49	<0.01
Detn limit		(0.01)

NATA Certificate Results in ppm

Sample	Depth (m)	Au
DH3-05	32 - 33	<0.01
DH3-06	33 - 34	<0.01
DH3-07	34 - 35	<0.01
DH3-08	35 - 36	<0.01
DH3-09	36 - 37	<0.01
DH3-10	37 - 38	<0.01
DH3-11	38 - 39	<0.01
DH3-12	39 - 40	<0.01
DH3-13	40 - 41	<0.01
DH3-14	41 - 42	<0.01
DH3-15	42 - 43	<0.01
DH3-16	43 - 44	<0.01
DH3-17	44 - 45	<0.01
DH3-18	45 - 46	<0.01
DH5-1	20 - 21	<0.01
DH5-2	21 - 22	<0.01
DH5-3	22 - 23	<0.01
DH5-4	23 - 24	<0.01
DH5-5	24 - 25	<0.01
DH5-6	25 - 26	<0.01
DH5-7	26 - 27	<0.01
DH5-8	27 - 28	<0.01
DH5-9	28 - 29	<0.01
DH5-10	29 - 30	<0.01
DH5-11	30 - 31	<0.01
DH5-12	31 - 32	<0.01
DH5-13	32 - 33	<0.01
DH5-14	33 - 34	<0.01
DH5-15	34 - 35	<0.01
DH6-01	20 - 21	<0.01
DH6-02	21 - 22	<0.01
DH6-03	22 - 23	<0.01
DH6-04	23 - 24	<0.01
DH6-05	24 - 25	<0.01
DH6-06	25 - 26	<0.01
DH6-07	26 - 27	<0.01
DH6-08	27 - 28	<0.01
DH6-09	28 - 29	<0.01
DH6-10	29 - 30	<0.01
DH6-11	30 - 31	<0.01

Detn limit (0.01)

analabs

Analysis code C3/4

Report AC 220/85

NATA Certificate

Results in ppm

Sample	Depth (m)	Au
DH6-12	31 - 32	<0.01
DH6-13	32 - 33	<0.01
DH6-14	33 - 34	<0.01
DH6-15	34 - 35	<0.01
DH6-16	35 - 36	<0.01
DH6-17	36 - 37	<0.01
Detn limit		(0.01)

APPENDIX J

Data sheets for Samples Collected by Western Mining Corporation 1984-1985

EXPLORATION DIVISION

SAMPLE DATA SHEET

Form 270

SAMPLE NUMBER	DRILL HOLE DEPTH FROM OR TO / SAMPLE CO-ORDINATE N/S E/W	DESCRIPTION
		A) MT. GRAINGER AREA
AA892724		Heatherbell (N.E.) - 60 cm H.W. veins, irreg & poddy in f.g. arkosic grit.
AA892725		Buttamuck well - 20-30 cm of H.W. tillite with thin qtz-irst vns.
AA892726		Grand Junction addit. - 15 cm qtz vn, dip 60 SW with MnO_2 in Sw.
AA892727		Paddys Gun - chips of carbonate & ex py blebs in shale.
AA892728		Chips over 5 m silicified Sh? - trending 080° at nose of anticline (plnging 25°).
AA892729		Chips of c.g. iM - prob. calc alkaline. In creek close to "diapir".

EXPLORATION DIVISION

SAMPLE DATA SHEET

Form 270

ANALYTICAL DATA (Values in ppm unless otherwise stated)

SAMPLE NUMBER	DRILL HOLE DEPTH / SAMPLE CO-ORDINATE	Au	Hg ppb	Sb	Ni	Cu	Co	Cr	Ag	Fe%	Mn	Pb	Zn	Bi	As
			A) MT. GRAINGER AREA												
AA892724		0.04	10	<1	30	45	20	210	1.0	7.2	280	20	50	0.8	265
AA892725		7.60	20	<1	70	10	110	170	2.0	9.7	4110	20	40	9.4	110
AA892726		0.07	15	<1	50	25	30	210	2.0	8.0	230	20	30	0.2	10
AA892727		0.08	15	<1	40	120	15	140	1.0	3.9	730	20	30	0.9	80
AA892728		0.02	15	<1	70	215	20	140	2.0	7.0	170	20	40	0.6	25
AA892729		<0.02	10	<1	110	10	40	120	3.0	10.6	210	60	60	0.1	<5
			B) AJAX												

AA89720	MT. GRAINGER
	+20Kg bulk sample from "ore dump" No. 2 open cut.
AA89721	Selective qtz-irst vein samples from No. 2 open cut.
AA89722	Sample of "carted ore" from 220 ft level (on shaft pad).
AA89723	Mn rich qtz vein on "ore" dump at No. 3 open cut.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

SAMPLING RECORD

Material: Rock Chip
Map Ref:
Depth:
Laboratory Request No.: SER1871/1872
Sampled Logged By: P.W.
Date: 14/11/84
LINE No.:
FROM
TO
Photo No
Bearing

PROJECT

Region: CENTRAL
Project: S.A. RECONNAISSANCE
Prospect:
Cost Code: 4184

DRILLING RECORD

Drill Type:
R.L. m Water Table At m
Dip Azm
Date:
CO-ORDINATES m N/S m E/W
HOLE No:

MT. GRAINGER

Sample	Au	Hg ppb	Sb	Ni	Cu	Co	Cr	Ag	Fe%	Mn	Pb	Zn	Bi	As
AA89720	0.14			110	65	175	290	0.5	2.4	8300	<10	80	0.2	<5
AA89721	0.08	15	<1	170	70	200	30	<0.5	4.0	10200	20	110	0.2	20
AA89722	<0.02	10	<1	20	5	15	10	0.5	3.1	500	10	40	0.1	15
AA89723	1.84	10	1	90	20	195	90	3.5	18.5	860	30	20	3.5	320

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

SAMPLING RECORD

Material: Rock Chip
Map Ref:
Depth:
Laboratory Request No: SER1871/1872
Sampled Logged By: P.W.
Date: 14/11/84
LINE No.:
FROM
TO
Photo No
Bearing

PROJECT

Region: CENTRAL
Project: SA RECONNAISSANCE
Prospect:
Cost Code: 4184

DRILLING RECORD

Drill Type:
R.L. m Water Table At m
Dip Azm
Date:
CO-ORDINATES m N/S m E/W
HOLE No:

EXPLORATION DIVISION

SAMPLE DATA SHEET

Form 270

SAMPLE NUMBER	DRILL HOLE DEPTH FROM ... TO / OR SAMPLE CO-ORDINATE N/S E/W	DESCRIPTION	ANALYTICAL DATA (Values in ppm unless otherwise stated)
		120 ft level - northern stope	
AA893001		2.5 m chips in stope close to F.W. - Tillite with qtz.-irst. stckwk.	
		220 ft level + 10 m down shaft	
AA893002		0.5 m H.W. vein dipping 45° S.W.	
		220 ft drive	
AA893003		2 m of F.W. stckwk.	
004		1 m of H.W. stckwk.	
005		7 m chips between samples AA003 and AA004.	
		120 ft level	
AA893006		3 m chips along drive in central part of stckwk.	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

SAMPLING RECORD

Material: Rock Chips	Depth:	Sampled Logged By: P.W.
Map Ref:	Laboratory Request No: SER1876	Date: JUNE 1985
LINE No.	FROM	Photo No
	TO	Bearing

PROJECT

Region: CENTRAL REGION
Project: MT. GRAINGER S.A
Prospect:
Cost Code: 4184

DRILLING RECORD

Drill Type:
R.L. m Water Table At m
Dip: Azm:
Date:

CO-ORDINATES m N/S m E/W

HOLE No

EXPLORATION DIVISION

SAMPLE DATA SHEET

Form 270

SAMPLE NUMBER	DRILL HOLE DEPTH FROM OR TO / SAMPLE CO-ORDINATE N/S E/W	DESCRIPTION	Au	Ni	Cu	Cr	Fe%	Mn	Pb	Zn	Bi	As	Sb
AA893001			0.28	50	35	80	3.2	1040	<20	30	0.4	10	<1
AA893002			0.04	30	20	100	3.0	460	<20	50	<0.1	5	<1
AA893003			0.02	30	20	110	4.0	3710	<20	40	<0.1	20	<1
004			0.04	50	20	110	3.8	1080	<20	60	<0.1	10	<1
005			0.02	50	15	130	2.9	3620	<20	50	0.1	10	<1
AA893006			0.04	110	205	120	4.1	20100	<20	160	0.1	20	<1

ANALYTICAL DATA (Values in ppm unless otherwise stated)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

SAMPLING RECORD

Material: Rock Chips
Depth:
Sampled/Logged By: P.W.
Map Ref:
Laboratory Request No. SER1876
Date: JUNE 1985
LINE No.
FROM
TO
Photo No.
Bearing

PROJECT

Region: CENTRAL REGION
Project: MT. GRAINGER S.A
Prospect
Cost Code 4184

DRILLING RECORD

Drill Type
R.L. m Water Table At m
Dip Azm
Date
CO-ORDINATES m N/S m E/W
HOLE No

EXPLORATION DIVISION

SAMPLE DATA SHEET

Form 270

SAMPLE NUMBER	DRILL HOLE DEPTH FROM OR TO / SAMPLE CO-ORDINATE N/S E/W	DESCRIPTION	ANALYTICAL DATA (Values in ppm unless otherwise stated)
		250 ft level in WSW Winze	
AA893047		S.W. part of wall - 1 m zone including 0.5 m H.W. bucky qtz.	
48		Ditto on N. wall.	
49		Channel in lode across floor of Winze 2 m below H.W.	
50		5 m above AA48, 1 m H.W. part of lode.	
		220 ft level by shaft	
AA893051		1.5 m of upper part of lode including 1.0 m lower portion of qtz.-irst. stkwk.	
		Surface - No. 2 cut new mill	
AA893052		H.W. part of lode - channel across 1 m at end of pit containing Manganese oxide + qtz., irst. veins.	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

SAMPLING RECORD

Material: Rock Chips | Depth: | Sampled/Logged By: P.W.

Map Ref: | Laboratory Request No. SER1882 | Date: 31/7/85

LINE No. | FROM | Photo No

TO | Bearing

PROJECT

Region: Central Region

Project: Mt. Grainger S.A

Prospect

Cost Code 4184

DRILLING RECORD

Drill Type:

R.L. m | Water Table At m

Dip | Azm

Date:

CO-ORDINATES m N/S m E/W

HOLE No

EXPLORATION DIVISION

SAMPLE DATA SHEET

Form 270

SAMPLE NUMBER	DRILL HOLE DEPTH FROM OR TO / SAMPLE CO-ORDINATE N/S E/W	DESCRIPTION	Au	Ag ppb	Hg ppb	Ni	Cu	Cr	Fe%	Mn	Pb	Zn	Bi	As	Sb
AA893047			<0.02	100	290	30	5	90	2.7	560	<20	40	0.2	95	
48			0.03	100	10	30	5	100	2.3	850	<20	50	0.1	25	
49			<0.02	<100	15	20	10	80	1.2	160	<20	30	0.2	10	
50			0.04	<100	20	20	5	110	2.4	1280	<20	40	0.1	30	
AA893051			<0.02	100	15	30	5	130	2.6	980	<20	70	0.2	35	
AA893052			<0.02	200	10	100	65	100	4.9	11900	<20	70	0.2	125	

(Values in ppm unless otherwise stated)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

SAMPLING RECORD

Material: Rock Chips
Depth:
Sampled/Logged By: P.W.
Map Ref:
Laboratory Request No.: SER1882
Date: 31/7/85
LINE No.
FROM
TO
Photo No.
Bearing

PROJECT

Region: CENTRAL REGION
Project: MT. GRAINGER S.A
Prospect:
Cost Code: 4184

DRILLING RECORD

Drill Type:
R.L. m Water Table At m
Dip Azm
Date:
CO-ORDINATES m N/S m E/W
HOLE No

WA[redacted]TO.

K.N.O. 962-5K.

KAMBALDA NICKEL OPERATIONS — ANALYTICAL REPORT

Method: FIRE ASSAY GOLD.
ACID DIGESTION A.A.S BASE METALS

Project: AMALGRAM

Analyst: W. Abbott

Date: 11-7-85

Sample No.	Ni %	Cu %	Co %	Zn %	Pb %	Fe %	Mn %	Cr %	MgO %	≈Hg %	Au ppm
AA849743	<.01	12.6	<.001	<.001	<.001	<.1	<.01	<.001	<.1	86	537

SAMPLE WEIGHT 7.2802 gm

Do give us a call if any of the above results are not clear.

Regards
John Harz

APPENDIX K

Sample Descriptions and Assay Results of Orientation Geochemical Rock Chip Sampling by D.L. Seymour (Jarmand Minerals and Exploration Pty. Ltd.) 1984 (b).

Sample Descriptions and Assay Results of Orientation Geochemical Rock Chip Sampling
by D.L. Seymour, (Jarmand Minerals and Explorations Pty. Ltd.)

Sample No.	Description	Au	Ag	Cu	Pb	Zn	Co	Ni	Cr	Cd	As	Bi	Mn	Mo	Sb	Sn	U	V	W	Fe %
4467	Mineralised quartz float and sub outcrop near NE corner of ML 5178.	BLD	0.25	12	10	21	80	474	144	BLD	6	6	195	2.5	BLD	BLD	21	9	BLD	2.29
4468	Mustard-yellow siltstones and shales with minor syngenetic limonite (after sulphides?) in minute siliceous augens.	BLD	BLD	67	14	68	8	89	74	BLD	BLD	BLD	54	1.6	BLD	BLD	26	60	6	4.97
4469	Qtz vein stockwork in arkosic tillite in backhoe cut.	BLD	BLD	17	13	16	18	411	132	BLD	BLD	BLD	476	2.5	BLD	BLD	29	10	6	3.89
4470	Managaniferous qtz. vein stockwork in highly altered arkosic tillite S. side of N. Medora decline.	BLD	BLD	18	7	15	77	609	272	BLD	BLD	BLD	2540	3.9	BLD	BLD	27	7	5	2.46
4471	Spotted Fe phyllitic siltstone in short drive near Jones shaft.	BLD	BLD	27	12	48	19	180	59	BLD	11	BLD	424	1.6	BLD	BLD	30	17	5	5.22
4472	Qtz vein stockwork in crumbly altered arkose from decline immediately N.E. of Mount Grainger summit.	BLD	0.33	13	15	12	77	690	250	BLD	BLD	6	248	2.4	BLD	BLD	34	16	8	6.43
4473	Less intense qtz vein stockwork in face of short adit below Buttamuck well mine.	BLD	BLD	7	14	16	44	634	209	0.70	BLD	BLD	442	2.7	BLD	BLD	37	9	BLD	6.11
4474	Mineralised ferruginous qtz veined Gumbowie Arkose member of Pepuarta Tillite in recent open cut workings at south end of Dustholes.	1.67	0.57	175	102	1366	29	45	126	0.50	27	15	209	3.4	BLD	BLD	43	12	BLD	12.3
4475	Manganiferous sulphide gossan with lesser qtz from southern end of the Myrtle open cut at the adit mouth, Dusholes.	1.61	1.29	723	757	847	183	75	184	1.50	270	16	7840	4.6	BLD	BLD	55	8	BLD	9.68
	Limit of Detection	0.04	0.05	5	5	5	1	2	2	0.05	5	5	1	1.0	5	5	5	2	4	0.01%

Note: All values in ppm unless otherwise stated.
BLD = below limit of detection.

APPENDIX L

Description and Assay Results of Samples collected by Dr C. Giles 18.3.86.

<u>No 2 open cut</u>

86/14	small sample, from particularly limonitic quartz vein.	0.05
86/15	large sample, average of all vein quartz (90% in sample).	<0.05
86/16	large sample, average of all vein quartz (90% sample (mostly from vein set dipping perpendicular to bedding contact).	0.07
86/17(A)	large sample, <u>true</u> stockwork immediately below h/w contact, 90% vein quartz, much sooty Mn oxides.	<0.05

<u>No 4 open cut</u>

86/17(B)	as for 86/17(A), lower part unit.	<0.05
86/18	small sample, particularly limonitic quartz vein.	<0.05
86/19	small sample, single white quartz vein perpendicular to bedding.	<0.05
86/20	as for 86/17(B), upper part unit.	<0.05
86/21	small sample, thin bedding conformable h/w vein.	0.07
86/22	small sample, thin vertical quartz-limonitic vein perpendicular to strike.	0.10

<u>No 3 open cut</u>

86/23	large sample, average all vein quartz (90% quartz in sample)	0.14
86/24	small sample - highly pyritic zone in quartz vein.	0.53
86/25	small sample - highly pyritic zone in quartz vein.	0.47

<u>Shattered Dream No 1 open cut</u>

86/26	large sample, exclusively highly pyritic vein quartz.	2.8
86/27	large sample, sericitised, stockworked quartzite (30% vein quartz).	0.08

<u>No 5 open cut</u>

86/28	large sample, exclusively vein quartz (90% sample) from bedding perpendicular veins.	0.08
86/29	small sample, intensely quartz-limonite stockwork.	0.49
86/30	typical limonite spotted, quartzite country rock.	<0.05

<u>No 7 open cut</u>

86/31	large sample, exclusively vein quartz (90% sample) from bedding perpendicular veins.	<0.05
86/32	small sample, composite of several very pyrite rich "patches"	0.10
86/33	large sample, typical stockwork veined quartzitic host unit.	<0.05

<u>No 6 open cut</u>

86/34	large sample, as for 86/31.	0.30
86/35	small sample, as for 86/32 - specifically vertical North-South vein.	0.35

<u>Iron clad</u>

86/36	large sample, dump near main shaft (stockwork in quartzite).	0.26
86/37	large sample, roof of aidt in stockwork bed.	0.21

<u>Note</u>

1. All samples are composite and weigh in excess of 2 kg.

APPENDIX M

Routine Petrographic and Mineragraphic Descriptions of Rock Specimens RS41-RS55. (AMDEL Report 5227/83, Pt. 1 and Pt. 11 by Dr Andy Kemp).

The Australian
Mineral Development
Laboratories

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Phone Adelaide 79 1662
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Please address all
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P.O. Box 114 Eastwood
SA 5063

amdel

23 June 1983

In reply quote: GS 1/16/0

Your Ref: 12.03

Director-General,
Department of Mines & Energy,
PO Box 151,
EASTWOOD, SA 5063.

REPORT GS 5227/83 - PART I

YOUR REFERENCE: Application dated 5 April 1983

MATERIAL: Rocks

LOCALITY: Mt. Grainger mine

IDENTIFICATION: MGS 29-44

DATE RECEIVED: 7 April 1983

WORK REQUIRED: Routine petrographic descriptions and mineragraphy

Investigation and Report by: Dr Andy Kemp

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Keith Henley

for Brian S. Hickman
Managing Director

jd

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PETROGRAPHY OF ROCKS FROM MT. GRAINGER MINE

1. INTRODUCTION

Fifteen samples of rocks from Mt. Grainger mine were received from Mr R. Horn, SA Department of Mines & Energy, with a request for routine petrographic descriptions of all samples and mineragraphic descriptions of those samples that contained sulphides. Particular attention was to be paid to identification of gold mineralisation and to alteration in the rocks.

2. PROCEDURES

Fifteen thin sections were prepared, including a section of sample MG42 that was not listed on the application. Four polished sections were also prepared. The following section gives the petrographic descriptions while the mineragraphic descriptions will follow in the final report.

Sample No. RS41/MGS29 T/S C39699

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	20-50
Clay minerals	35-50
Opaque	10-15
?Sericite	5-15
Heavy minerals	Trace

The above percentage variations reflect differing proportions of detrital quartz to groundmass.

Generally poorly sorted quartz grains range up to 0.5 mm across; grains are dominantly angular to subangular and poor dimensional parallelism of elongate grains imparts a weakly developed penetrative structure. Many grains show partially cuspate outlines, and this together with angularity suggests many have a volcanic exhalative origin,and have suffered little transport. All quartz grains show strain effects.

The area sectioned contains one very fine grained sericite/clay clast approximately 2 mm across of uncertain origin (?possibly volcanic).

The matrix consists predominantly of fine kaolinite with intergrown ?sericite. Kaolinite frequently forms slightly vermicular 'books', with some apparently derived by replacement of ?sericite.

Opaque material occurs mainly as finely disseminated haematite, with occasional clots up to 0.6 mm across.

Heavy minerals are mainly of tourmaline and up to 0.1 - 0.2 mm across.

Conclusion

Broadly, the rock is a clay rich sandstone, but form of quartz, nature of clasts and composition of groundmass suggest strong volcanic affinities. Glass shards are absent, but a volcaniclastic origin seems likely.

Sample No. RS42/MGS30 T/S C39700

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	85+
Clay minerals	10
Opaque	1-2
?Pyrophyllite	<1

The sample is of an extensively strained and recrystallised quartzite with anhedral to euhedral pseudomorphs of clay minerals and opaques.

The bulk of the sample consists of approximately equant subhedral quartz grains <0.5 mm across. All grains show strain effects, and margins between coalesced overgrowths are highly irregular to sutured, showing a lack of textural equilibrium.

The sample is extensively replaced by quartz veins, with strained subhedral grains up to 5 mm across showing partial recrystallisation ("grain diminution"). Replacement by quartz appears to have been passive, with quartz veins including euhedral clay/opaque pseudomorphs.

Pseudomorphs are up to approximately 1.5 mm across with some containing fine quartz grains and clots of pyrophyllite. Form and composition of many of the pseudomorphs suggests they are after feldspar.

Fine rhombohedral voids may be casts of carbonate (?dolomite) or siderite. Larger voids are lined with botryoidal haematite and some show associated clots of pyrophyllite up to approximately 0.4 mm across. Origin of these voids is uncertain, but pyrophyllite suggests hydrothermal activity. Faint irregular boxwork textures in some voids suggests replacement of sulphides.

Conclusion

The sample is of an extensively silicified quartzite with pseudomorphed minerals (?feldspar) suggesting a strong volcanic component. Straining and partial recrystallisation are post-silicification.

Sample No. RS43/MGS31 T/S C39701

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	95+
Opaque	1-2
Clay minerals	<1
Heavy minerals	Tr

This sample is similar in many respects to that previously described, and is of a metaquartzite with quartz veining.

Quartz grains in the host are generally <0.5 mm across with sutured to curved and occasionally straight intergrain boundaries. Variation in grain size, the high percentage of non-rational grain boundaries and paucity of equal angle triple points indicates a non-equilibrium texture which is, however, slightly better developed than that of Sample RS42. Quartz grains adjacent to haematite coated irregular voids occasionally show good development of unstrained euhedral forms against haematite, indicating formation after that of the voids, and prior to deposition of haematite.

Silicification is associated with coarse quartz veining, with strained subhedral vein quartz forming grains up to 2.5 - 3.0 mm across, which occasionally show partial recrystallisation ('grain diminution').

Vein-like to occasionally partially euhedral vugs are coated to partially infilled with opaques (mainly haematite) with opaques cementing quartz in irregular patches up to approximately 1 mm across. Rare irregular vugs are infilled with clay minerals and fine haematite. The form of the latter suggests it may be after framboidal pyrite, and the form of some larger vugs suggests they may be after sulphides.

Relationships between quartz, opaques and 'vugs' suggests extensive solution and ?mineralisation prior to silicification. Formation of euhedral quartz is post deformation and major recrystallisation.

Conclusion

The sample is of a silicified metaquartzite with possible sulphide mineralisation now represented by haematite lined vugs with associated later euhedral quartz.

Sample No. RS44/MGS32 T/S C39702

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	65
Clay minerals	20
Opaque	10
Pyrophyllite	5

The sample is of a slightly metamorphosed, partially silicified and hydrothermally altered quartz rich rock, of probable sedimentary/ tuffaceous origin and arkosic composition.

Quartz grains comprising the dominant component are strained and show marginal recrystallisation and occasional overgrowth development. Where original grain outlines can be discerned, grains are angular to subrounded, up to approximately 0.75 mm across and moderately to poorly sorted. Chalcedonic quartz cement is observable in some (restricted) areas.

Other probably original detrital material is now represented by clay minerals, pyrophyllite and subsidiary opaques. The majority of these clots lack any external form or internal structure, are up to 2.5 mm across, and may represent feldspathic material. Occasional clots contain apparently subhedral grains in which clay minerals are in approximately optical continuity and may represent feldspar grains.

The sample contains numerous voids and pseudomorphs showing euhedral rhombic cubic to ?hexagonal forms, ranging from <50 μm to 1.5 mm across. Replacements include opaques, clay minerals and pyrophyllite,and rhombic pseudomorphs appear to be early formed (pre secondary quartz). Forms suggest they are after dolomite or siderite. Other cubic and ?hexagonal forms (probably modified cubes), mainly infilled with haematite, are possibly after sulphides.

Pyrophyllite is patchily developed and forms submicroscopic flakes and subradiated clusters, the latter up to 0.5 - 1 mm across. Association with haematite pseudomorphs is marked, with extensive replacement of 'matrix' (excluding quartz). Haematite and pyrophyllite development in some patches appears associated with extensive fracturing of quartz grains, and similar fracturing is also seen in adjacent quartz veins. Other characteristics of the latter are similar to those described from previous samples.

Conclusion

The sample is of a silicified and hydrothermally altered ?sandstone with a probable high (approximately 20%) original feldspar content.

Sample No. RS45/MGS33 T/S C39703

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	30
Feldspar (partially altered to pyrophyllite and/or sericite)	25
?Siderite + Fe-oxides	20
Lithic clasts (excluding carbonate and/or Fe-oxide clasts)	15
?Dolomite	<1
Opaque	<1
Calcite	Tr
Biotite	Tr
Heavy minerals	Tr

The sample is of a coarse polymict greywacke, with feldspar and rock fragments up to approximately 5 mm across.

Subangular to subrounded quartz grains up to 2.5 - 3 mm across are commonly strained with irregular authigenic overgrowths. Some grains, not listed under "Lithic clasts' above, are composed of coarse quartz and feldspar. Feldspar in these and mono-mineralic grains is of plagioclase and untwinned K-feldspar. Many plagioclase grains are angular euhedral with preferential replacement of central zones reflecting compositional zonation. Occasional feldspar grains up to 5 mm across are of fractured and partially altered microcline with patchy albite (patch perthite).

Lithic clasts have a range of composition, with none dominating, and include microcrystalline siderite, partially sideritised fine sandstone, and basic volcanic fragments composed predominantly of plagioclase feldspar. Rounded grains of coarsely crystalline carbonate (?dolomite) are up to 1.25 mm across.

The matrix is composed mainly of coarsely crystalline siderite extensively replaced by Fe-oxides. Rhombohedral forms are common and the cement appears to have formed early, with good crystal forms against secondary quartz.

Calcite forms rare patches up to 0.5 mm across and is apparently related to fine late calcite veins.

Conclusion

The sample is of a badly sorted polymict greywacke with an early formed, in part replacive, siderite cement. Quartz veining shows characteristics similar to those displayed in previous samples.

Sample No. RS46/MGS34 T/S C39704

Thin Section

A visual estimate of the constituents gives:-

	%
Feldspar (patchily altered to pyrophyllite and/or sericite)	∿50
Quartz	40
Siderite and Fe-oxides	5
Opaque	1-2
Biotite (extensively altered to chlorite)	∿1
Calcite	<1
Heavy minerals	Tr

The sample is of a slightly deformed, veined and hydrothermally altered granite, with a coarse hypidiomorphic granular texture. Quartz and feldspar grains are up to 4 - 5 mm across, with ragged biotite grains up to approximately 4 mm across.

Greater than $^2/_3$ of the feldspar is composed of untwinned to simply twinned K-feldspar and microcline. Plagioclase appears to be albitic. Feldspars show slight deformation (bending of twinn lamellae) which appears to have occurred in the 'plastic' state. Both K- and plagioclase feldspar show patchy and often intense alteration to pyrophyllite and/or sericite, with fine grain size of the alteration products precluding positive identification. Minor albite veins are associated with this alteration. Biotite flakes show extensive alteration to chlorite. Highly oxidised siderite occurs as rare fine disseminated rhombohedral grains, as coarse subhedral grains associated with quartz veining, and as coarse grained patchy replacements.

Calcite forms fine late veins and patchy calcite is associated with solution vugs in siderite.

Rare opaque grains up to 1.3 mm across are of ?magnetite extensively altered to haematite.

Conclusion

The sample is of a hydrothermally altered and veined two feldspar leucogranite, with deformation seen in feldspars possibly occurring in the plastic state. The rock has undergone slight tectonic deformation and late stage calcite veining.

Sample No. RS47/MGS35 T/S C39705

Thin Section

A visual estimate of the constituents gives:-

	%
Feldspar (patchily altered to pyrophyllite and/or sericite)	45
Quartz	40
Siderite and Fe-oxides	10
Biotite (extensively altered to chlorite)	1-2
Opaque	1
Calcite	<1
Muscovite	Tr
Heavy minerals	Tr

The sample is similar to RS46 in mineralogy and texture, and is of a ?hydrothermally altered granite. The texture is hypidiomorphic granular with quartz and feldspar grains up to 5 mm+ across. Quartz grains are commonly strained, slightly fractured and siderite and Fe-oxides commonly occur along quartz/feldspar grain boundaries.

Greater than $^2/_3$ of the feldspar is of untwinned to simply twinned K-feldspar and microcline. The latter frequently shows albitic patches (patch perthite) probably due to exsolution during slow cooling. Untwinned albite also forms rims to some highly altered untwinned ?K-feldspar grains and as such is probably a secondary alteration product.

Twinned plagioclase feldspar is commonly finer grained than K-feldspar and is probably of albite, although alteration precludes a definite identification. All feldspar shows patchy and often intense alteration to pyrophyllite and/or sericite.

Ragged biotite flakes up to 2 - 3 mm across are partially altered to chlorite and Fe-oxides along cleavage planes; chlorite is probably penninite.

Highly oxidised siderite occurs mainly with dominant quartz in veins up to 8 mm+ thick and forms fractured subhedral grains up to 1 - 2 mm across. Calcite is associated with siderite in apparent voids in these veins and has probably formed by breakdown of siderite.

Conclusion

The sample is of a two-feldspar leucogranite, slightly deformed, which has undergone probable hydrothermal alteration and veining by quartz and siderite.

Note: Many grains/fragments in the greywacke could be derived from the granite(s) from which RS46 and 47 were taken.

Sample No. RS48/MGS36 T/S C39706

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	75+
Pyrophyllite (mainly replacing ?feldspar and lithic clasts)	20
Fe-oxides	1-2
Opaques	∿1
Chert clasts	<1
Heavy minerals	Tr

The sample is of a hydrothermally altered medium grained poorly sorted sandstone, possibly originally arkosic. Single crystal quartz grains range up to 2 mm across, with coarse multicrystalline quartz aggregates of probable igneous origin up to 3.75 mm maximum dimension. Other lithic clasts now replaced by pyrophyllite, are lensoid and up to 5 mm in length.

Quartz grains are strained, with subrounded to rounded outlines and frequently show extensive development of authigenic overgrowths. Overgrowths frequently show fine inclusions of pyrophyllite, indicating late development probably associated with quartz veining. Quartz also occurs intergrown in pyrophyllite clots, and as such is probably an alteration product of feldspar. The area sectioned is cut by a quartz vein up to approximately 1.5 mm thick in which quartz shows only slight straining and recrystallisation.

Pyrophyllite occurs in two forms. The dominant of these is as fine aggregates which probably replace detrital feldspar. The subordinate occurrence is as bent frequently subradiated tabular - elongate to fibrous grains up to 0.7 mm in length forming clots up to 1 - 2 mm across, and intergrowths with fine pyrophyllite in patches up to 5 mm across. The latter contain subordinate quartz and in these patches pyrophyllite appears to replace all pre-existing components.

Opaque material is generally associated and intergrown with pyrophyllite as anhedral grains up to 1 mm across of ?magnetite, now extensively altered to haematite and limonite.

Conclusion

The sample is of a poorly sorted feldspathic sandstone which has undergone silicification possibly associated with hydrothermal alteration.

Sample No. RS49/MGS37 T/S C39707

Thin Section

A visual estimate of the constituents gives:-

	%
Opaque (mainly finely disseminated Fe-oxides)	40
Sericite	30
Clay minerals	20
Quartz	10
Heavy minerals	Tr

The above percentages are very approximate due to fine grain size and compositional variation.

Lithologic banding is cut at high angles by a slightly wavy banding caused by variation in concentration of fine Fe-oxides. A fine foliation due to sericite alignment approximately parallels lithologic banding and is deformed by a weakly developed crenulation cleavage.

Apart from fine Fe-oxides and occasional euhedral opaque grains, the sample consists of a fine intergrowth of sericite, clay minerals and quartz, with lithologic banding mainly due to variation in sericite/clay/quartz proportions. Lithologic bands range from approximately 0.25 - 5 mm thick, with sharp to gradational interfaces.

Lensoid clots up to approximately 1.75 mm in length are elongate parallel to lithologic banding and composed predominantly of iron oxides, with occasional euhedral forms indicating possible replacement of sulphides. Occasional clots are predominantly of clay minerals and it appears such clots have been preferential sites for mineralisation.

Apparently randomly distributed euhedral opaque grains are of haematite, with forms suggesting replacement of pyrite.

Conclusion

The sample is of an oxidised iron rich sericitic shale, with pseudomorphs after apparently randomly distributed and early forming sulphides.

Sample No. RS50/MGS38 T/S C39708

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	35
Pyrophyllite (including much material also listed under 'Lithic clasts')	30
Lithic clasts	25
Opaque	5
Clay minerals	<5

The sample is of a coarse poorly sorted greywacke/conglomerate with elongate lithic clasts up to 1.25 cm in length, multicrystalline quartz aggregates up to approximately 9 mm across and single crystal quartz grains up to 2.5 mm.

Quartz grains are subangular to dominantly subrounded to rarely well rounded with very limited authigenic overgrowths. Quartz grains are rarely in contact and show only slight grain penetration.

Lithic clast range widely in composition, with many showing extensive replacement by pyrophyllite which precludes positive identification of original rock types.

Many clasts are of quartz rich fine grained volcanic rocks (?rhyolites) with occasional clasts containing quartz phenocrysts. Fine to medium grained sandstone clasts are also common, with a matrix to quartz grains composed of a microcrystalline aggregate of pyrophyllite.

One clast is composed of fine dusty recrystallised non-orientated quartz, with regular laminae up to 0.2 mm thick replaced by pyrophyllite, and may be of a banded 'tuff' of rhyolitic composition.

The majority of clasts contain 90%+ of pyrophyllite with minor secondary quartz, lack internal structure, and are possibly of felsic volcanics.

Opaque grains are mainly euhedral pseudomorphs formed mainly of haematite and voids. Some contain inclusions of pyrophyllite, which suggests original ?sulphide formation was contemporaneous with that of pyrophyllite.

Irregular veins are composed of lamaellar to massive opaques, with minor haematite and associated voids. Opaques have not been positively identified, but are possibly ilmenite.

Conclusion

The sample is of a hydrothermally altered and mineralised greywacke/ conglomerate, with a high percentage of clasts of probable acid volcanic derivation.

Sample No. RS51/MGS39 T/S C39709

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	60-65
Clay minerals	15-20
Pyrophyllite	10
Opaque	10
?Jarosite	Tr

The sample is of a hydrothermally altered medium grained sandstone, with a matrix now composed mainly of clay minerals and pyrophyllite, and with the latter minerals forming pseudomorphs of feldspar.

Quartz grains up to approximately 0.5 mm across with angular to dominantly subrounded outlines show good development of authigenic quartz overgrowths, with development of irregular to commonly sutured intergrain boundaries which frequently contain fine opaques.

Patchy distribution of pyrophyllite and clay minerals may be a reflection of original heterogeneities, due to uneven hydrothermal replacement, or a combination of these factors. It appears that clay minerals have mainly formed from pyrophyllite at a later stage.

The sample is cut by a quartz vein approximately 2 - 2.5 mm across composed of strained grains occasionally showing dimensional orientation and sutured boundaries.

Occasional euhedral haematite/void pseudomorphs have an apparent random distribution and are possibly after sulphides.

Rhombohedral forms up to 0.25 mm across are vacant to partially to totally infilled with clay and/or pyrophyllite. It appears probable that these forms are siderite casts from which siderite has been dissolved, with subsequent infill by pyrophyllite and alteration to clay minerals.

Conclusion

The sample is of a fine to medium grained sandstone, probably originally feldspathic, which has been hydrothermally altered, with silicification and alteration of feldspar to pyrophyllite. Formation of clay may be associated with later oxidation of opaques.

Sample No. RS52/MGS40 T/S C39710

Thin Section

A visual estimate of the constituents gives:-

	%
?Sericite	∿65
Fe-oxides + opaques	15
Clay minerals	∿10
Quartz	10
Heavy minerals (mainly tourmaline)	<1

The above percentages are very approximate due to fine grain size of the sample. It consists dominantly of a fine foliated intergrowth of sericite, quartz and opaques/Fe-oxides containing rounded clay-rich clots up to approximately 2 mm across.

Sericite flakes are <25 μm in length with fine oxidised opaques forming anhedral elongate grains up to approximately 50 μm in length.

Quartz grains are angular, subhedral to occasionally euhedral and generally <50 μm maximum dimension, with elongate grains showing dimensional parallelism with foliation.

Partially oxidised coarser opaque grains up to 0.15 - 0.2 mm across form clots up to 3 - 4 mm in length elongate parallel to foliation.

Approximately round 'spots' observed at macroscopic scale are seen to deviate markedly from this form under the microscope. Many show well developed plane surfaces and rounded forms similar to those displayed by feldspars, with no deflection of external foliation. Spots are composed of a fine intergrowth of clay minerals, fine partially to totally oxidised opaques, quartz, sericite and minor tourmaline. Some spots show a concentric zonation and/or a central void, possibly reflecting original compositional zonation, and it is thought they may represent altered fine grained volcanic clasts, possibly of air-fall origin.

Conclusion

The sample is of an extensively altered fine grained rock of uncertain origin. Spots thought to be fine grained volcanic material indicate the rock is probably of volcaniclastic/sedimentary origin, with the foliation representing relict bedding.

Sample No. RS53/MGS41 T/S C39711

Thin Section

A visual estimate of the constituents gives:-

	%
Opaque	95+
Quartz	1-2
Clay minerals	<1

The sample consists of massive opaques (?magnetite) extensively altered to haematite, with disseminated quartz veins and rare clay rich patches.

Quartz grains are the most interesting feature of the sample. They show euhedral and occasionally lath shaped forms, with most displaying irregular faces due to probable magmatic corrosion; grains are up to 0.25 mm in length with a lack of preferred orientation.

Clay rich patches up to 2 mm across contain occasional quartz grains similar to those described above, and anhedral fine opaque grains. Clays are iron stained and of uncertain type. Wavy lamination in some clay patches may indicate a partially derived secondary origin for some of the clay.

Conclusion

The sample is of an iron ore of magmatic (volcanic) origin, with fine quartz crystals and clay patches which may have been dominantly of volcanic glass, although this suggestion is extremely tentative.

Sample No. RS54/MGS43 T/S C39712

Thin Section

A visual estimate of the constituents gives:-

	%
?Pyrophyllite, iron oxides and clay minerals (matrix)	60
Quartz	25
Lithic clasts	15
Heavy minerals	Tr

The sample is of a poorly sorted sandstone/greywacke with a fine matrix now composed of secondary minerals.

Quartz grains are subangular to predominantly subrounded with rare well rounded grains, and range up to 0.75 mm across. Rare overgrowths contain fine ?pyrophyllite inclusions. Rounded lithic clasts are up to 2.5 mm across, with coarser clasts composed of multicrystalline quartz aggregates. Some of the latter appear to be of metaquartzite, with some also of probable volcanic origin. Clasts now composed of ?pyrophyllite, iron oxides, clay minerals and quartz show textures indicating an igneous progenitor. Lack of flow textures in these clasts suggests they may be of minor acid to ?intermediate intrusives.

The matrix is composed mainly of ?pyrophyllite and iron oxides in approximately equal proportions, with rare ?pyrophyllite flakes up to 0.2 mm in length.

Greater than 90% of groundmass material has a grain size of <25 - 40 μm, with quartz grains ranging down to approximately this grain size.

Opaques form irregular patches up to 1 - 2 mm across and appear to be mainly of haematite. Rare euhedral grains with hexagonal forms are also of haematite.

Rare heavy mineral grains are of tourmaline and up to 0.15 mm across.

Conclusion

The sample is of a poorly sorted coarse grained sandstone/greywacke, with a clay/silt matrix now composed wholly of secondary minerals. The latter are probably due in the main to hydrothermal alteration.

Sample No. RS55/MGS44 T/S C39713

Thin Section

A visual estimate of the constituents gives:-

	%
?Sericite	~55
Quartz	20
Fe-oxides and opaques	15
Clay minerals	10
Heavy minerals	Tr

The lithology is similar to samples RS49/MGS37 and RS52/MGS40, and the above percentage estimates are again very approximate due to the fine grain size.

The sample displays a fine discontinuous to wispy lamination shown by varying concentrations of finely disseminated iron oxides, with some oxide-deficient laminae up to 7 mm thick. Lamination is approximately paralleled by a foliation due to alignment of sericite flakes. Both foliation and lamination show slight deformation around rounded 'spots' observable at a macroscopic scale and up to 2.5 mm diameter.

'Groundmass' quartz occurs as fine angular grains up to approximately 0.1 mm across, with elongate grains showing approximate dimensional parallelism with lamination/foliation.

Frequently rounded 'spots' up to 2.5 mm across, which are often totally to partially vacant, are composed of iron oxides, clay minerals, ?sericite, quartz and rare tourmaline, and frequently show a concentric zonation due to varying Fe-oxide concentrations.

Rounded forms dominate, but many 'spots' show slightly irregular to angular outlines. Similarity of composition and grain size between 'spots' and matrix suggests a similar source.

Conclusion

The sample is of a finely laminated and foliated siltstone, with rounded clasts of probable volcanic origin.

Not required.

Sample No. MGS42 T/S C39708A

Thin Section

A visual estimate of the constituents gives:-

	%
Quartz	65
Opaque	25
Clay minerals	10
?Pyrophyllite	<1

The sample is of a quartz rich sandstone, now with a clay matrix, which has been extensively replaced by quartz and opaques.

Strained detrital quartz grains with subangular to mainly subrounded outlines are up to approximately 1 mm across with poor dimensional parallelism of elongate grains imparting a weak penetrative structure. Quartz grains are poorly sorted with rare lithic clasts of fine grained metaquartzite. Irregular grain boundaries of quartz appear to be mainly due to restricted overgrowths against a clay matrix, but there is no clear evidence (inclusions etc.) for this.

The matrix to quartz grains is composed mainly of fine clay minerals, probably kaolinite, with finely disseminated opaques.

The sample is cut by a strained quartz vein up to approximately 4 mm thick, which appears to have passively replaced the host (identifiable detrital quartz included in vein quartz). Vein quartz is highly fractured, with fractures infilled with opaques, which also pervasively replace the host. Host replacement is dominantly of clay matrix. Irregular patches up to approximately 4 mm across composed of clay minerals and opaques, with subsidiary ?relict quartz show probable formation of clay from ?pyrophyllite, with clays in some patches showing intense iron staining. In many cases the iron stained clays appear to be a later phase (i.e. distinct from clay derived from 'hydrothermal' minerals) and are possibly related to weathering.

Composition of opaque phases is difficult to determine, but unaltered material appears to be of magnetite with another phase, possibly ilmenite. Alteration is predominantly to haematite.

Conclusion

The sample is of a quartz sandstone with a clay matrix (apparently not authigenic), which has been silicified and replaced by 'iron ore', with later weathering.

To R. Horn - Mineral Resources

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In reply quote:

amdel

23 June, 1983

GS1/16/0

The Director,
Department of Mines,
PO Box 151,
EASTWOOD, SA 5063

Attention: Mr R. Horn

REPORT GS 5227/83 Final

YOUR REFERENCE: Application dated 5 April, 1983

MATERIAL: Rocks

LOCALITY: Mount Grainger Mine

IDENTIFICATION: MGS 31, 38, 41, 42 (MGS 42 not ... [illegible])

DATE RECEIVED: 7 April, 1983

WORK REQUIRED: Polished section preparation and mineragraphic descriptions

Investigation and Report by: Dr A. Kemp

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Keith Henley

for Brian S. Hickman
Managing Director

mhb

Received 24/6/83

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MINERAGRAPHIC DESCRIPTIONS OF MT GRAINGER ROCKS

1. INTRODUCTION

Four mineragraphic descriptions of rocks from Mt Grainger mine are given in the following report. This completes the work requested on these samples.

Sample No. MGS 31

Polished Section

A visual estimate of the constituents gives:-

	%
Gangue	90+
Fe-oxides mainly limonite (goethite)	5
Pyrite	1-2
Ti-rich phase	Tr

The sample consists predominantly of slightly 'rounded' subhedral to euhedral pseudomorphs in quartz. Pseudomorphs are up to 5 mm across with ?hexagonal forms and infilled with quartz, Fe-oxides and, more rarely pyrite, with minor quartz and Fe-oxides.

Grains composed mainly of pyrite have a thin (approximately 35 μm) rim of goethite which is commonly separated from pyrite by a thinner band of ?quartz. Inclusions in pyrite up to 0.5 - 0.6 mm across and occasionally showing ?hexagonal forms, have central 'cores' of quartz with goethite rims similar to those exterior to the pyrite. Finer inclusions of quartz only (<0.1 mm across) also show poorly developed 'hexagonal' forms. Goethite/quartz pseudomorphs show varying proportions of the two components. Goethite is commonly spongy, with banding paralleling margins and included quartz grains. Goethite normally constitutes the marginal phase(s) with quartz occupying central zones, but in some pseudomorphs distribution is irregular.

Goethite infilling irregular voids up to 0.6 mm across frequently shows a botryoidal form. Margins of these voids are frequently plane, and voids may represent solution cavities partially infilled with quartz prior to goethite development. These botryoidal goethite filled voids are occasionally marginal to goethite/quartz pseudomorphs.

Fine scattered occurrences of ilmenite show extensive alteration, possibly to anatase.

Conclusion

It is tempting to suggest pseudomorphs are after pyrite, but this fails to explain rimming of pyrite with goethite, with no evidence of alteration of the pyrite.

Sample No. MGS 38

Polished Section

A visual estimate of the constituents gives:-

	%
Gangue	95+
Haematite	1-2
Goethite	1
?Ilmenite	Tr

Specular haematite is the dominant opaque component, lining an elongate vein-like void up to 2 - 3 mm thick. Elongate basal plates of haematite are up to approximately 0.3 - 0.4 mm in length and occasionally show twinning. Haematite is occasionally included in probable secondary quartz associated with the void, and these inclusions commonly show more equant less euhedral forms. Haematite also occurs as fine grains along quartz grain boundaries adjacent to the void.

Goethite occurs as irregular spongy grains up to 0.3 mm across, with spongy inclusions apparently paralleling a well developed cleavage in some of the grains.

Rare fine ?goethite grains up to 0.16 mm across show well developed 'triangular lamellar' patterns (?triangular boxworks) and may be after sulphides.

Rare detrital quartz grains contain fine ?ilmenite grains up to approximately 30 μm across.

Sample No. MGS 41

Polished Section

A visual estimate of the constituents gives:-

	%
Psilomelane (senso latu)	55
Pyrolusite	40
Gangue	5

The sample consists of a fractured and veined mass of pyrolusite, extensively veined by psilomelane.

Individual pyrolusite masses are up to 5 - 8 mm across, with some showing an apparent relict cleavage. Masses are criss-crossed by fractures which show no particular preferred orientation, although a faint trellised pattern may occasionally be discerned, and are probably after manganite.

Individual fractured masses are separated by 'channelways' partially to totally infilled with secondary manganese minerals. Examination of the latter showed them to be composed predominantly of Mn and K, and they are probably members of the cryptomelane - hollandite - coronadite group, with the former dominating.

Manganese minerals show good development of rhythmic textures, with layers due to crystallographic (probably mineralogical) and density differences. Some bands show apparent crystallographic continuity with sections showing continuous anisotropic effects under + nic.

Gangue minerals included in 'psilomelane' are mainly of quartz which frequently shows euhedral forms, and occasional grains of ?monazite. Elongate quartz grains are up to 0.2 mm in length, show random orientation and are rarely in contact. Quartz is of secondary origin, contemporaneous with 'psilomelane'.

Sample No. MGS 42

Polished Section

A visual estimate of the constituents gives:-

	%
'Psilomelane'	~40
Gangue	40
Pyrolusite	20
?Monazite	Tr

The sample consists predominantly of branching veins of 'psilomelane' in a silicified quartzite.

Veins are up to 4 - 5 mm thick and frequently show rythmic layering and 'sectional effects' similar to those described from the previous sample. SEM examination again showed Mn and K to be the dominant elements present and conclusions on mineralogy are similar to those drawn for Sample No. MGS 41.

This sample shows features not seen in MGS 41. 'Psilomelane' is frequently interbanded with material showing 'frost-like' structures, with the latter material commonly lining the veins, and pyrolusite. Included in 'psilomelane' are approximately rounded grains up to 2 mm across which are extensively fractured and occasionally show relict cleavage. These grains are of pyrolusite, probably after manganite in some cases.

Rare grains up to approximately 0.1 mm across occurring with 'psilomelane' and goethite contain high percentages of REE's and may be of monazite.

Conclusion

The sample is composed predominantly of secondary manganese oxides. Fine grain size and rythmic layering precludes positive identification within the cryptomelane - hollandite - coronadite series.

APPENDIX N

Petrographic Description and X-ray Diffraction of Spotted Siltstone collected by B.J. Morris from No. 2 Level Main Shaft (AMDEL Report GS 555/83 by Dr Michael Farrand).

To B. Morris - Mineral Resources

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11 August 1982

GS 1/16/0

Director-General,
Department of Mines & Energy,
PO Box 151,
EASTWOOD, SA 5063.

Attention: Mr Brian Morris

REPORT GS 555/83

YOUR REFERENCE:	Application for examination dated 23 July 1982
MATERIAL:	Rock specimen
LOCALITY:	Mount Grainger Goldfield
IDENTIFICATION:	6732 RS 40
DATE RECEIVED:	26 July 1982
WORK REQUIRED:	Petrographic description and X-ray diffraction

Investigation and Report by: Dr Michael Farrand
X-ray Diffraction Analysis by: Dr Roger Brown

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Alan Welch

Acting Chief
Geological Services Section
for Norton Jackson
Managing Director

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jd/2

PETROGRAPHY OF A SEDIMENTARY ROCK SPECIMEN

1. INTRODUCTION

A specimen of fine-grained sediment with frequent rounded cavities was received from the South Australian Department of Mines & Energy, Mineral Resources Section. The specimen was obtained underground in the Mt. Grainger Goldfield and a request was made for both petrographic description and X-ray diffraction of material from the cavities, with a view to establishing the source and original content of the cavities.

2. PROCEDURE

A thin section was prepared from the rock, treated with alizarin red-S stain to emphasise the presence of calcite and examined in transmitted light. Material for X-ray diffraction was picked from cavities on a freshly broken surface of the rock since the cavities were empty on the weathered surface and on surfaces cut with a diamond saw using water as a coolant.

The specimen number is 6732 RS 40, the thin section number is C37252.

3. PETROGRAPHY

Rock Name:
Micaceous siltstone

Hand Specimen:
The specimen is a light grey, fine-grained rock pitted with many cavities about 1.5 mm across. On the weathered surface and the sawn surfaces, the cavities are empty but in places display a light brown stain round the rims. On a broken surface a pale yellow to rusty-brown coloured, fine-grained material with an open structure remains in the cavities although the latter are mainly open space. The specimen displays parallel joint faces which are probably bedding planes and a cleavage at about 45° to the joint faces which is probably metamoprhic in origin. The sedimentary nomenclature has been used for the specimen since the most prominent planes are the joint or bedding planes and since the use of regional metamorphic terminology implies a wider description than a single specimen justifies.

Thin Section:
Mineral percentages by visual estimation are:

	%
Quartz	30
Muscovite	50
Clay minerals	15
Iron oxides	5
Tourmaline	trace

Quartz occurs as angular to rounded grains up to 0.3 mm in maximum dimension. Most grains are somewhat elongated and measure about 0.05 mm in length. These grains display a preferred orientation which coincides with that of the mica flakes. The shape of the quartz grains is due more to processes of recrystallisation than to the original fragmentation of the detrital grains. Quartz also occurs as the filling of a fine veinlet about 1 mm across.

Muscovite flakes are about 0.03 mm in length and display a strict preferred orientation. They tend to be ragged in shape. It is the orientation of the mica which is mainly responsible for the metamorphic cleavage of the rock.

A very fine-grained material of low birefringence occurs interstitially to the quartz and mica. This may include very fine quartz but is probably mainly a kaolinite clay.

The iron oxides occur as occasional black detrital grains but mainly as a light brown limonite staining which is particularly abundant on the weathered edge of the rock and round the rim of open cavities. A few cavities are almost filled by amorphous limonite which is insoluble and hence not removed by water. One grain of limonite is pseudomorphous after pyrite and measures 0.5 mm across.

A few grains of detrital tourmaline of blue and yellow colour are present.

4. THE CAVITIES

Material removed from the cavities and scanned by the X-ray diffractometer consisted mainly of quartz with minor muscovite only. Amorphous limonite would not be recorded.

A few patches of fine-grained quartz and a little mica were observed optically in rare cavities which were not empty. Apart from limonite, no material was present which was not a major rock constituent. Even in the newly-broken rock surfaces the cavities are largely open space. A soluble mineral or minerals have been leached out. Clearly the identification of original material can only be conjectural but a reasonable suggestion would be that the material was siderite. It is suggested that siderite concretions developed during diagenesis and included the fine-grained quartz (and possibly clay) of the original sediment. The concretions developed before the metamorphic episode since the orientation of the mica is diverted around some of the cavities. A carbonate is the most probable soluble mineral. The tentative identification of siderite rather than any other carbonate is based on the remnant limonite associated with the cavities. Whatever the mineral was, it was leached out of the rock at a late stage in its history, leaving the cavities with the original rock constituents still present in some cases.

APPENDIX O

Routine Petrographic Report on Five Rock Samples, RS66 - RS 70.
(AMDEL Report GS 6428/84 by Don McColl).

To R. Horn - Mineral Resources.

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amdel

24 February 1984

In reply quote: GS 1/16/0

Your Ref: 12.03/58 EX-122

Director-General,
Department of Mines & Energy,
PO Box 151,
EASTWOOD, SA 5063.

Attention: Mr R. Horn

REPORT GS 6428/84

YOUR REFERENCE:	Application dated 6 February 1984
IDENTIFICATION:	Paratoo, 1:100 000 sheet 6732 RS Nos. 66-70 inclusive
MATERIAL:	Rock samples (5)
LOCALITY:	Mount Grainger gold mine
DATE RECEIVED:	9 February 1984
WORK REQUIRED:	Preparation of standard thin sections of each, with routine petrographic description, comments on alteration, and identification of opaques

Investigation and Report by: Don McColl

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

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for Brian S. Hickman
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jd

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PETROGRAPHIC DESCRIPTIONS OF FIVE ROCK SAMPLES FROM THE VICINITY OF MOUNT GRAINGER GOLD MINE

Sample: 6732 RS 66; TSC41713

Applicant's No.
MGU-18

Rock Name:
Weathered limonitic quartzite

Hand Specimen:
A massive medium to fine-grained yellowish-brown rock, containing a random profuse scattering of black-brown ?limonite grains disseminated throughout.

Thin Section:
A visual estimate of the constituents is as follows:

	%
Quartz	∿70
Muscovite (sericite)	5
Opaques (goethite/limonite)	20-30

This rock is composed almost entirely of quartz with a scattering of massive goethite masses throughout. The goethite occurs almost entirely as pseudomorphous microcrystalline masses, which replicate the form of earlier idiomorphic pyrite crystals, which have an essentially cubic habit modified by minor pyritohedral faces. Within the section area these are up to 3.0 mm in diameter, but within the hand specimen a few occasional crystals even up to 10 mm can be seen. By transmitted light these goethite pseudomorphs can be seen to have internal curving botryoidal to concentric patterns typical of the oxidation of pyrite which appears to have been the sole sulphide present. In oblique illumination the section shows no traces of residual sulphide, and in places the pseudomorphous outlines have become somewhat diffuse, with earthy ochreous limonite permeating outwards along the interstices of the host rock from each former pyrite crystal.

The host rock is now essentially a fine to medium-grained quartzite, which does not show a typically uniform granuloblastic texture. Most of the crystals range in size from 0.2 to 1.0 mm, and perhaps among the coarser crystals, the internal inclusions show a faint suggestion of former sedimentary rounding indicative of an origin as a sandstone or similar material. The crystals have now formed into a partial geometric mosaic, with some straight intercrystalline boundaries, and also an inter-granular mosaic with curving or irregular boundaries. Most of the quartz shows considerable strain and there has evidently been a great deal of quartz mobilisation and neo-mineralisation. This is similarly indicated by the presence of very abundant fine flakes of muscovite, which occur both as patches of fine argillaceous mesh, and also occasional slightly coarser single flakes which are caught within the quartz interstices. Other relatively small flakes of sericitic mica occur as random inclusions within the actual quartz crystal peripheries where they have been overgrown by recrystallisation.

The rock is taken to represent a medium to fine-grained slightly argillaceous sandstone, which has been recrystallised and mineralised with pyrite during what appears to have been relatively mild hydrothermal conditions. The rock has subsequently been weathered and somewhat leached by near-surface groundwater producing goethite replicas of the former sulphide crystals, and a slightly porous rock with a sparse scattering of leaching voids. All the dark (brown-black) mineral blebs throughout this sample appear to consist of the same goethitic material.

Sample: 6732 RS 67; TSC41714

Applicant's No.
MG1A-19

Rock Name:
Silicified argillaceous sandstone (quartzite)

Hand Specimen:
A fine to medium-grained pale yellow-brown quartz-rich rock, traversed by cherty quartz veins of varied thicknesses. Patches of clay-sericite are present as fissure-fillings within the rock and among the intergranular interstices.

Thin Section:
A visual estimate of the constituents is as follows:

	%
Quartz	~90
Muscovite (with sericite and clay minerals)	7-10
Opaques (goethite/limonite)	2-3
Zircon	trace

This rock has some aspects which are similar to the preceding sample in that it is composed principally of quartz, with a minor but significant proportion of ?sericitic clay mineral disseminated throughout. An unusual feature is that the quartz grains which make up the principal areas of host rock vary greatly in size from about 1.0 mm down to an average of between 0.1 and 0.2 mm. The coarser grains frequently show considerable relict angularity, and are dispersed rather randomly throughout the finer material. All the quartz grains are internally fairly clear and transparent, but along their margins are turbid and irregular, passing into more cherty microcrystalline material filling the interstices. There appears to have been copious recrystallisation of the quartz between adjacent crystals, in places resembling authigenic overgrowths.

The interstitial chert also contains a plentiful dissemination of sericite flakes and almost certainly some clay mineral. Some of the sericite would be more appropriately described as small muscovite flakes, which may actually be of detrital origin in part. Most is, however, in the form of very thin often pointed flakes less than 0.1 mm wide, which are now totally included in the recrystallised quartz. Small patches of turbid intermeshed sericite flakes without quartz may represent former detrital feldspars or fragments of lithic argillites. Very rare rounded to sub-rounded granules of zircon also occur as inclusions within the recrystallised quartz, and are obviously of detrital origin. Opaques are relatively scarce in this rock, but there is an appreciable proportion of ultrafine particles that seem to be mostly iron oxides or hydroxides. Some of this material is definitely goethitic, but some hematite and perhaps even leucoxene may be present in these 1 to 5 micron size particles. A very few goethite pseudomorphs after pyrite crystals from 1 to 3 mm in diameter are present along the margins of the cherty quartz veins, but this material which is more analogous to that in sample RS 66 is very sparse.

The actual cherty quartz veins are much more transparent than the general sericitic quartz matrix. The veins also consist of coarser quartz crystals which may be up to 1.0 mm diameter. This quartz forms a rather irregular granoblastic mosaic of irregular polygonal crystals having fairly deeply sutured intergranular boundaries. The crystals are all heavily strained, and the impression is given that they were typical vein quartz, which is undergoing recrystallisation by stress in the presence of ?hydrothermal fluids.

The origin of this rock is rather obscure, but it appears to represent a former sediment, such as a rapidly accumulated unsorted sandstone from a moderately deep water environment beyond the depth of normal wave action influence. It has been veined with hydrothermal quartz, and perhaps also simultaneously sericitised and partially recrystallised in a stressed condition.

Sample: 6732 RS 68; TSC41715

Applicant's No.
MGS-76

Rock Name:
Weathered lithic quartzite

Hand Specimen:
A medium-grained massive quartz metasediment, with a weakly defined ?bedding lamination and a fine texture of interstitial voids, all lightly coloured a yellow-brown with ochreous limonite.

Thin Section:
A visual estimate of the constituents is as follows:

	%
Quartz	∿80
Sericite (muscovite and ?clay mineral)	10-15
Calcite	2-3
Opaques (goethite/limonite)	2

This rock is composed dominantly of quartz, with a scattering of clay-sericite masses replicating former lithic grains, and a few limonite-lined leached voids throughout. Although the quartz has not metamorphosed into a granoblastic mosaic of subangular to polygonal crystals, in many places rounded to subrounded outlines of former detrital grains are still visible, as trains of ultrafine inclusions which have now been enveloped in authigenic siliceous overgrowths. The intergranular boundaries are intricately sutured, and often interstices contain small areas of fine cherty intergrowths. The quartz grains all show a greater or lesser degree of internal strain, suggesting that there has been considerable stress associated with the metamorphic/hydrothermal recrystallisation. Few crystals exceed 0.5 mm diameter, so the original sandy sediment was rather fine-grained.

About 20% of this aggregate appears to have originally consisted of other lithic fragments. These are now represented by cherty masses of quartz, intergrown with various proportions of sericite and clay minerals disseminated throughout. In some cases, the lithic fragments appear to have been of entirely argillaceous composition, and are now represented by a mesh of fine sericite (?muscovite), and perhaps traces of argillaceous remnants. These frequently have ovoid to lenticular forms, which tend to be aligned with their long axes in a common direction parallel to the vague lamination noted in hand specimen. Rather less common than these, are voids which appear to replicate former detrital grains, but which are not occupied by masses of finely granular calcite, or else lined with earthy to microgranular limonite (?goethite), which often encloses fine muscovite flakes as well. A few clearly pseudomorphous replicas of goethite after pyritohedral pyrite crystals up to 0.2 mm diameter, are rather sparsely distributed.

now ? –

This rock appears to represent a rather more evenly-grained sandy metasediment, with an appreciable proportion of lithic contaminants, which has been recrystallised and altered during apparently mild metamorphic/hydrothermal conditions. Subsequently it has been weathered and somewhat leached by near-surface groundwaters. The whole process having obvious similarities to some aspects of the two previously described samples.

Sample: 6732 RS 69; TSC41716

Applicant's No.
MGS-77

Rock Name:
Limonitic lithic quartzite with quartz veins

Hand Specimen:
A massive medium-grained siliceous brown rock, traversed by broad quartz veins, and containing a number of cavities lined with earthy yellowish-brown limonite and black manganiferous dendrites.

Thin Section:
A visual estimate of the constituents is as follows:

	%
Quartz	70-80
Sericite (muscovite, and ?clay mineral)	15-20
Opaques (goethite/limonite)	3-5
Pyrolusite (dendrites)	trace
Zircon	trace

This rock is a trifle coarser than sample RS 68, but in other respects it is very similar. The average grain size is in the 0.3 to 0.5 mm interval, and a few grains are as much as 1.0 mm. There is also possibly a little more clay-sericite present, both as replicas of former lithic grains and as trails of flakes caught between the former intergranular interstices. Limonite (goethite) replicas after former sulphide grains occur spasmodically, but most of the limonite is present as earthy linings filling interstices or lining ?leaching voids, as is the trace of dendritic manganese oxides.

The quartz has, as in other samples in this group, metamorphosed into a partially granoblastic mosaic of subangular to polygonal crystals, but in many places these can be seen to have developed from rounded to ovoid detrital grains. The intergranular boundaries are now intricately sutured and overgrown in many places with a cherty mosaic of very fine crystals, throughout which there is commonly an abundance of fine muscovite and sericite inclusions. Many of the quartz grains showing ovoid to elongate outlines, have a tendency toward common alignment of their longer axes, which is probably a vague relict of the former bedding direction. Most of the quartz grains show considerable internal strain suggesting that there has been considerable stresses, possibly associated with the metamorphic/hydrothermal processes which have introduced the veining.

Within the quartz veins which are commonly up to 2 cm wide, the quartz tends to occur as larger and more transparent crystals. These have an allotriomorphic to granoblastic texture, but are still internally strained and somewhat recrystallised, particularly along their margins.

At least 20% of the original sediment appears to have consisted of lithic argillaceous grains. These have been replaced by intergrowths of clay mineral and sericite/muscovite, which to some extent merges into the interstitial sericite. In most of these relict grains, however, there are different concentrations of finely divided opaques, which have remained unaltered and so indicate the outline of the former grain. There are also a few very fine (20 to 40 microns) detrital grains of zircon scattered throughout the aggregate.

Although most of the limonite is present as earthy interstitial material, which is probably only an exotic deposit from weathering and groundwater circulation, there are a few pseudomorphous masses of goethite, which have replaced clearly pyritohedral crystals of sulphide (?pyrite) up to 0.5 mm diameter. There has, therefore, at some stage been a phase of sulphide mineralisation, which may well have accompanied the introduction of the quartz veins.

This rock, like the previous examples, represents a sandy metasediment, which was originally of rather uneven grain size, and contained a moderate proportion of lithic contaminants. It has been recrystallised and sericitised during relatively mild metamorphic/hydrothermal alteration processes, which probably introduced the quartz veining and led to much of the siliceous recrystallisation.

Sample: 6732 RS 70; TSC41717

Applicant's No.
MGS-78

Rock Name:
Lithic quartzite

Hand Specimen:
A light grey-brown medium-grained siliceous metasediment, with a darker coloration permeating one end of the specimen. There is a very weak overall parallel stratification which is probably a relict bedding structure.

Thin Section:
A visual estimate of the constituents is as follows:

	%
Quartz	∿90
Sericite (muscovite, and ?clay mineral)	7-10
Opaques (goethite)	1-2
Opaques (leucoxene)	trace

This rock is a slight variant on the preceding samples, but most closely resembles sample RS 68. It is particularly rich in quartz, with somewhat sparser disseminations of clay-sericite, both as relict lithic grains and interstitial traces. The quartz has similarly been metamorphosed into a granoblastic mosaic of subrounded to subangular crystals which clearly show their detrital origins. Rounded outlines of former detrital sand grains are visible as trails of ultrafine inclusions lying along the original detrital boundaries, but which are now overgrown by authigenic silica. This aggregate has not been metamorphosed into such a tightly interlocked mosaic of the previous samples, and many crystals still retain some of their former rounded granular shape despite the overgrowths, which leaves small intergranular interstices where other material has lodged. Many of the quartz grains have somewhat ovoid outlines, with a tendency for the longer axes to have a common alignment, indicating the probable bedding direction noted in hand specimen. As with the former samples, these quartz grains are fairly heavily internally strained, and the intergranular boundaries are in various stages of recrystallising into a finer cherty mosaic at the contact points. The original quartz sand grains are not as coarse as appears in the hand specimen, and the relict outlines suggest that the coarsest sand grains were no more than 0.5 mm.

Possibly 10% of the former aggregate appears to have originally consisted of ?argillaceous lithic fragments, with possibly some detrital muscovite or micaceous fragments. Most have been sericitised to at least some degree, and a random mesh of fine flakes in a ?clay mineral matrix is the most common. These are frequently distorted into the interstices between the more rounded or ovoid quartz grains, and elongated in the direction of the weakly defined bedding direction.

A few voids occur throughout the rock which may have been produced by near-surface leaching and solution of relatively small carbonate crystals. These have left distinctly rhombohedral openings, which are empty in some cases, but toward one end of the section there is a fairly extensive permeation of the intergranular interstices by limonite and/goethite. This has frequently formed massive goethitic fillings of these rhombohedral cavities which accordingly resemble pseudomorphs. There is also a few insignificant similar interstitial fillings of cream-white leucoxene in part of the section area. This material probably represents degenerate detrital titanian iron oxides. The rock appears to represent a fairly fine evenly-grained sandy metasediment, with a minor proportion of argillaceous lithic contaminants which has been recrystallised and lightly altered in metamorphic/hydrothermal conditions. Weathering and leaching by near-surface groundwaters has introduced an irregular pigmentation of limonite.

APPENDIX P

Identification of Yellow Mineral in Cavities in Quartz Rock No. 1 Open Cut. (AMDEL Report GS 3846/83 by Michael Till).

To R. Horn - Mineral Resources.

The Australian Mineral Development Laboratories
Flemington Street, Frewville, South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

amdel

Please address all correspondence to P.O. Box 114 Eastwood SA 5063

21 January 1983

In reply quote: GS 1/16/0

Your Ref: 12.03

Director-General,
Department of Mines & Energy,
PO Box 151,
EASTWOOD, SA 5063.

Attention: Mr R. Horn

REPORT GS 3846/83

YOUR REFERENCE: Application dated 13 January 1983

MATERIAL: Yellow mineral in cavities in quartz rock

LOCALITY: Mt. Grainger Goldfield, Paratoo, South Australia - 6732; NED 101

DATE RECEIVED: 14 January 1983

WORK REQUIRED: Identification of yellow mineral (MB1)

Investigation and Report by: Michael Till

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Keith Henley

for Norton Jackson
Managing Director

jd/1

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IDENTIFICATION OF YELLOW MINERAL IN QUARTZ ROCK

1. INTRODUCTION

A quartz rock sample was received from Mr R. Horn of the South Australian Department of Mines and Energy with a request for the identification of the yellow mineral in cavities and vugs in the rock.

2. PROCEDURE

A portion of the yellow mineral was scraped from the rock and analysed by X-ray powder diffractometry.

3. RESULTS

The yellow mineral is sulphur.

APPENDIX Q

Grain Size Analysis Sheets

GRAIN SIZE ANALYSIS SHEET

Sample No: 2/13 Analysis No: 83.S1.18

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: No. 2 Open Cut (Nth. Medora) Quartz vein with limonitic boxwork - North face - sample over 1 m width.

Weight Taken: 458.8 grams
Agitation: Start 1.30 hr Finish 2.00 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	68.7	14.97	14.97	0.6	A1707/83
2.36	2360	58.5	12.75	27.72	0.3	A1708/83
1.18	1180	65.5	14.28	42.00	0.3	A1709/83
0.85	850	29.9	6.52	48.52	0.2	A1710/83
0.60	600	30.6	6.69	55.21	0.2	A1711/83
0.30	300	61.4	13.38	68.59	0.3	A1712/83
0.075	75	41.5	9.04	89.87	0.5	A1714/83
	-75	46.5	10.13	100.00	1.9	A1715/83
		458.8	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 2/20

Analysis No: 83.S1.19

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: No. 2 Open Cut (Nth. Medora) East face channel sample over 2 m White Sandstone with quartz veins and veinlets.

Weight Taken: 490.2 grams
Agitation: Start 3.00 hr Finish 3.30 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	57.4	11.71	11.71	0.2	A1716/83
2.36	2360	61.2	12.48	24.19	<0.1	A1717/83
1.18	1190	66.8	13.63	37.82	<0.1	A1718/83
0.85	850	29.4	6.00	43.82	<0.1	A1719/83
0.60	600	35.1	7.16	50.98	<0.1	A1720/83
0.30	300	81.6	16.64	67.72	<0.1	A1721/83
0.15	150	54.4	11.10	78.72	<0.1	A1722/83
0.075	75	40.6	8.28	87.00	<0.1	A1723/83
	-75	63.7	13.00	100.00	<0.1	A1724/83
		490.2	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 2/27 Analysis No: 83.S1.20

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: No. 2 Open Cut (Nth. Medora) East face with 4 m from hanging wall - Sample over 2 m from top to bottom - White Sandstone with numerous quartz veinlets - Fe & Mn.

Weight Taken: 367.8 grams
Agitation: Start 8.00 hr Finish 8.30 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	39.8	10.82	10.82	<0.1	A1725/83
2.36	2360	48.6	13.21	24.03	<0.1	A1726/83
1.18	1180	55.7	15.14	39.17	<0.1	A1727/83
0.85	850	24.5	6.66	45.83	<0.1	A1728/83
0.60	600	23.4	6.36	52.19	<0.1	A1729/83
0.30	300	51.2	13.92	66.11	<0.1	A1730/83
0.15	150	44.5	12.10	78.21	<0.1	A1731/83
0.075	75	32.0	8.70	86.91	0.1	A1732/83
	-75	48.1	13.09	100.00	0.1	A1733/83
		367.8	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 2/34 Analysis No: 83.S1.21

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: No. 2 Open Cut (Nth. Medora) N.W. corner of cut - Quartz vein in sandstone over 1 m - Mn & Fe oxides.

Weight Taken: 540.6 grams
Agitation: Start 8.30 hr Finish 9.00 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	51.5	9.52	9.562	0.1	A1734/83
2.36	2360	72.5	13.41	22.93	<0.1	A1735/83
1.18	1180	85.3	15.78	38.71	<0.1	A1736/83
0.85	850	38.5	7.12	45.83	<0.1	A1737/83
0.60	600	35.7	6.60	52.43	<0.1	A1738/83
0.30	300	73.5	13.60	66.03	<0.1	A1739/83
0.15	150	60.7	11.23	77.26	<0.1	A1740/83
0.075	75	41.6	7.69	84.95	0.1	A1741/83
	-75	81.4	15.05	100.00	0.1	A1742/83
		540.6	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 2/41 Analysis No: 83.S1.22

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: No. 2 Open Cut - West face - White bleached sandstone with mica and sericite? - Greenish clayey material. Sample over 2 m.

Weight Taken: 485.6 grams
Agitation: Start 10.30 hr Finish 11.00 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	35.7	7.35	7.35	<0.1	A1743/83
2.36	2360	53.0	10.91	18.26	<0.1	A1744/83
1.18	1180	75.6	15.57	33.83	<0.1	A1745/83
0.85	850	36.5	7.52	41.35	<0.1	A1746/83
0.60	600	35.1	7.23	48.58	<0.1	A1747/83
0.30	300	75.5	15.54	64.12	4.6	A1748/83
0.15	150	60.7	12.50	76.62	<0.1	A1749/83
0.075	75	41.1	8.48	85.10	<0.1	A1750/83
	-75	72.4	14.90	100.00	<0.1	A1751/83
		485.6	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 2/6 Analysis No: 83.S1.23

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: No. 2 Open Cut (Nth. Medora) Pinkish sandstone with quartz/ironstone veinlets and some manganese - Sample over 1 m below Hanging Wall contact.

Weight Taken: 439.0 grams
Agitation: Start 11.00 hr Finish 11.30 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	39.3	8.95	8.95	<0.1	A1698/83
2.36	2360	35.8	8.15	17.10	0.6	A1699/83
1.18	1180	59.6	13.58	30.68	0.6	A1700/83
0.85	850	32.1	7.31	37.99	0.5	A1701/83
0.60	600	32.6	7.43	45.42	0.1	A1702/83
0.30	300	67.1	15.28	60.70	0.1	A1703/83
0.15	150	64.7	14.74	75.44	0.1	A1704/83
0.075	75	53.0	12.08	87.52	0.4	A1705/83
	-75	54.8	12.48	100.00	0.8	A1706/83
		439.0	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 3/6 Analysis No: 83.S1.24

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 180

Date Sampled: 28/3/83

Description of Sample: Quartz/manganese gossan? Sample from bulldozer cut near Orroroo Treasure shaft - In M.L. 5178.

Weight Taken: 453.9 grams
Agitation: Start 1.00 hr Finish 1.30 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	18.0	3.97	3.97	<0.1	A1752/83
2.36	2360	38.6	8.50	12.47	0.9	A1753/83
1.18	1180	75.2	16.57	29.04	0.5	A1754/83
0.85	850	38.7	8.53	37.57	0.2	A1755/83
0.60	600	36.5	8.04	45.61	0.2	A1756/83
0.30	300	75.5	16.63	62.24	0.3	A1757/83
0.15	150	62.9	13.86	76.10	0.5	A1758/83
0.075	75	51.89	11.43	87.53	5.0	A1759/83
	-75	56.6	12.47	100.00	5.6	A1760/83
		453.9	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 4/6 | Analysis No: 83.S1.25

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 180

Date Sampled: 28/3/83

Description of Sample: Sample of quartz vein exposed in Bulldozer scrape in drainage channel south of Sth. Medora shaft.

Weight Taken: 415.4 grams
Agitation: Start 1.45 hr Finish 2.15 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	30.1	7.25	7.25	<0.1	A1761/83
2.36	2360	39.3	9.46	16.71	<0.1	A1762/83
1.18	1180	63.4	15.26	31.97	<0.1	A1763/83
0.85	850	34.3	89.26	40.23	<0.1	A1764/83
0.60	600	35.5	8.55	48.78	<0.1	A1765/83
0.30	300	74.3	17.87	66.65	<0.1	A1766/83
0.15	150	57.2	13.77	80.42	<0.1	A1767/83
0.075	75	40.7	9.80	90.22	0.4	A1768/83
	-75	40.6	9.78	100.00	0.2	A1769/83
		415.4	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 5/6 Analysis No: 83.S1.26

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 180

Date Sampled: 28/3/83

Description of Sample: Sth. Medora shaft ore dump. - Ore mined from main underlay shaft - Consists of quartz with limonitic boxwork. Visible gold?

Weight Taken: 570.3 grams
Agitation: Start 2.15 hr Finish 2.45 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	50.6	8.87	8.87	0.1	A1770/83
2.36	2360	56.6	9.92	18.79	0.5	A1771/83
1.18	1180	86.6	15.19	33.98	0.1	A1772/83
0.85	850	42.5	7.45	41.43	0.2	A1773/83
0.60	600	42.6	7.47	48.90	0.2	A1774/83
0.30	300	89.6	15.71	64.61	<0.1	A1775/83
0.15	150	74.8	13.12	77.73	<0.1	A1776/83
0.075	75	60.3	10.57	88.30	2.0	A1777/83
	-75	66.7	11.70	100.00	5.7	A1778/83
		570.3	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 6/6 Analysis No: 83.S1.27

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: Channel sample along south face No. 3 Open Cut (Nth. Medora) - Quartz veining in sandstone with sericitic alteration.

Weight Taken: 414.1 grams
Agitation: Start 3.30 hr Finish 4.00 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	71.4	17.24	17.24	0.1	A1779.83
2.36	2360	43.2	10.43	27.67	<0.1	A1780/83
1.18	1180	62.9	15.19	42.86	<0.1	A1781/83
0.85	850	29.5	7.13	49.99	<0.1	A1782/83
0.60	600	28.4	6.86	56.84	0.1	A1783/83
0.30	300	54.7	13.21	70.06	<0.1	A1784/83
0.15	150	46.8	11.30	81.36	<0.1	A1785/83
0.075	75	31.4	7.58	88.94	<0.1	A1786/83
	-75	45.8	11.06	100.00	0.3	A1787/83
		414.1	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 7/6 Analysis No: 83.S1.28

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 180

Date Sampled: 28/3/83

Description of Sample: Trench Immediately north of the South Medora underlay shaft (SMT.1) Sandstone with quartz veining.

Weight Taken: 441.5 grams
Agitation: Start 8.00 hr Finish 8.30 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	62.1	14.07	14.07	<0.1	A1788/83
2.36	2360	71.3	16.15	30.22	<0.1	A1789/83
1.18	1180	74.5	16.87	47.09	<0.1	A1790/83
0.85	850	31.0	7.02	54.11	0.1	A1791/83
0.60	600	30.0	6.80	60.91	<0.1	A1792/83
0.30	300	57.6	13.05	73.96	<0.1	A1793/83
0.15	150	40.0	9.06	83.02	<0.1	A1794/83
0.075	75	26.5	6.00	89.02	<0.1	A1795/83
	-75	48.5	10.98	100.00	0.1	A1796/83

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 8/6 Analysis No: 83.S1.29

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 180

Date Sampled: 28/3/83

Description of Sample: Shattered Dream - Open Cut No. 1. Channel of ferruginous quartz vein with pyrite.

Weight Taken: 542.3 grams
Agitation: Start 9.0 hr Finish 9.30 hr

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	38.6	7.16	7.16	<0.1	A1797/83
2.36	2360	66.4	12.30	19.46	0.3	A1798/83
1.18	1180	99.3	18.40	37.86	0.2	A1799/83
0.85	850	44.7	8.28	46.14	0.2	A1800/83
0.60	600	43.2	8.00	54.14	0.1	A1801/83
0.30	300	82.0	15.19	69.33	0.4	A1802/83
0.15	150	58.5	10.84	80.17	<0.1	A1803/83
0.075	75	45.1	8.36	88.53	0.1	A1804/83
	-75	61.9	11.47	100.00	0.4	A1805/83
		542.3	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 9/6 Analysis No: 83.S1.30

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: Nth. Medora Trench T.8 - Arkose with quartz veining - Chip sample along floor of trench.

Weight Taken: 468.2 grams
Agitation: Start 8.00 h Finish 8.30 h

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	39.2	8.37	8.37	<0.1	A1806/83
2.36	2360	51.4	11.00	19.37	<0.1	A1807/83
1.18	1180	83.3	17.80	37.17	<0.1	A1808/83
0.85	850	39.3	8.39	45.56	<0.1	A1809/83
0.60	600	38.8	8.28	53.84	<0.1	A1810/83
0.30	300	75.9	16.20	70.04	<0.1	A1811/83
0.15	150	54.7	11.68	81.72	<0.1	A1812/83
0.075	75	41.8	8.93	90.65	<0.1	A1813/83
	-75	43.8	9.35	100.00	<0.1	A1814/83
		468.2	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 10/6 Analysis No: 83.S1.31

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: Nth. Medora - Trench T.7 beside track to main shaft. Chip sample of Arkose with quartz veinlets.

Weight Taken: 471.0 grams
Agitation: Start 08.45 h Finish 09.15 h

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	21.2	4.50	4.50	<0.1	A1815/83
2.36	2360	30.9	6.56	11.06	<0.1	A1816/83
1.18	1180	64.4	13.67	24.73	<0.1	A1817/83
0.85	850	33.6	7.13	31.86	<0.1	A1818/83
0.60	600	36.5	7.75	39.61	<0.1	A1819/83
0.30	300	82.0	17.41	57.02	<0.1	A1820/83
0.15	150	79.0	16.77	73.79	<0.1	A1821/83
0.075	75	61.6	13.08	86.87	<0.1	A1822/83
	-75	61.8	13.13	100.00	<0.1	A1823/83
		471.0	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 11/6 Analysis No: 83.S1.32

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 183

Date Sampled: 28/3/83

Description of Sample: Quartz vein with limonite boxwork in South Underlay at Jones Shaft workings.

Weight Taken: 433.9 grams
Agitation: Start 09.30 h Finish 10.00 h

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	18.5	4.26	4.26	0.5	A1824/83
2.36	2360	31.8	7.33	11.59	3.6	A1825/83
1.18	1180	70.4	16.22	27.81	4.2	A1826/83
0.85	850	38.1	8.78	36.59	2.0	A1827/83
0.60	600	35.0	8.07	44.66	1.9	A1828/83
0.30	300	62.7	14.46	59.12	2.1	A1829/83
0.15	150	43.8	10.09	69.21	1.2	A1830/83
0.075	75	30.5	7.03	765.24	3.9	A1831/83
	-75	100.1	23.76	100.00	1.8	A1832/83
		433.9	100.00			

Gold Assay by Amdel - Fire Assay - Code K 4/1

GRAIN SIZE ANALYSIS SHEET

Sample No: 12/6 Analysis No: 83.S1.33

Project: Mount Grainger goldmine

Location - Hundred: Coglin
- Section: 180

Date Sampled: 28/3/83

Description of Sample: Sth. Medora shaft area - Trench SMT.4 - Arkose with quartz veining.

Weight Taken: 509.5 grams
Agitation: Start 11.30 h Finish 12.00 h

B.S. Screen Opening	B.S. Opening Microns	Retained gm	Retained %	Cumulative %	Gold Assay grams/tonne	Sample No.
4.75	4750	25.4	4.99	4.99	<0.1	A1833/83
2.36	2360	46.9	9.20	14.19	<0.1	A1834/83
1.18	1180	78.5	15.41	29.60	<0.1	A1835/83
0.85	850	37.8	7.42	37.02	<0.1	A1836/83
0.60	600	38.1	7.48	44.50	<0.1	A1837/83
0.30	300	88.3	17.33	61.83	<0.1	A1838/83
0.15	150	79.2	15.54	77.37	<0.1	A1839/83
0.075	75	24.5	4.81	82.18	<0.1	A1840/83
	-75	90.8	17.82	100.00	<0.1	A1841/83
		509.5	100.00			

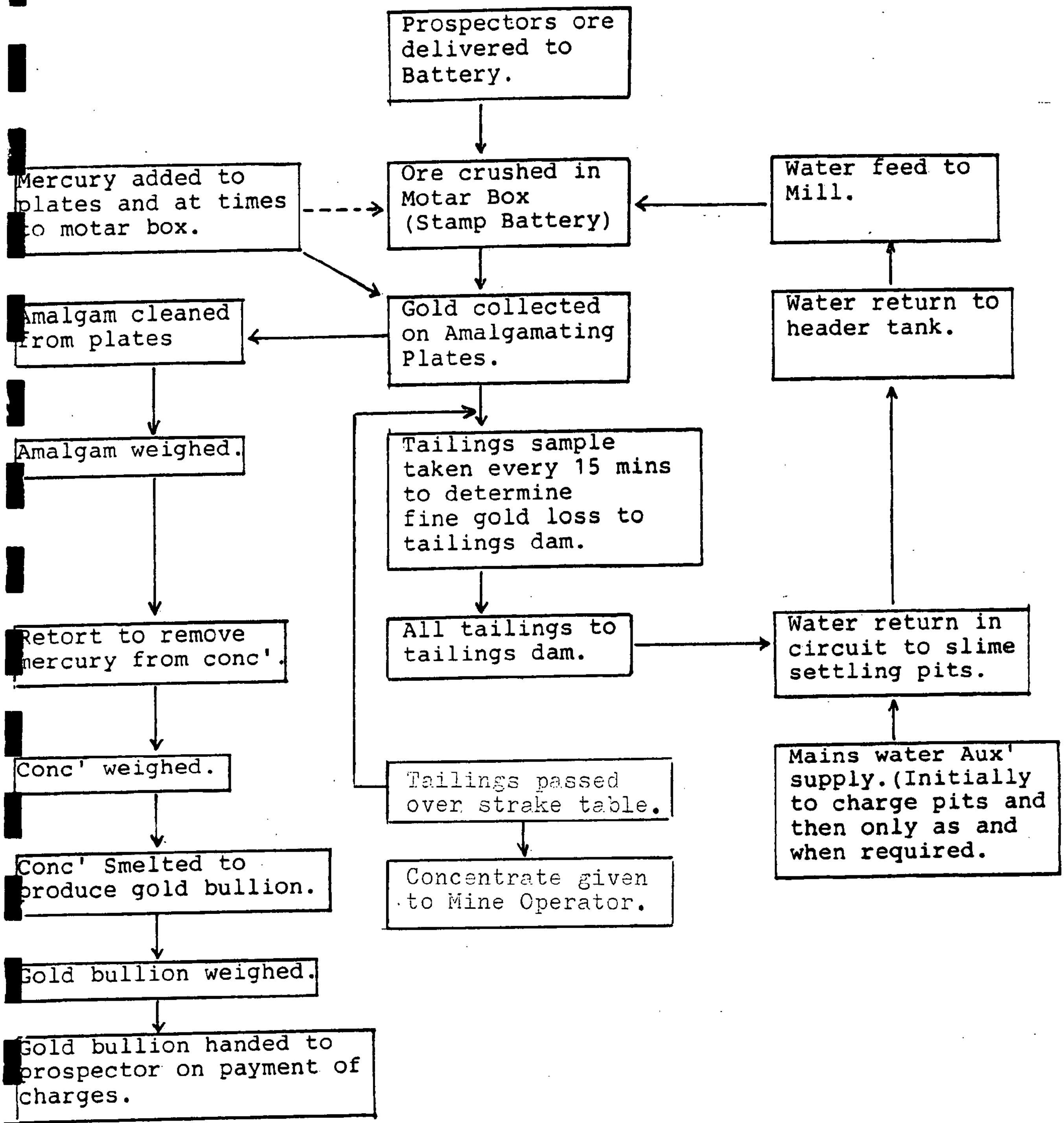
Gold Assay by Amdel - Fire Assay - Code K 4/1

APPENDIX R

Flow Sheet for Operations at the Peterborough State Battery

DEPARTMENT OF MINES AND ENERGY
PETERBOROUGH GOVERNMENT BATTERY

FLOW SHEET FOR OPERATIONS AT BATTERY



APPENDIX S

Certificate From the Perth Mine, W.A., for Refinery of Bullion from Parcels 1498, 1499, 1502, 1513 and 1517 from North and South Medora Mines

P.M.3A—S.&McD.—40M/6/81

THE PERTH MINT, W.A.

MEMORANDUM of the Out-Turn of Deposit No. 1801, lodged on 27 October, 1982 by J.J. SIMNOVEC

Weight before Melting ozs.		Weight after Melting ozs.		ASSAY REPORT Gold	ASSAY REPORT Silver	Fine Gold ozs.		Fine Silver Allowed ozs.	
7	55	7	50	4090	025	3	07	–	17

Fine Gold @ $ 442.96 per oz. $	c	Fine Silver @ $ 9.01 per oz. $	c	Total $	c	Deduct Charges	$	c	Amount Due $	c
1,359	89	1	53	1,361	42	Ordinary	11	25		
						Extra	6	00		
						Special				
						Total	17	25	1,344	17

Payable 2 November, 1982.
The Perth Mint,
Perth, W.A.

Steven Gee
For the Director

APPENDIX T

Analysis of Four Samples of Gold Bullion by Universal Inspection & Testing Co. Pty. Ltd. Parcels 1541, 1546, 1549 and 1552

UNIVERSAL INSPECTION & TESTING COMPANY PTY. LIMITED (INCORPORATED IN N.S.W.)

- INDUSTRIAL ANALYSIS AND ASSAYING
- SUPERVISION AND SAMPLING OF CARGO
- CONTROL AND SPECIFICATION TESTING

REPORT No. 83/673

THIS CONFIDENTIAL REPORT SHOULD NOT BE REPRODUCED WITHOUT OUR WRITTEN APPROVAL — * DENOTES 'NOT MORE THAN'

SAMPLE		ALLOY CODE	ORDER NUMBER	RECEIVED / REPORTED
ORIGIN	AMDEL MINING & EXPLORATION PTY.LTD.			31.10.83
DESCRIPTION	4 Au Samples			

NUMBER	%	Al	Si	Fe	Cu	Mn	Mg	Pb	Ni	Zn	Ti	Sn	Cr	Na	Bi	Cd	Ag	Sb	Be	As

Parcel		Wt. before Sampling	Au %
1541	No.1	22.7458	34.2
1546	" 2	2.2692	67.0
1552	" 3	13.2741	73.9
1549	" 4	8.2122	77.6

UNIVERSAL INSPECTION & TESTING COMPANY PTY. LIMITED
151 SOUTH ROAD, CROYDON, S.A. 5008. PHONE 46 3533
(P.O. BOX 101, HINDMARSH, S.A. 5007)
(Laboratories: Adelaide, Melbourne, Sydney)

[signature]

ep46929

APPENDIX U

Qualitative Spectrographic Analysis of Amalgam from Parcel 1552
(AMDEL Report AC 6461/83)

To R. Horn - Mineral Resources

The Australian
Mineral Development
Laboratories

emington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

1/16/0 - AC 6461/83

14 July 1983

NATA CERTIFICATE

Mt. Grainger
Amalgam from Parcel 1552

The Director General,
S.A. Department of Mines & Energy,
P.O. Box 151,
EASTWOOD S.A. 5063

'A'54/83.

REPORT AC 6461/83

YOUR REFERENCE: Application of 20 June 1983
Project 12.03

IDENTIFICATION: As listed

DATE RECEIVED: 21 June 1983

D. Patterson
Chief Chemist
Analytical Chemistry Division

D.G. Bowditch
for B. Hickman
Managing Director

ij

Received 15/7/83

Head Office:
Flemington Street, Frewville
South Australia 5063,
Telephone (08) 79 1662
Telex: Amdel AA82520
Pilot Plant:
Osman Place
Thebarton, S.A.
Telephone (08) ~~42 8052~~ 43 5733
Branch Laboratories:
Melbourne, Vic.
Telephone (03) 645 3093
Perth, W.A.
Telephone (09) 325 7311
Townsville
Queensland 4814
Telephone (077) 75 1377

THE STRALIAN MINERAL DEVELOPMENT L. RATORIES

REPORT AC 6461/83.

Page 1/1

QUALITATIVE SPECTROGRAPHIC ANALYSIS

Sample No.	Major	Minor	Heavy Trace	Trace	Faint Trace	Very Faint Trace
	100% — 10%	10% — 1%	1% — 5000ppm — 1000	1000 — 500ppm — 100	100 — 50ppm — 10	10 — 5ppm — 1
A2393/83	Cu	Au*	Ag	Fe Ca Zn Ti	Sn Ni Pb V	

* Au > 5%

APPENDIX V

Analysis of Slag from Smelting Parcel 1552 at Peterborough Battery (AMDEL Report AC 5443/83)

To R. Horn - Mineral Resources.

1/16/0 - AC 5443/83

29 April 1983

The Australian Mineral Development Laboratories
Flemington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

NATA CERTIFICATE

The Director-General,
S.A. Department of Mines & Energy,
P.O. Box 151,
EASTWOOD, S.A. 5063

REPORT AC 5443/83

YOUR REFERENCE:	Application of 19.4.83 12-03
IDENTIFICATION:	As listed
DATE RECEIVED:	19 April 1983

D. K. Rowley
Manager
Analytical Chemistry Division

D.G. Bowditch
for Norton Jackson
Managing Director

Received
6/5/83

cjw

Head Office:
Flemington Street, Frewville
South Australia 5063,
Telephone (08) 79 1662
Telex: Amdel AA82520
Pilot Plant:
Osman Place
Thebarton, S.A.
Telephone (08) ~~49 6053~~ 43 5733
Branch Laboratories:
Melbourne, Vic.
Telephone (03) 645 3093
Perth, W.A.
Telephone (09) 325 7311
Townsville
Queensland 4814
Telephone (077) 75 1377

Parcel No. 1552

ANALYSIS
ppm

SAMPLE MARK	COPPER Cu	LEAD Pb	ZINC Zn	COBALT Co	SILVER Ag	ARSENIC As	GOLD Au
PBS 10	34	320	165	20	1	100	<0.05
PBS 11	5100	170	280	30	95	90	1850

NOTE: Due to the small quantity of material supplied, all values have been determined by AAS

Method: C1/C2, C3/1

PBS 10. Slag from first smelt.

PBS 11. Slag from third smelt of bullion.

APPENDIX W

Results of Au, Ag and Base Metal Determinations of Bullion Buttons from Parcels 1592 - 1598 (Warman International Ltd. Report 84/170631)

WARMAN INTERNATIONAL LTD.

(INCORPORATED IN QLD.)

TELEGRAMS & CABLES.
"WARMANCO" SYDNEY
PHONE. 436 6789
TELEX: AA20711

POSTAL ADDRESS:
P.O. BOX 51
ARTARMON
N.S.W. 2064
AUSTRALIA

LABORATORIES
18-26 DICKSON AVENUE
ARTARMON
SYDNEY
NEW SOUTH WALES

RESEARCH & DEVELOPMENT DIVISION

LABORATORY REPORT 84/170631

CLIENT	Abignano Limited PO Box 195 PYMBLE 2073
OUR LABORATORY No.	4362 — ORDER No. 113078
DATE RECEIVED	December 17, 1984
MATERIAL AND IDENTIFICATION	Seven bullion buttons marked 1592-1598
OBJECT OF TESTWORK	To determine Au, Ag and base metals by fire assay

RESULTS

Tonnage	Sample	Au %	Ag %	base metals %	g/t Head
9.3	1592	31.3	2.7	66.0	0.38
5.6	1593	10.4	1.4	88.2	0.24
7.0	1594	12.4	1.4	86.2	0.43
8.4	1595	11.7	1.1	87.2	0.30
10.8	1596	12.0	0.7	87.3	0.16
11.0	1597	8.5	0.7	90.8	0.15
10.0	1598	8.7	1.2	90.1	0.17

Battery Tails	Sample Tails	Cal. Head
2.10	0.50	2.48
1.20	0.45	1.44
1.20	0.22	1.63
0.50	0.12	0.80
0.40	0.11	0.56
0.56	0.12	0.71
1.36	0.15	1.53
(P Talbot)	(R. Horn)	

André Zdroykowski
Assay Supervisor

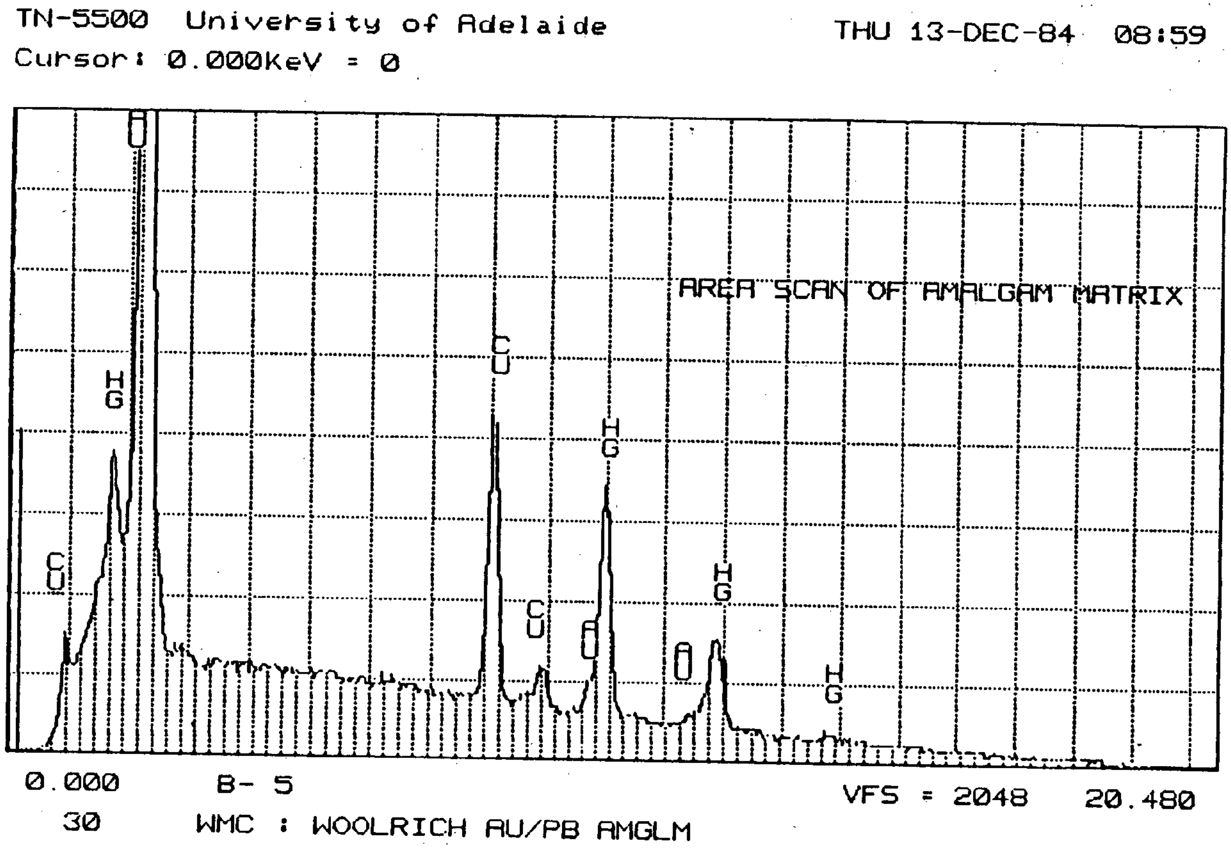
December 18, 1984

AJZ:sh
84/4004

APPENDIX X

ECP Scan of Amalgam from Strake Concentrates for Parcel 1592
(Courtesy of Western Mining Corporation)

This is the amalgam — contains Hg, Cu + some gold-minor.

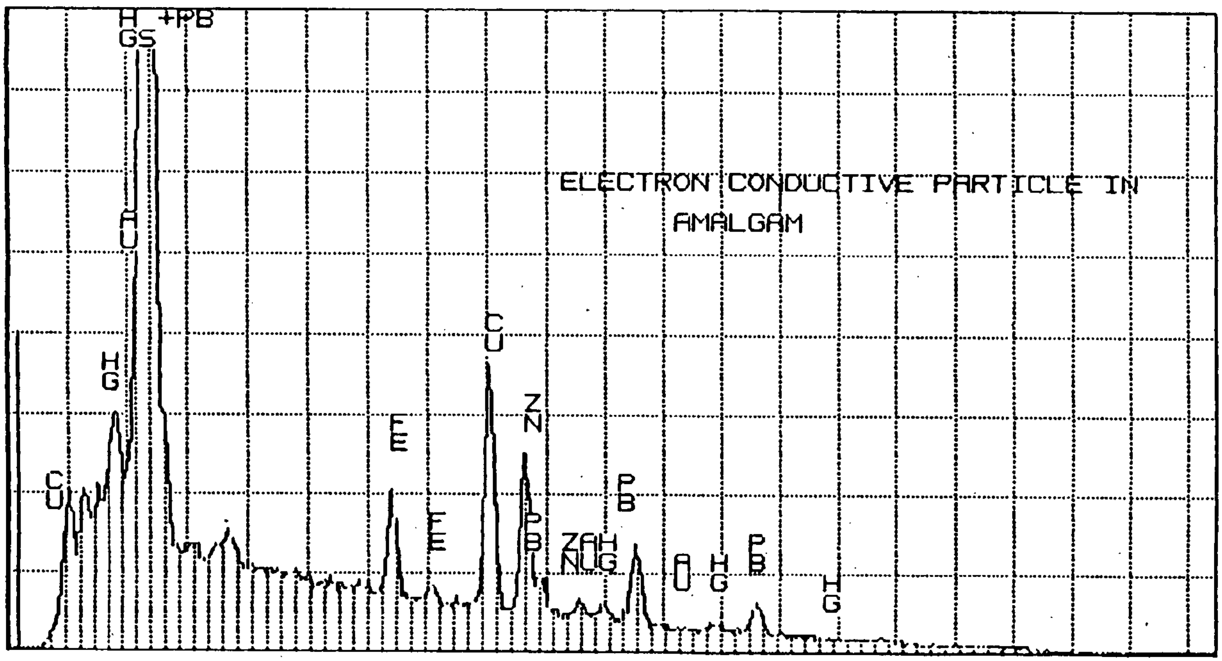


Mt. [illegible] Goldmine
Amalgam from [illegible] conc. parcel. 1592.

This is an entrained particle in
the amalgam - contains Pb, Cu, Zn Fe + S. & minor Hg

TN-5500 University of Adelaide THU 13-DEC-84 09:11

Cursor: 0.000KeV = 0



0.000 B- 5 VFS = 2048 20.480

30 WMC : WOOLRICH AU/PB AMGLM

```
IPP-4E/80 .MAIN
IPP:
IPP:
MAG=?179
W.D.F.=?1
IPP:
LABEL: WMC/WOOLRICH AMG\GLGM
IPP:
IPP:
```

APPENDIX Y

Water Analysis Report on Sample of Water from Mt. Grainger, Mine Shaft, AMDEL Report AC 3939/83

WATER ANALYSIS REPORT AMDEL COMPUTER SERVICES

SAMPLE ID. W1/83 3939/83

CHEMICAL COMPOSITION		MILLIGRAMS PER LITRE MG/L	MILLIEQUIVS. PER LITRE ME/L
CATIONS			
CALCIUM	(CA)	140.0	7.0
MAGNESIUM	(MG)	270.0	22.2
* SODIUM	(NA)	1250.0	54.4
POTASSIUM	(K)	30.0	0.8
ANIONS			
HYDROXIDE	(OH)	0.	0.0
CARBONATE	(CO3)	0.	0.0
BICARBONATE	(HCO3)	200.	3.3
* SULPHATE	(SO4)	985.	20.5
* CHLORIDE	(CL)	2121.	59.8
FLUORIDE	(F)	1.40	0.1
NITRATE	(NO3)	< 1.	0.0

TOTALS AND BALANCE

CATIONS (ME/L) 84.3 DIFF = 0.6
ANIONS (ME/L) 83.7 SUM = 168.0

DIFF*100.
--------- = 0.4 %
SUM

DERIVED AND OTHER DATA	
CONDUCTIVITY (E.C.) MICRO-S/CM AT 25 DEG. C	7752.
TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE MG/L
A. BASED ON E.C.	
B. CALCULATED (HCO3=CO3)	4897.
C. RESIDUE ON EVAP. AT 180 DEG. C	5200
TOTAL HARDNESS AS CACO3	1461.
CARBONATE HARDNESS AS CACO3	164.
NON-CARBONATE HARDNESS AS CACO3	1297.
TOTAL ALKALINITY AS CACO3	164.
FREE CARBON DIOXIDE (CO2)	
SUSPENDED SOLIDS	
SILICA (SIO2)	12.3
BORON (B)	0.8
	UNITS
REACTION - PH	7.6
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO (ME/L)	64.5 %

REMARKS

ACCOUNT R HORN (12.03)
FROM MT GRAINGER MINE SHAFT
VIDE R HORN MINERAL
RESOURCES BRANCH

NAME- D ^ M & E
ADDRESS-S A

HUNDRED-
SECTION-
HOLE NO-
SUPPLY-
SAMPLE COLLECTED BY- R. Horn.

WATER CUT-
WATER LEVEL-
DEPTH HOLE-

DATE COLLECTED 21/1/83
DATE RECEIVED 21/1/83

ANALYSIS

	------------- µg/L				-----------------------------			Q3	mg/L
SAMPLE MARK	IRON Fe	BARIUM Ba	COPPER Cu	LEAD Pb	ZINC Zn	MANGANESE Mn	SILVER Ag	MERCURY Hg	PHOSPHATE PO_4
W1/83	830	8	<10	<20	1620	185	<5	<0.1	<0.005
Method:	--------------		Q2/4		----------------------------------				Q4/1

APPENDIX Z

Reverse Circulation Drillhole field Logs

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH - 1

DRILLING METHOD: REVERSE CIRC PERCUSSION
PROJECT: MT GRAINGER
DRILLER: H FILTNESS
COLLAR LEVEL:
LOGGER: BOB GRAY
TOTAL DEPTH: 45
DATE COMMENCED: 14-7-84
DATE COMPLETED: 15-7-84
ANGLE 60° off HORIZONTAL.

INTERVAL	SAMPLE	DESCRIPTION	
0 to 6	—	Shale	
6 to 9	—	Shale & Grit	
9 to 12	—	Shale	
12 to 17	—	Shale & Grit some quartz	
17 to 20	—	Shale & Grit	
20 to 22	—	Shale	
22 to 24	—	Shale & Grit	
24 to 27	—?	Shale & Grit with quartz	
27 to 29	—?	Shale	
29 to 30	DH-1-01	Shale & Grit with quartz (unit)	<0.01
30 to 31	DH-1-02	Grit with quartz (unit)	"
31 to 32	DH-1-03	Grit with quartz (unit)	"
32 to 33	DH-1-04	Grit with quartz (unit)	"
33 to 34	DH-1-05	Grit with quartz (unit)	"
34 to 35	DH-1-06	Grit with Shale.	"
35 to 36	DH-1-07	Shale	
36 to 37		Shale	
37 to 45		Shale	
to			
to			
to			
to			
to			
to			
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to			
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to			
to			
to			
to			

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH-2

DRILLING METHOD: REVERSE CIRC PERCUSSION

PROJECT: MT GRAINGER.

DRILLER: H FILTNESS

COLLAR LEVEL:

LOGGER: BOB. GRAY.

TOTAL DEPTH: 45 m

DATE COMMENCED: 15-7-84

DATE COMPLETED: 15-7-84

ANGLE VERTICAL.

INTERVAL	SAMPLE	DESCRIPTION	
0 to 9	—	shale	
9 to 11	—	shale & grit with quartz	
11 to 13	—	shale	
13 to 21	—	shale & grit	
21 to 23	—	shale & grit with quartz & Iron.	
23 to 27	—	shale	
27 to 28	DH-2-01	shale.	<0.01
28 to 29	DH-2-02	shale & grit with quartz	"
29 to 30	" " 03	shale & grit with quartz	0.16
30 to 31	" " 04	shale & grit	<0.01
31 to 32	" " 05	shale & grit	0.05
32 to 33	" " 06	grit with quartz	0.10
33 to 34	" " 07	shale & grit with quartz	"
34 to 35	" " 08	shale & grit with quartz	0.10
35 to 36	" " 09	grit with quartz	0.20
36 to 37	" " 10	grit with quartz	<0.01
37 to 38	" " 11	grit with quartz	"
38 to 39	" " 12	grit with quartz	"
39 to 40	" " 13	grit with quartz	"
40 to 41	" " 14	grit with quartz	"
41 to 42	" " 15	grit with quartz	"
42 to 43	" " 16	shale & grit with quartz	"
43 to 44	" " 17	shale & grit with quartz	"
44 to 45	" " 18	shale	"
to			
to			
to			
to			
to			
to			
to			
to			
to			

ARKOSE ?

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH-3

DRILLING METHOD: REVERSE CIRC PERCUSSION PROJECT: MT GRAINGER

DRILLER: H FILTNESS COLLAR LEVEL:

LOGGER: BOB. GRAY TOTAL DEPTH: 45 m

DATE COMMENCED: 13-7-84 DATE COMPLETED: 13-7-84

ANGLE 60° off HORIZ.

INTERVAL	SAMPLE	DESCRIPTION	
0 to 7	—	Shale & Grit	
7 to 9	—	Shale	
9 to 12	—	Shale & Grit	
12 to 15	—	Shale & Grit	
15 to 18	—	Shale & Grit	
18 to 21	—	Shale	
21 to 24	—	Shale	
24 to 27	—	Shale	
27 to 28	—	Shale	
28 to 29	DH-3-01	Shale	
29 to 30	DH-3-02	Shale.	
30 to 31	DH-3-03	Shale	
31 to 32	DH-3-04	Shale	
32 to 33	DH-305	Shale & grit	<0.01
33 to 34	DH-3-06	Shale & Grit	"
34 to 35	DH-3-07	Grit with Quartz (ARKOSE ?)	"
35 to 36	DH-3-08	Grit with Quartz	"
36 to 37	DH-3-09	Grit with Quartz	"
37 to 38	DH-3-10	Grit with Quartz	"
38 to 39	DH-3-11	Grit with Quartz	"
39 to 40	DH-3-12	Grit with Quartz	"
40 to 41	DH-3-13	Grit with Quartz	"
41 to 42	DH-3-14	Grit with Quartz	"
42 to 43	DH-3-15	Grit with Quartz	"
43 to 44	DH-3-16	Shale	"
44 to 45	DH-3-17	Shale.	
to			
to			
to			
to			
to			
to			
to			

13 samples sent to Amdel for assay DH-3-05 to 17

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH-4

DRILLING METHOD: REVERSE CIRC PERCUSSION
PROJECT: Mt GRAINGER
DRILLER: H FILTNESS
COLLAR LEVEL:
LOGGER: BOB GRAY
TOTAL DEPTH: 73m
DATE COMMENCED: 13-7-84
DATE COMPLETED: 14-7-84

ANGLE – VERTICAL 6.0m Bearing 170° from DH3.

INTERVAL	SAMPLE	DESCRIPTION	
0 to 4	—	shale & grit with quartz	
4 to 7	—	shale & grit with quartz	
7 to 10	—	shale & grit with quartz	
10 to 13	—	shale	
13 to 16	—	shale	
16 to 19	—	shale & grit	
19 to 22	—	shale & grit	
22 to 25	—	shale & grit with quartz	
25 to 28	—	shale & grit	
28 to 31	—	shale	
31 to 34	—	shale	
34 to 37	—	shale	
37 to 40	DH-4-01	shale & grit } ARKOSE. ?	<0.01
40 to 43	DH-4-02	grit with quartz	0.26
43 to 46	DH-4-03	grit with quartz	
46 to 49	DH-4-04	grit-shale with quartz	0.16
49 to 52	—	shale	<0.01
52 to 55	—	shale	
55 to 58	—	shale	
58 to 61	—	fresh shale	
61 to 64	—	fresh shale	
64 to 67	—	fresh shale	
67 to 70	—	fresh shale	
70 to 73	—	fresh shale.	
to			
to			
to			
to			
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to			
to			
to			

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH5

DRILLING METHOD: REVERSE CIRC. CORE

PROJECT: MA. GRAINGER

DRILLER: H. Filtness

COLLAR LEVEL:

LOGGER: B. BRINK

TOTAL DEPTH: 35 m

DATE COMMENCED: 11/7/84

DATE COMPLETED: 11/7/84

60° declination on bearing 108°

INTERVAL(m)	SAMPLE	DESCRIPTION	Au ppm
0 to 3		overburden tillite with arkose	
3 to 6		boulders.	
6 to 9			
9 to 12		"	
12 to 15		"	
15 to 18		"	
18 to 20		"	
20 to 21	DH5/1	shaley tillite with arkose grit	<0.01
to 22	2	arkose	"
to 23	3	"	"
to 24	4	"	"
to 25	5	"	"
to 26	6	"	"
to 27	7	"	"
to 28	8	"	"
to 29	9	"	"
to 30	10	"	"
to 31	11	"	"
to 32	12	"	"
to 33	13	"	"
to 34	14	footwall slate	"
to 35	15	" "	"
to			
to			
to			
to			
to			
to			
to			
to			
to			
to			
to			

Depth of hole 52 m.

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH6

DRILLING METHOD: Reverse circ. coring/percussion PROJECT: Mt. Grainger.

DRILLER: H. Filtness COLLAR LEVEL:

LOGGER: B. Brink TOTAL DEPTH: 52 m.

DATE COMMENCED: 12/7/84 DATE COMPLETED: 12/7/84

INTERVAL	SAMPLE	DESCRIPTION	
0 to 20		overburden tillite (shaley with arkose	
to		boulders)	
20 to 21	DH6/1		<0.01
21 to 22	2	tillite plus arkose	"
to 23	3	"	"
to 24	4	"	"
to 25	5	"	"
to 26	6	"	"
to 27	7	"	"
to 28	8	"	"
to 29	9	"	"
to 30	10	"	"
to 31	11	"	"
to 32	12	"	"
to 33	13	"	"
to 34	14	"	"
to 35	15	"	"
to 36	16	"	"
to 37	17	"	"
to 38	18	"	"
to 39	19	"	"
to 40	20	"	"
to 41	21	"	"
to 42	22	"	"
to 43	23	"	"
to 44	24	"	"
to 45	25	"	"
to 46	26	"	"
to 47	27	"	"
to 48	28	"	"
to 49	29	"	"
to 50	30	Scale	"
to 51	31		"

DH-7 Site 6·0 m on bearing 27° from Survey Station MG 2

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH-7

DRILLING METHOD: REVERSE CIRC PERCUSSION | PROJECT: MT GRAINGER.

DRILLER: H FILTNESS | COLLAR LEVEL:

LOGGER: BOB. GRAY | TOTAL DEPTH: 31 m

DATE COMMENCED: 19-7-84 | DATE COMPLETED: 19-7-84

ANGLE 60° off HORIZ direction 125° mag

INTERVAL	SAMPLE	DESCRIPTION	
0 to 8	—	Shale with grit some quartz	
8 to 9	—	Shale with quartz	
9 to 11	—	Shale	
11 to 12	—	Shale with grit	
12 to 14	—	Shale	
14 to 15	DH-7-01	Shale with grit (9 samples 01 to 09 sent to AMDEL for assay.)	<0·01
15 to 16	" " 02	Shale & grit with quartz	<0·01
16 to 17	" " 03	grit with quartz	0·10
17 to 18	" " 04	grit with quartz	0·20
18 to 19	" " 05	grit with quartz	0·10
19 to 20	" " 06	grit with quartz	0·05
20 to 21	" " 07	grit with quartz	<0·01
21 to 22	" " 08	grit with quartz	0·05
22 to 23	" " 09	Shale	<0·01
23 to 24	" " 10	Shale	
24 to 25	" " 11	Shale	
25 to 26	" " 12	Shale	
26 to 27	" " 13	Shale	
27 to 28	" " 14	Shale	
28 to 29	" " 15	Shale	
29 to 30	" " 16	Shale	
30 to 31	" " 17	Shale	
to			
to			
to			
to			
to			
to			
to			
to			
to			
to			
to			

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH-8

DRILLING METHOD: REVERSE CIRC PERCUSSION PROJECT: MT GRAINGER

DRILLER: H FILTNESS COLLAR LEVEL:

LOGGER: BOB GRAY TOTAL DEPTH: 37m

DATE COMMENCED: 19-7-84 DATE COMPLETED: 19-7-84

ANGLE - Vertical Sited 1.5m on bearing 305 from DH 07.

INTERVAL	SAMPLE	DESCRIPTION	
0 to 12	—	Shale & grit with some quartz	
12 to 16	—	Shale	
16 to 17	—	Grit with quartz	
17 to 18	—	Shale & grit with quartz	
18 to 19	—	Shale	
19 to 20	DH-8-01	Shale with quartz	<0.01
20 to 21	" " 02	Shale & grit with quartz	"
21 to 22	" " 03	Grit with quartz	0.10
22 to 23	" " 04	Grit with quartz	<0.01
23 to 24	" " 05	Grit with quartz	0.05
24 to 25	" " 06	Grit with quartz	<0.01
25 to 26	" " 07	Grit with quartz	0.20
26 to 27	" " 08	Grit with quartz	0.16
27 to 28	" " 09	Grit with quartz	0.05
28 to 29	" " 10	Grit with quartz	0.10
29 to 30	" " 11	Grit with quartz	<0.01
30 to 31	" " 12	Grit with quartz	"
31 to 32	" " 13	Grit with quartz	"
32 to 33	" " 14	Grit with quartz	"
33 to 34	" " 15	Grit with quartz	"
34 to 35	" " 16	Grit with shale	"
35 to 36	" " 17	Shale	"
36 to 37	" " 18	Shale	"
to ~~38~~			
to ~~39~~			
to			
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to			

18 samples sent to AMDEL for assay.

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH-9

DRILLING METHOD: REVERSE CIRC PERCUSSION PROJECT: MT GRAINGER

DRILLER: H FILTNESS COLLAR LEVEL:

LOGGER: BOB GRAY TOTAL DEPTH: 44

DATE COMMENCED: 16-7-84 DATE COMPLETED: 17-7-84

ANGLE 60° off HORIZ. DIRECTION 129° Mag.

INTERVAL	SAMPLE	DESCRIPTION	
0 to 4	—	Shale with grit	
4 to 9	—	Shale & grit with quartz	
9 to 11	—	Shale with quartz	
11 to 16	—	Shale with grit & quartz	
16 to 17	DH-9-01	Shale with grit & quartz	<0.01
17 to 18	DH-9-02	Grit with Quartz	"
18 to 19	" " 03	Grit with Quartz & Fe	"
19 to 20	" " 04	Grit with Quartz & Fe	"
20 to 21	" " 05	Grit with Quartz	"
21 to 22	" " 06	Shale & Grit	"
22 to 23	" " 07	Shale.	"
23 to 24	" " 08	Shale	"
24 to 25	" " 09	Shale	"
25 to 26	" " 10	Shale	"
26 to 27	" " 11	Grit with Quartz & Fe	"
27 to 28	" " 12	Shale with grit	"
28 to 29	" " 13	Shale	0.05
29 to 30	" " 14	Shale	<0.01
30 to 31	" " 15	Grit with quartz	0.26
31 to 32	" " 16	Grit with quartz	0.20
32 to 33	" " 17	Grit with quartz & Fe	0.05
33 to 34	" " 18	Grit with quartz & Fe	<0.01
34 to 35	" " 19	Grit with quartz	"
35 to 36	" " 20	Grit with quartz	"
36 to 37	" " 21 22	Grit with quartz	"
37 to 38	" " 23	Grit with quartz	0.05
38 to 39	" " 24	Grit with quartz (larger chips)	<0.01
39 to 40	" " 25	Grit with quartz	"
40 to 41	" " 26	Grit with quartz	"
41 to 42	" " 27	Grit with quartz	"
42 to 43	" " 28	Grit with quartz	"
43 to 44	" " 29	Shal & grit w quartz.	"
to Sample DH-9-22		cuttings from cyclone blockage samples affected	

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: DH 10

DRILLING METHOD: REVERSE CIRCULATION PERCUSSION
PROJECT: Mt GRAINGER
DRILLER: H. FILTNESS
COLLAR LEVEL:
LOGGER: BOB GRAY
TOTAL DEPTH: 65 m
DATE COMMENCED: 17-7-84
DATE COMPLETED: 19-7-84
ANGLE VERTICAL 1·5 m on Bearing 209° from DH09

INTERVAL	SAMPLE	DESCRIPTION	
0 to 9·7m	—	Shale & grit with quartz	
9·7 to 9·8	—	Shale & grit with abundant mica	
9·8 to 14	—	Shale & grit with quartz	
14 to 16	—	Shale & increased grit with quartz	
16 to 18	—	Shale	
18 to 19	DH10-01	Shale	<0.01
19 to 20	DH10-02	Grit with Quartz ——— 19 – 20 m	0.16
20 to 21	" " 03	Grit with Quartz	<0.01
21 to 22	" " 04	Grit with Quartz	"
22 to 23	" " 05	Grit with Quartz	"
23 to 24	" " 06	Grit with Quartz	"
24 to 25	" " 07	Grit with Quartz	"
25 to 26	" " 08	Grit with Quartz	"
26 to 27	" " 09	Shale	"
27 to 28	" " 10	Shale	"
28 to 29	" " 11	Grit with Quartz	"
29 to 30	" " 12	Grit with Quartz	"
30 to 31	" " 13	Grit & shale	"
31 to 32	" " 14	Grit & shale	"
32 to 33	" " 15	Grit & shale	"
33 to 34	" " 16	Shale	"
34 to 35	" " 17	Shale	"
35 to 36	" " 18	Shale & grit	"
36 to 37	" " 19	Shale & grit	"
37 to 38	" " 20	Shale & grit	"
38 to 39	" " 21	Shale	0.10
39 to 40	" " 22	Shale	<0.01
40 to 41	" " 23	Shale & grit with quartz	"
41 to 42	" " 24	Grit with quartz & Fe	"
42 to 43	" " 25	Shale	0.05
43 to 44	" " 26	Shale & grit with quartz	<0.01
44 to 45	" " 27	Shale & grit	"
45 to 46	" " 28	Shale with quartz.	"

G. ABIGNANO PTY. LIMITED

MINING DIVISION

FIELD LOG OF DRILL HOLE NO: 10

DRILLING METHOD: REVERSE CIRC. PERCUSSION | PROJECT: MT GRAINGER.
DRILLER: H. FILTNESS | COLLAR LEVEL:
LOGGER: BOB GRAY | TOTAL DEPTH: 65 m
DATE COMMENCED: 17-7-84 | DATE COMPLETED: 19-7-84

INTERVAL	SAMPLE	DESCRIPTION
46 to 47	DH-10-29	Shale
47 to 48	" " 30	shale c grit with quartz
48 to 49	" " 31	Grit with quartz
49 to 50	" " 32	Grit with quartz
50 to 51	" " 33	fresh Grit with quartz
51 to 52	" " 34	fresh Grit with quartz (very fine visible gold in SS)
52 to 53	" " 35	fresh Grit with quartz
53 to 54	" " 36	fresh Grit with quartz
54 to 55	" " 37	fresh Grit with quartz
55 to 56	" " 38	fresh Grit with quartz
56 to 57	" " 39	fresh Grit with quartz
57 to 58	" " 40	weathered Grit with quartz
58 to 59	" " 41	fresh Grit with quartz
59 to 60	" " 42	fresh Grit with quartz
60 to 61	" " 43	fresh Grit with quartz
61 to 62	" " 44	weathered Grit with shale
62 to 63	" " 45	weathered Grit with shale
63 to 64	" " 46	weathered shale with grit
64 to 65	" " 47	weathered shale.
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to		

(bracketed note beside samples 35–43): grit sandstone altered gradually to quartzite

Right-hand column (as written, top to bottom): <0.01, 0.05, <0.01, ", ", 0.05, 0.05, <0.01, 0.05, <0.01, ", ", ", ", ", ", ", ", ", "

APPENDIX AA

Assay Results and Sample Weights for Reverse Circulation Drillhole Samples (AMDEL Report AC 220/85)

The Australian Mineral Development Laboratories

emington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

NATA CERTIFICATE

3/0/0 - AC 220/85

10 August 1984

Mr. B. Brink,
Abignano Limited,
P.O. Box 195,
PYMBLE N.S.W. 2073

RECEIVED
15 AUG 1984
Ans'd

REPORT AC 220/85

YOUR REFERENCE:	Order Number 113059
REPORT COMPRISING:	Cover Sheet Pages 1 - 2 Pages G1 - G8
DATE RECEIVED:	16 July 1984

D. Patterson
Chief Chemist
Analytical Chemistry Division

ij

Head Office:
lemington Street, Frewville
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Telephone (08) 79 1662
Telex: Amdel AA82520
Pilot Plant:
Osman Place
Thebarton, S.A.
Telephone (08) ~~42 0059~~ 43 5733
Branch Laboratories:
Melbourne, Vic.
Telephone (03) 645 3093
Perth, W.A.
Telephone (09) 325 7311
Townsville
Queensland 4814
Telephone (077) 75 1377

ANALYSIS

ABIGNANO WEIGHTS

SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg
DH5- 1	8	DH6- 1	7½	DH1- 1	7½	DH9- 1	11½
2	13 3/4	2	20½	2	15	2	8½
3	13	3	16	3	8	3	11½
4	10	4	9	4	10	4	10 3/4
5	9	5	10	5	11	5	9
6	8½	6	7	6	13	6	10½
7	10½	7	8½	7	10½	7	13½
8	9½	8	8			8	7½
9	9½	9	10	DH2- 1	5 3/4	9	12 3/4
10	9½	10	10	2	6 3/4	10	7½
11	9½	11	8	3	7	11	5
12	8 3/4	12	9	4	5	12	5 3/4
13	11	13	9½	5	7 3/4	13	4½
14	10½	14	7½	6	10½	14	7
15	6½	15	10	7	14½	15	11½
		16	9	8	16	16	9
DH3- 5	14	17	7	9	21	17	2 3/4
6	10½	18	10	10	11	18	1½
7	9½	19	9½	11	10 3/4	19	6½
8	8	20	7½	12	9½	20	6½
9	6	21	20	13	6	21	12½
10	5½	22	8	14	6½	22	48
11	11½	23	5	15	8	23	8 3/4
12	7½	24	7½	16	5½	24	9 3/4
13	9½	25	7½	17	4	25	13 3/4
14	10½	26	10	18	13½	26	10½
15	11½	27	9½			27	9
16	7	28	7½			28	17½
17	11 3/4	29	6			29	20
18	13½	30	7				
		31	7½				

ANALYSIS

ABIGNANO WEIGHTS

SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg	SAMPLE MARK	DRY WEIGHT Kg
DH10- 1	11½	DH10-25	6	DH8- 1	8	DH7- 1	5½
2	5½	26	5 3/4	2	8½	2	8½
3	5	27	6 3/4	3	14	3	4
4	4½	28	7	4	8	4	5½
5	2 3/4	29	6	5	11	5	4
6	5½	30	9½	6	6½	6	5 3/4
7	4	31	8½	7	8	7	5 3/4
8	4½	32	16 3/4	8	12	8	4 3/4
9	7½	33	13½	9	4½	9	7½
10	7½	34	7½	10	4½		
11	5 3/4	35	5½	11	7½	DH4- 1	15
12	5 3/4	36	12	12	4	2	27
13	4½	37	6	13	5½	3	36
14	4 3/4	38	4½	14	6	4	14
15	6 3/4	39	6 3/4	15	5		
16	6	40	4½	16	9½		
17	6	41	4½	17	10		
18	4½	42	4	18	9 3/4		
19	5½	43	3½				
20	6	44	8				
21	10	45	9½				
22	6 3/4	46	9				
23	4½	47	7½				
24	4½						

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Analysis code C3/4 Report AC 220/85 Page G1

NATA Certificate Results in ppm

Sample	Depth (m)	Au
DH6-18	37 - 38	<0.01
DH6-19	38 - 39	<0.01
DH6-20	39 - 40	<0.01
DH6-21	40 - 41	<0.01
DH6-22	41 - 42	<0.01
DH6-23	42 - 43	<0.01
DH6-24	43 - 44	<0.01
DH6-25	44 - 45	<0.01
DH6-26	45 - 46	<0.01
DH6-27	46 - 47	<0.01
DH6-28	47 - 48	<0.01
DH6-29	48 - 49	<0.01
DH6-30	49 - 50	<0.01
DH6-31	50 - 51	<0.01
DH1-1	29 - 30	<0.01
DH1-2	30 - 31	<0.01
DH1-3	31 - 32	<0.01
DH1-4	32 - 33	<0.01
DH1-5	33 - 34	<0.01
DH1-6	34 - 35	<0.01
DH1-7	35 - 36	<0.01
DH2-1	27 - 28	<0.01
DH2-2	28 - 29	<0.01
DH2-3	29 - 30	0.16
DH2-4	30 - 31	<0.01
DH2-5	3 - 32	0.05
DH2-6	32 - 33	0.10
DH2-7	33 - 34	0.10
DH2-8	34 - 35	0.10

Detn limit (0.01)

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Analysis code C3/4 Report AC 220/85 Page G2

NATA Certificate Results in ppm

Sample	Depth (m)	Au
DH2-9	35 - 36	0.20
DH2-10	36 - 37	<0.01
DH2-11	37 - 38	<0.01
DH2-12	38 - 39	<0.01
DH2-13	39 - 40	<0.01
DH2-14	40 - 41	<0.01
DH2-15	41 - 42	<0.01
DH2-16	42 - 43	<0.01
DH2-17	43 - 44	<0.01
DH2-18	44 - 45	<0.01
DH9-01	16 - 17	<0.01
DH9-02	17 - 18	<0.01
DH9-03	18 - 19	<0.01
DH9-04	19 - 20	<0.01
DH9-05	20 - 21	<0.01
DH9-06	21 - 22	<0.01
DH9-07	22 - 23	<0.01
DH9-08	23 - 24	<0.01
DH9-09	24 - 25	<0.01
DH9-10	25 - 27	<0.01
DH9-11	26 - 27	<0.01
DH9-12	27 - 28	<0.01
Detn limit		(0.01)

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Analysis code C3/4 Report AC 220/84

NATA Certificate Results in ppm

Sample	Depth (m)	Au
DH9-13	28 - 29	0.05
DH9-14	29 - 30	<0.01
DH9-15	30 - 31	0.26
DH9-16	31 - 32	0.20
DH9-17	32 - 33	0.05
DH9-18	33 - 34	<0.01
DH9-19	34 - 35	<0.01
DH9-20	35 - 36	<0.01
DH9-21	36 - 37	<0.01
DH9-22	37 - 38	0.05
DH9-23	38 - 39	0.05
DH9-24	39 - 40	<0.01
DH9-25	40 - 41	<0.01
DH9-26	41 - 42	<0.01
DH9-27	42 - 43	<0.01
DH9-28	43 - 44	<0.01
DH9-29	44 - 45	<0.01
DH10-1	18 - 19	<0.01
DH10-2	19 - 20	0.16
DH10-3	20 - 21	<0.01
DH10-4	21 - 22	<0.01
DH10-5	22 - 23	<0.01
DH10-6	23 - 24	<0.01
DH10-7	24 - 25	<0.01

Detn limit (0.01)

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Analysis code C3/4 Report AC 220/85 Page G4

NATA Certificate Results in ppm

Sample	Depth (m)	Au
DH10-8	25-26	<0.01
DH10-9	26 - 27	<0.01
DH10-10	27 - 28	<0.01
DH10-11	28 - 29	<0.01
DH10-12	29 - 30	<0.01
DH10-13	30 - 31	<0.01
DH10-14	31 - 32	<0.01
DH10-15	32 - 33	<0.01
DH10-16	33 - 34	<0.01
DH10-17	34 - 35	<0.01
DH10-18	35 - 36	<0.01
DH10-19	36 - 37	<0.01
DH10-20	37 - 38	<0.01
DH10-21	38 - 39	<0.01
DH10-22	39 - 40	0.10
DH10-23	40 - 41	<0.01
DH10-24	41 - 42	<0.01
DH10-25	42 - 43	<0.01
DH10-26	43 - 44	0.05
DH10-27	44 - 45	<0.01
DH10-28	45 - 46	<0.01
DH10-29	46 - 47	<0.01
DH10-30	47 - 48	0.05
DH10-31	48 - 49	<0.01
DH10-32	49 - 50	<0.01
DH10-33	50 - 51	<0.01
DH10-34	51 - 52	0.05
DH10-35	52 - 53	0.05
DH10-36	53 - 54	<0.01
DH10-37	54 - 55	0.05
DH10-38	55 - 56	<0.01
DH10-39	56 - 57	<0.01
DH10-40	57 - 58	<0.01
DH10-41	58 -59	<0.01
Detn limit		(0.01)

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Analysis code C3/4 Report AC 220/85 Page G5

NATA Certificate Results in ppm

Sample	Depth (m)	Au
DH10-42	59 - 60	<0.01
DH10-43	60 - 61	<0.01
DH10-44	61 - 62	<0.01
DH10-45	62 - 63	<0.01
DH10-46	63 - 64	<0.01
DH10-47	64 - 65	<0.01
DH8-01	19 - 20	<0.01
DH8-02	20 - 21	<0.01
DH8-03	21 - 22	0.10
DH8-04	22 - 23	<0.01
DH8-05	23 - 24	0.05
DH8-06	24 - 25	<0.01
DH8-07	25 - 26	0.20
DH8-08	26 - 27	0.16
DH8-09	27 - 28	0.05
DH8-10	28 - 29	0.10
DH8-11	29 - 30	<0.01
DH8-12	30 - 31	<0.01
DH8-13	31 - 32	<0.01
DH8-14	32 - 33	<0.01
DH8-15	33 - 34	<0.01
DH8-16	34 - 35	<0.01
DH8-17	35 - 36	<0.01
DH8-18	36 - 37	<0.01
Detn limit		(0.01)

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Analysis code C3/4 Report AC 220/85 Page 66

NATA Certificate Results in ppm

Sample	Depth (m)	Au
DH7-01	14-15	<0.01
DH7-02	15-16	<0.01
DH7-03	16-17	0.10
DH7-04	17-18	0.20
DH7-05	18-19	0.10
DH7-06	19-20	0.05
DH7-07	20-21	<0.01
DH7-08	21-22	0.05
DH7-09	22-23	<0.01
DH4-01	37-40	<0.01
DH4-02	40-43	0.26
DH4-03	43-46	0.16
DH4-04	46-49	<0.01

Detn limit (0.01)

NATA Certificate   Results in ppm

Sample	Depth (m)	Au
DH3-05	32 - 33	<0.01
DH3-06	33 - 34	<0.01
DH3-07	34 - 35	<0.01
DH3-08	35 - 36	<0.01
DH3-09	36 - 37	<0.01
DH3-10	37 - 38	<0.01
DH3-11	38 - 39	<0.01
DH3-12	39 - 40	<0.01
DH3-13	40 - 41	<0.01
DH3-14	41 - 42	<0.01
DH3-15	42 - 43	<0.01
DH3-16	43 - 44	<0.01
DH3-17	44 - 45	<0.01
DH3-18	45 - 46	<0.01
DH5-1	20 - 21	<0.01
DH5-2	21 - 22	<0.01
DH5-3	22 - 23	<0.01
DH5-4	23 - 24	<0.01
DH5-5	24 - 25	<0.01
DH5-6	25 - 26	<0.01
DH5-7	26 - 27	<0.01
DH5-8	27 - 28	<0.01
DH5-9	28 - 29	<0.01
DH5-10	29 - 30	<0.01
DH5-11	30 - 31	<0.01
DH5-12	31 - 32	<0.01
DH5-13	32 - 33	<0.01
DH5-14	33 - 34	<0.01
DH5-15	34 - 35	<0.01
DH6-01	20 - 21	<0.01
DH6-02	21 - 22	<0.01
DH6-03	22 - 23	<0.01
DH6-04	23 - 24	<0.01
DH6-05	24 - 25	<0.01
DH6-06	25 - 26	<0.01
DH6-07	26 - 27	<0.01
DH6-08	27 - 28	<0.01
DH6-09	28 - 29	<0.01
DH6-10	29 - 30	<0.01
DH6-11	30 - 31	<0.01
Detn limit		(0.01)

Analysis code C3/4 Report AC 220/85 Page G.

NATA Certificate Results in pp

Sample	Depth (m)	Au
DH6-12	31 - 32	<0.01
DH6-13	32 - 33	<0.01
DH6-14	33 - 34	<0.01
DH6-15	34 - 35	<0.01
DH6-16	35 - 36	<0.01
DH6-17	36 - 37	<0.01
Detn limit		(0.01)

APPENDIX BB

Results of Bulk Cyanide Leach Assays of Solution and Residues from Bulked Reverse Circulation Drillhole Samples Obtained by Abignano Limited (AMDEL Report T 6011)

The Australian
Mineral Development
Laboratories

amdel

Flemington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

31 August 1984

OD 3/0/0

Mr G.B. Brink
Exploration and Mining Manager
Abignano Limited
19-21 Bridge Street
PYMBLE NSW 2073

REPORT: T6011

YOUR REFERENCE:	Order Number 113062
MATERIAL:	Drill hole samples
LOCALITY:	Mt Grainger, South Australia
WORK REQUIRED:	Bulk cyanide leach with assays of solution and residues

Investigation and Report by: P.G. Capps

Acting Manager, Operations Division: W.M. Walker

W.M. Walker

for Brian S. Hickman,
Managing Director

Pilot Plant: Osman Place
Thebarton S.A.,
Telephone 43 8053
Branch Laboratories:
Perth W.A.
Telephone 325 7311
Melbourne Vic.
Telephone 645 3093

rp

1. INTRODUCTION

Abignano Limited are currently investigating the Mt Grainger gold deposit in South Australia. Bulk samples have been taken for sampling and gold assay at AMDEL as well as for processing through the State Government battery at Peterborough (AMDEL Reports OD 6507 and 6991/84). Agreement between assay sample values and results from the Peterborough battery has been poor.

A drilling programme has recently been completed by Abignano and the drill hole samples assayed at AMDEL. Results of these assays have been reported separately.

In view of the lack of consistency in indicated gold values, Abignano requested AMDEL to carry out a bulk cyanide leach on selected assay sample balances. Solution and residue assays would be used to provide a check of the combine drill hole sample assays.

2. PROCEDURE AND RESULTS

The following drill hole samples were nominated by Abignano Limited for inclusion in the bulk leach sample:

DH1, all intersections	(7)
DH2, all intersections	(18)
DH3, 5-17	(13)
DH4, 1-3	(3)
DH5, all intersections	(15)
DH6, 14-29	(16)
DH7, 1-8	(8)
DH8, all intersections	(18)
DH9, 11-29	(18)
DH10, 22-37	(16)
	(132)

Reserve portions of 0.5 to 1 kg were riffled from each of the above intersections, and the balances blended to constitute the bulk sample. The weight of the bulk sample, obtained from average intersection weights, assay pulp weights and reserve portion weights, was approximately 860 kg.

The bulk sample was agitation cyanide leached at 30% solids, pH 11 and 0.1% NaCN solution for a period of 48 hours. At the completion of this time, the leached slurry was pumped to a sampler via a spiral to collect any coarse free gold remaining after leaching.

Tailing from the spiral was sampled by an automatic timed sample cutter such that 20% of the slurry was collected in a smaller (400 litre) tank. The slurry was vigorously agitated and recirculated, and a sample taken for solution and residue gold assay.

The spiral concentrate was panned by hand to reduce the sample size, and the pan concentrate dried and assayed for gold.

Gold assays of the gravity concentrate, cyanide leach residue and cyanide solution, were used to determine a calculated head assay for the bulk sample of Au 0.12 g/t.

Assay discrepancies previously encountered for other bulk samples, could in part be explained if a large proportion of gold was present as coarse grains. However, the gravity concentrate obtained from the bulk cyanide leach residue contained only 0.3% of the gold at a grade of 5.1 g/t. This suggests that, in the drill hole samples examined, only a very low proportion of the gold occurred as coarse grains.

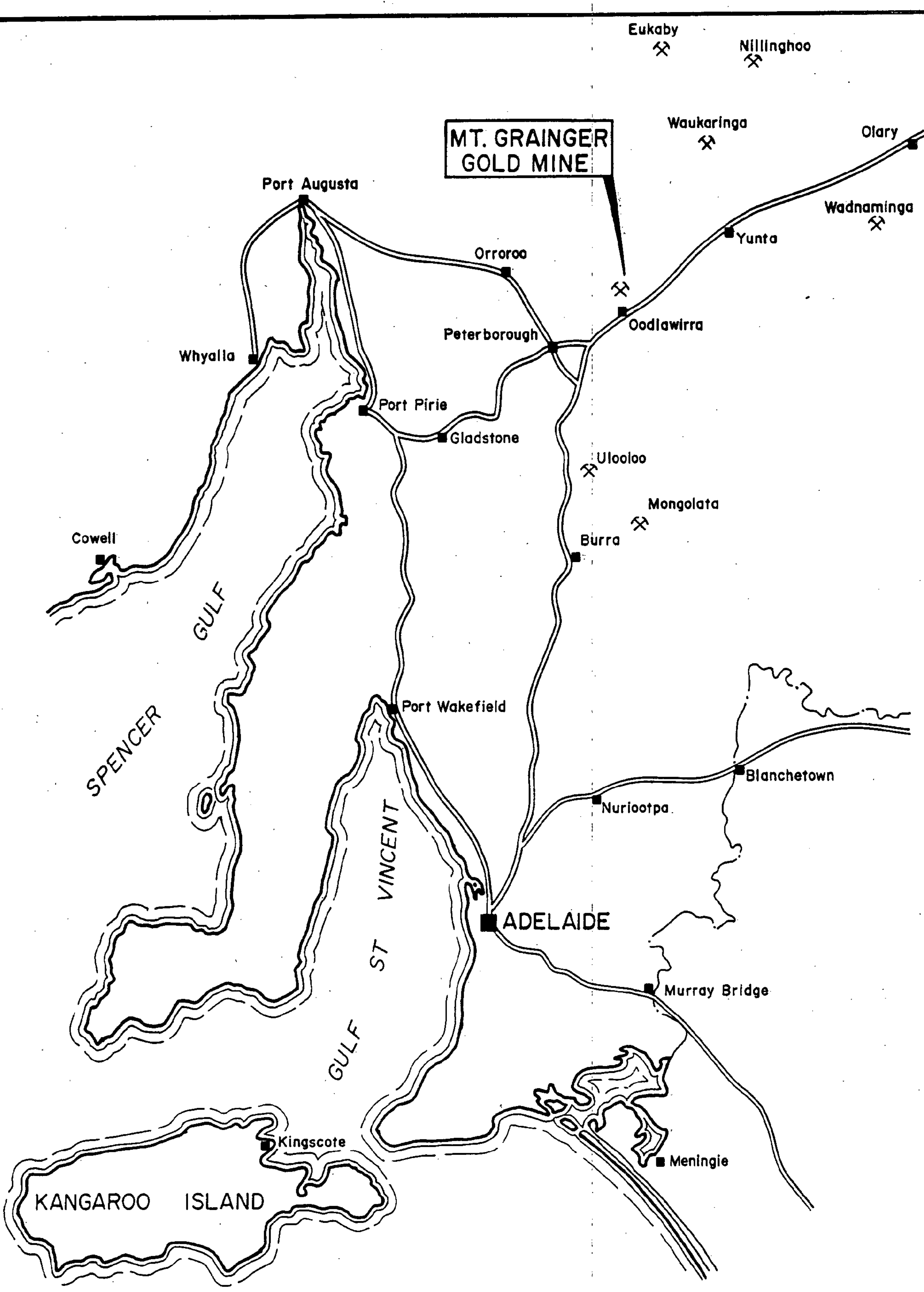


FIG. I

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SEC. 180 AND 183 - HD COGLIN
LOCALITY PLAN

COMPILED	C.M. Horn	CDO	DATE 8·10·87
DRAWN	J.W	SCALE 1:2,000,000	
DATE		PLAN NUMBER	
CHECKED		S19206	

3928

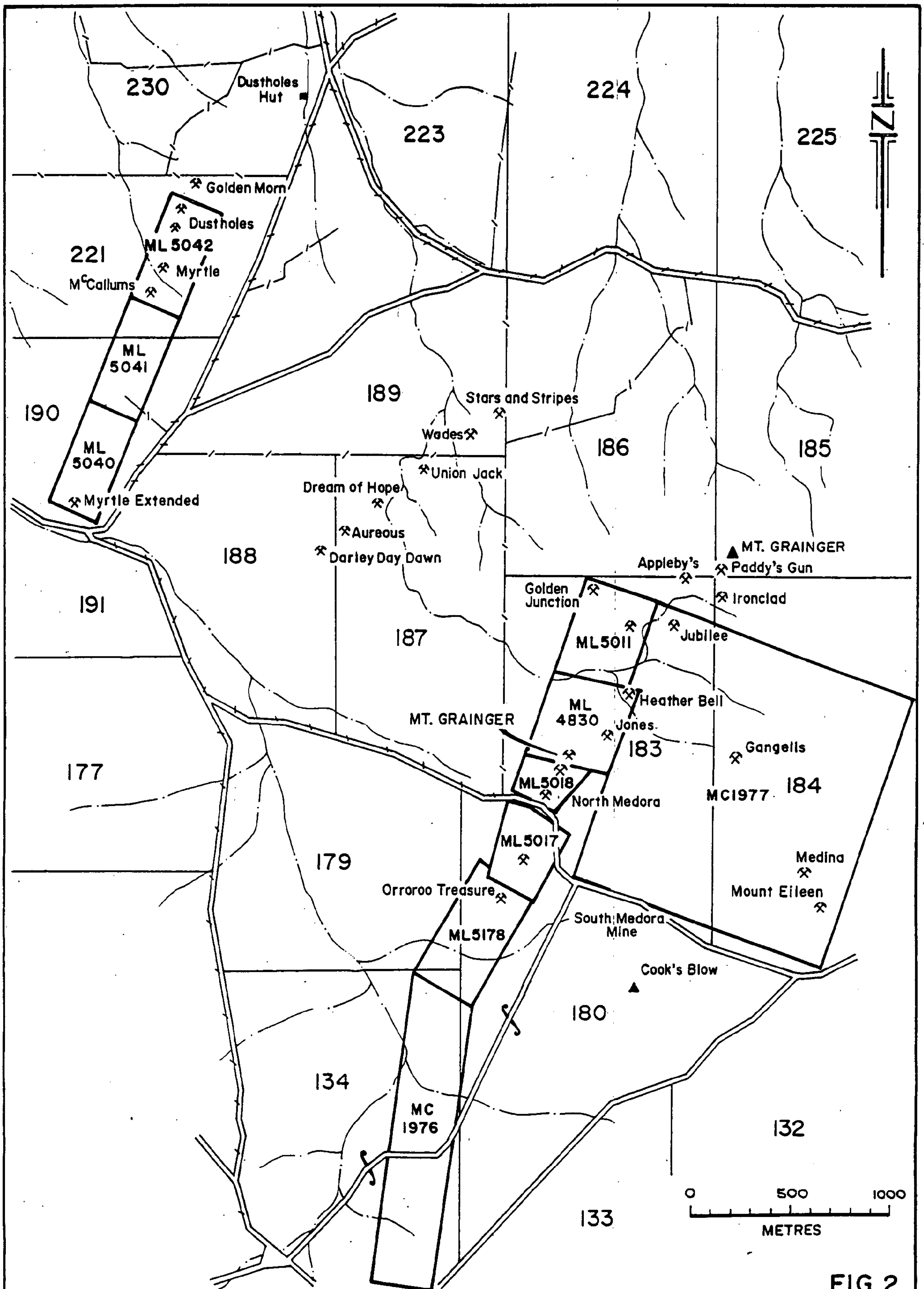
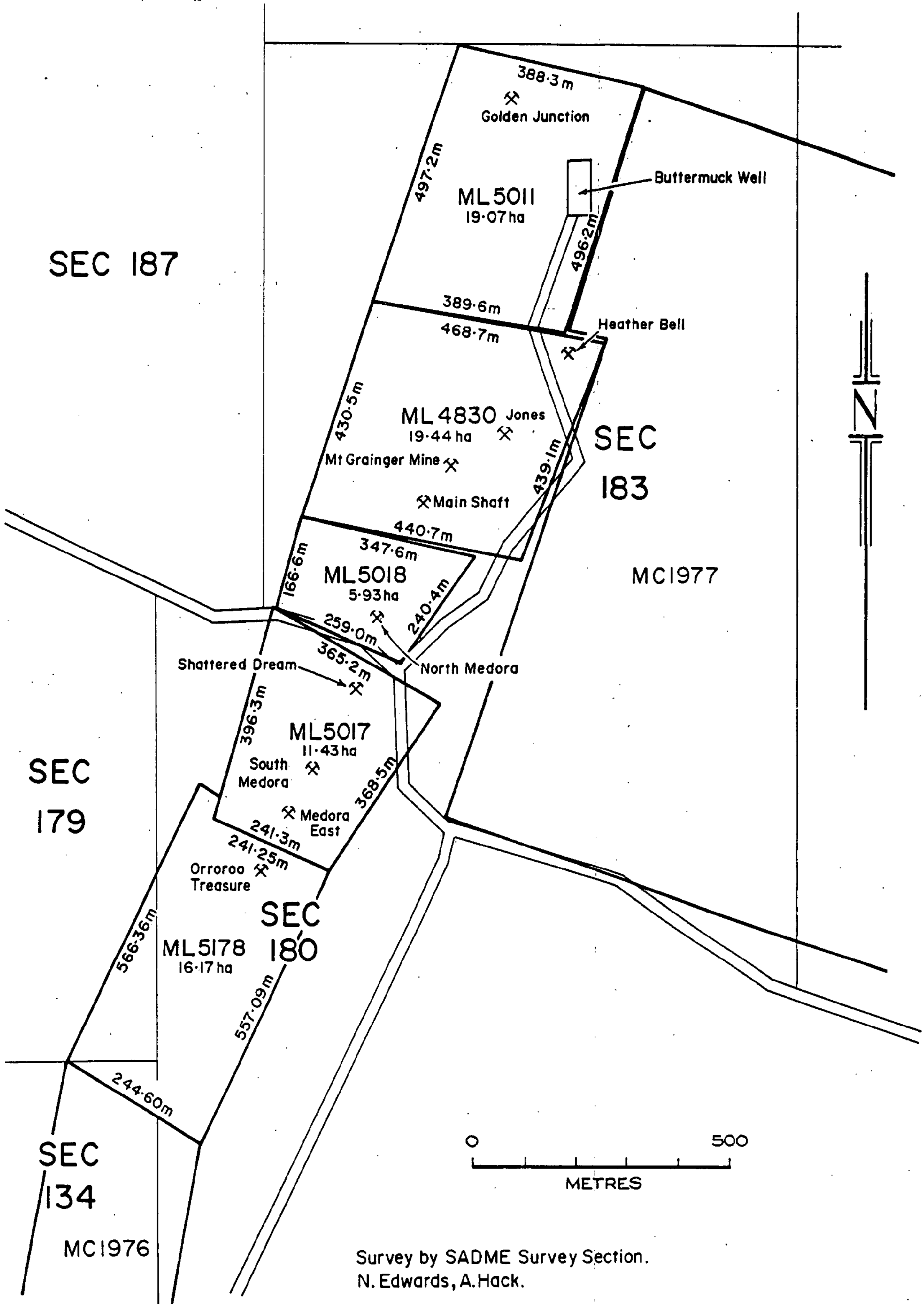


FIG. 2

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED C.M. Horn	CDO	8·10·87 DATE
MOUNT GRAINGER GOLD MINE MINING TENEMENTS	DRAWN J.W.	SCALE 1:25,000	
	DATE	PLAN NUMBER	
	CHECKED	S19207	

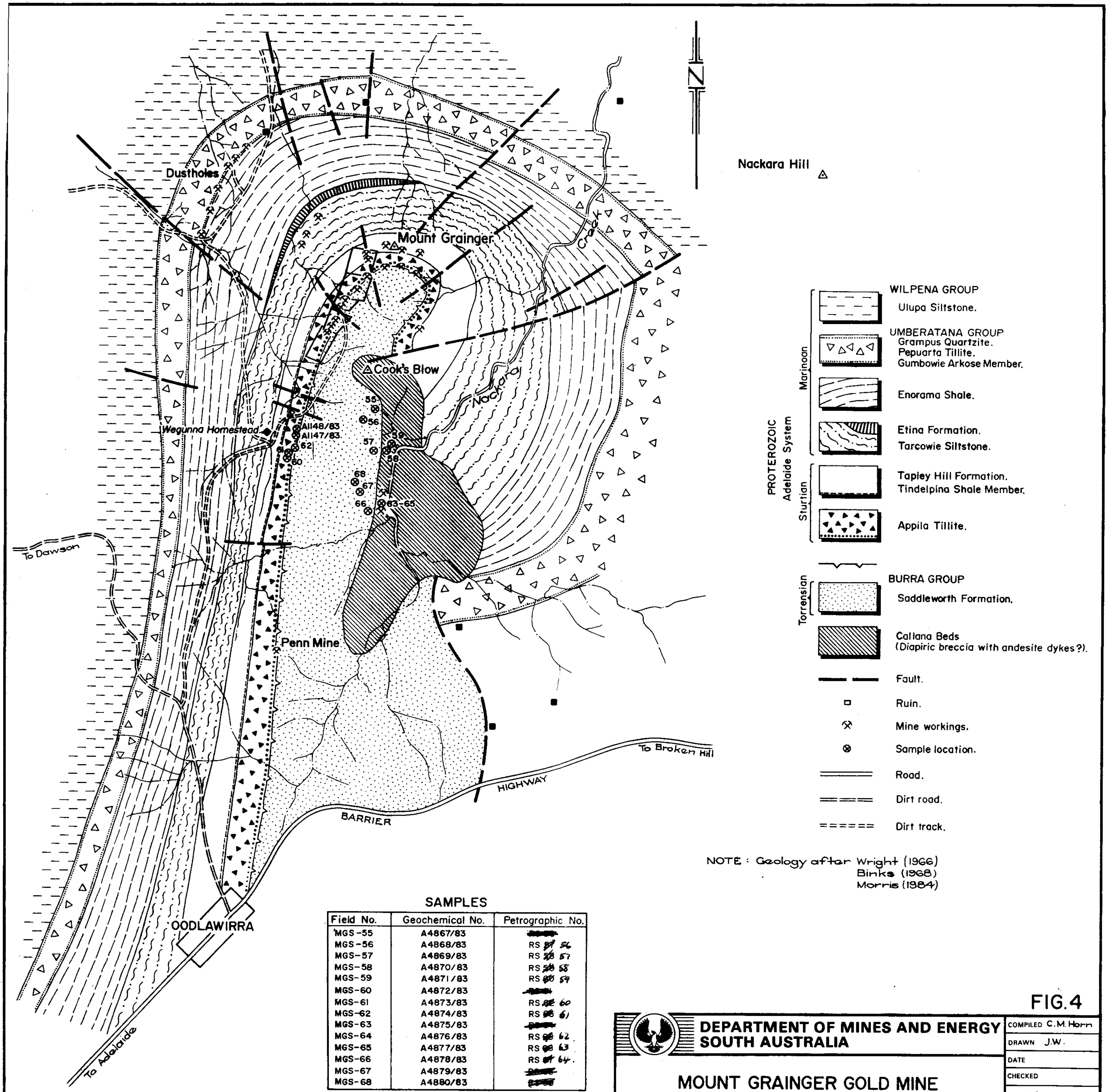


Survey by SADME Survey Section.
N. Edwards, A. Hack.

FIG. 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	C D O	8·10·87 DATE
MOUNT GRAINGER GOLDMINE SEC. 180 AND 183 – HD COGLIN MINING TENURE	DRAWN J.W.	SCALE 1:10,000	
	DATE	PLAN NUMBER	
	CHECKED	S19208	

3928



SAMPLES

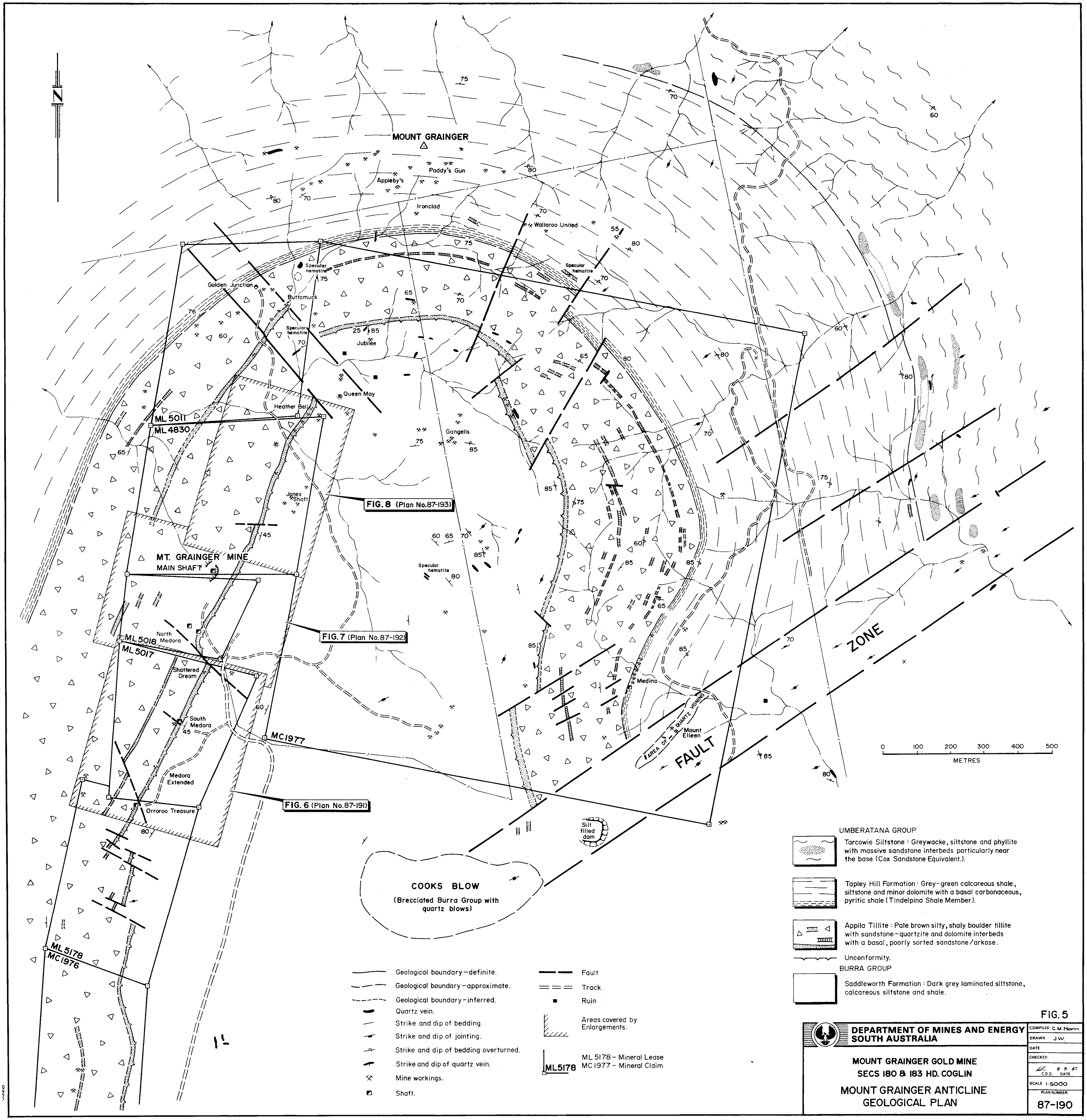
Field No.	Geochemical No.	Petrographic No.
MGS-55	A4867/83	[illegible]
MGS-56	A4868/83	RS 56
MGS-57	A4869/83	RS 57
MGS-58	A4870/83	RS 58
MGS-59	A4871/83	RS 59
MGS-60	A4872/83	[illegible]
MGS-61	A4873/83	RS 60
MGS-62	A4874/83	RS 61
MGS-63	A4875/83	[illegible]
MGS-64	A4876/83	RS 62
MGS-65	A4877/83	RS 63
MGS-66	A4878/83	RS 64
MGS-67	A4879/83	[illegible]
MGS-68	A4880/83	[illegible]

FIG. 4

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN
REGIONAL GEOLOGY

COMPILED C.M. Horn
DRAWN J.W.
DATE
CHECKED
C.D.O. DATE 8·6·87
SCALE 1:50,000
PLAN NUMBER 87-189



N
MOUNT GRAINGER
Paddy's Gun
Appleby's
Ironclad
Wallaroo United
Specular hematite
Golden Junction
Buttamuck
Jubilee
Queen May
Heather Bell
ML 5011
ML 4830
Gangells
Jones Shaft
FIG. 8 (Plan No. 87-193)
MT. GRAINGER MINE
MAIN SHAFT
North Medora
ML 5018
ML 5017
Shattered Dream
FIG. 7 (Plan No. 87-192)
South Medora
MC1977
Medora Extended
Orroroo Treasure
FIG. 6 (Plan No. 87-191)
ML 5178
MC1976
Silt filled dam
COOKS BLOW
(Brecciated Burra Group with quartz blows)
Medina
AREA OF QUARTZ VEINING
Mount Elleen
FAULT
ZONE
0 100 200 300 400 500
METRES
UMBERATANA GROUP
Tarcowie Siltstone : Greywacke, siltstone and phyllite with massive sandstone interbeds particularly near the base (Cox Sandstone Equivalent.).
Tapley Hill Formation : Grey-green calcareous shale, siltstone and minor dolomite with a basal carbonaceous, pyritic shale (Tindelpina Shale Member).
Appila Tillite : Pale brown silty, shaly boulder tillite with sandstone-quartzite and dolomite interbeds with a basal, poorly sorted sandstone/arkose.
Unconformity.
BURRA GROUP
Saddleworth Formation : Dark grey laminated siltstone, calcareous siltstone and shale.
Geological boundary - definite.
Geological boundary - approximate.
Geological boundary - inferred.
Quartz vein.
Strike and dip of bedding.
Strike and dip of jointing.
Strike and dip of bedding overturned.
Strike and dip of quartz vein.
Mine workings.
Shaft.
Fault
Track
Ruin
Areas covered by Enlargements.
ML5178
ML 5178 - Mineral Lease
MC 1977 - Mineral Claim
FIG. 5
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA
MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN
MOUNT GRAINGER ANTICLINE
GEOLOGICAL PLAN
COMPILED C.M. Horn
DRAWN J.W.
DATE
CHECKED
C.D.O. DATE
SCALE 1:5000
PLAN NUMBER
87-190

FIG. 6

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MT GRAINGER GOLDMINE
SECS. 180 & 183, HD. COGLIN

GEOLOGICAL PLAN - SOUTHERN SHEET

COMPILED C.M.Horn · DRAWN J.W. · SCALE 1:500 · PLAN NUMBER 87-191

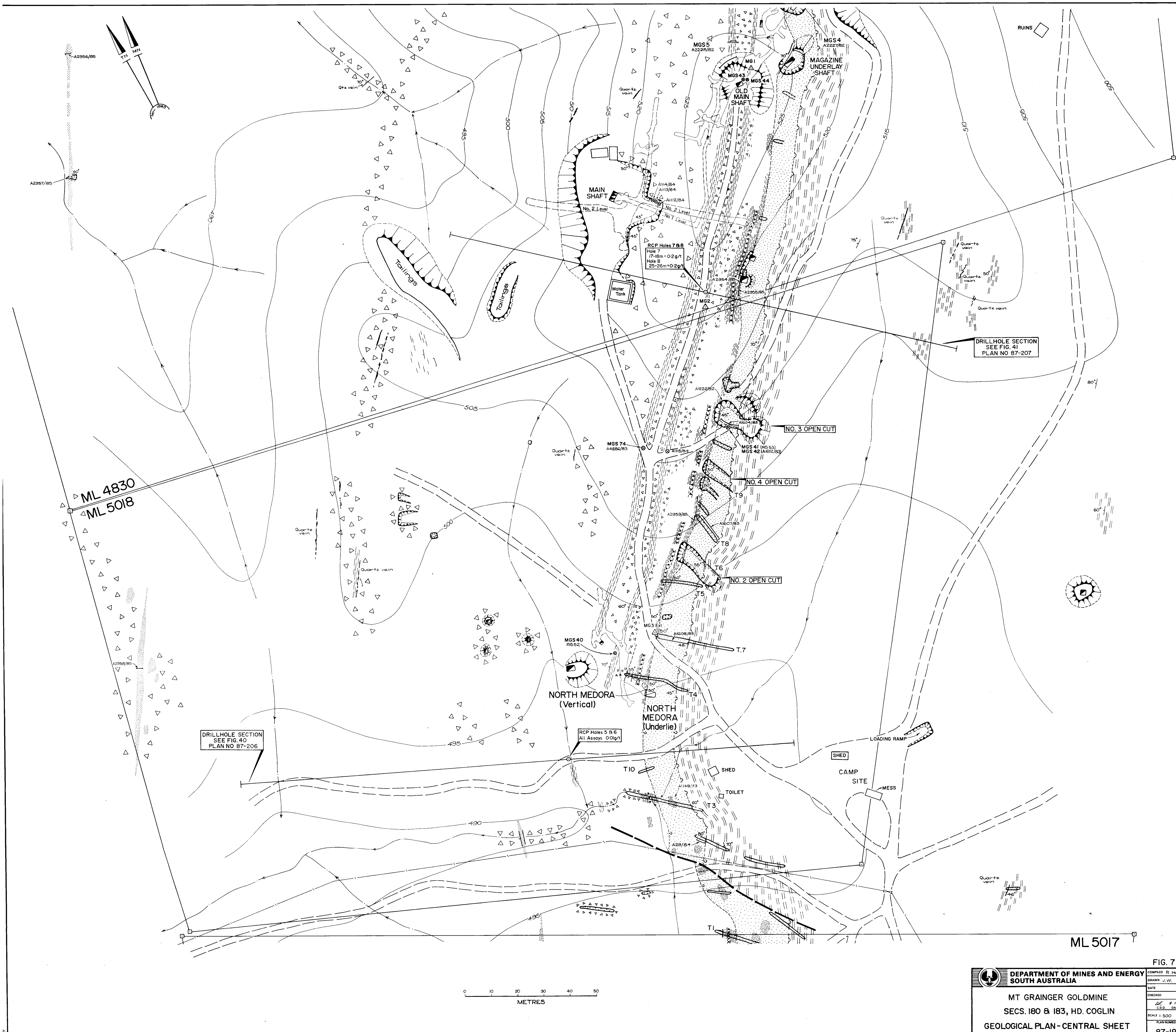


FIG. 7

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MT GRAINGER GOLDMINE

SECS. 180 & 183, HD. COGLIN

GEOLOGICAL PLAN - CENTRAL SHEET

COMPILED R. Horn
DRAWN J.W.
SCALE 1:500
PLAN NUMBER 87-192

FIG. 8

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MT GRAINGER GOLDMINE

SECS. 180 & 183, HD. COGLIN

GEOLOGICAL PLAN - NORTHERN SHEET

COMPILED R. Horn | DRAWN J.W. | SCALE 1:500 | PLAN NUMBER 87-193

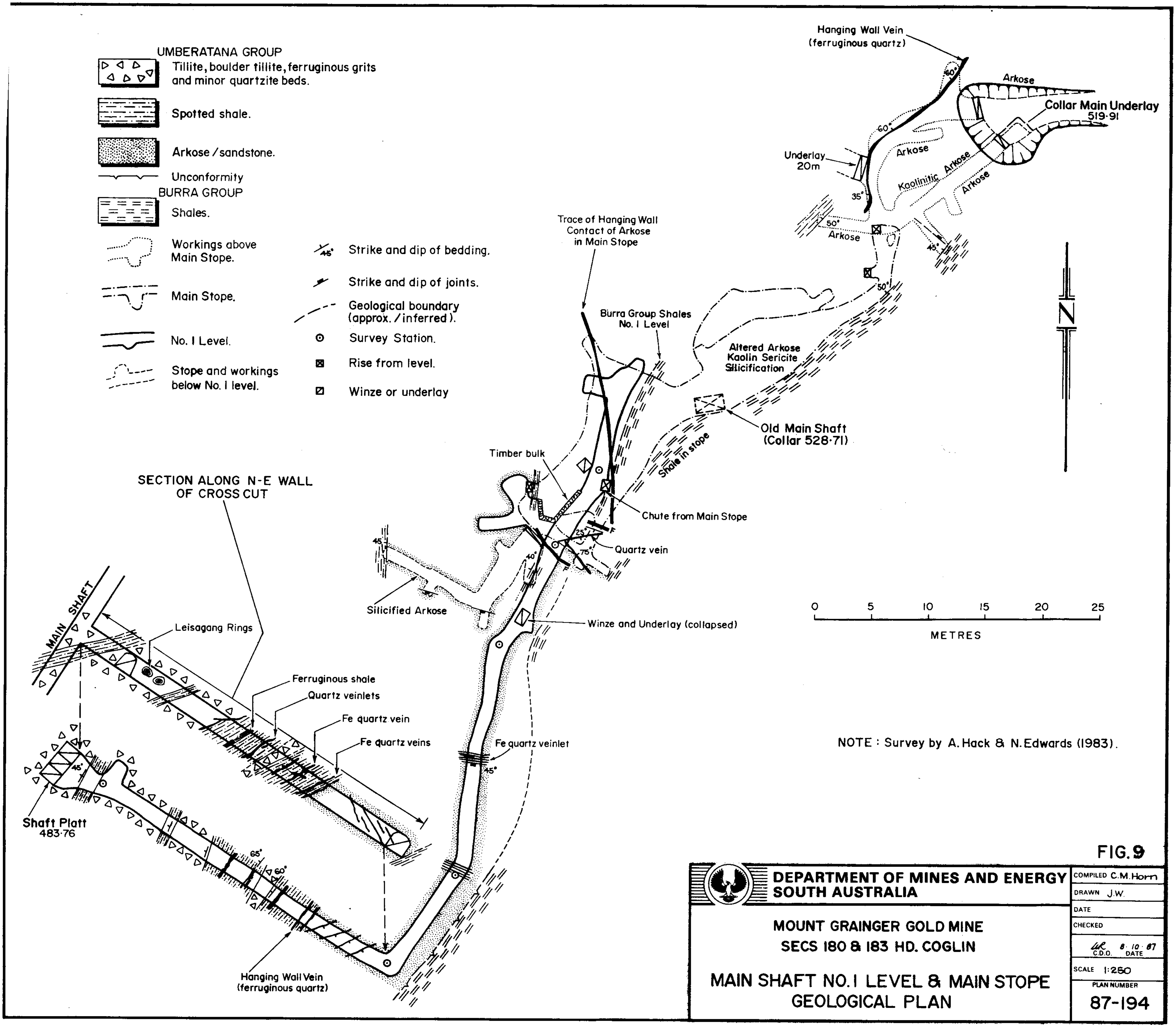
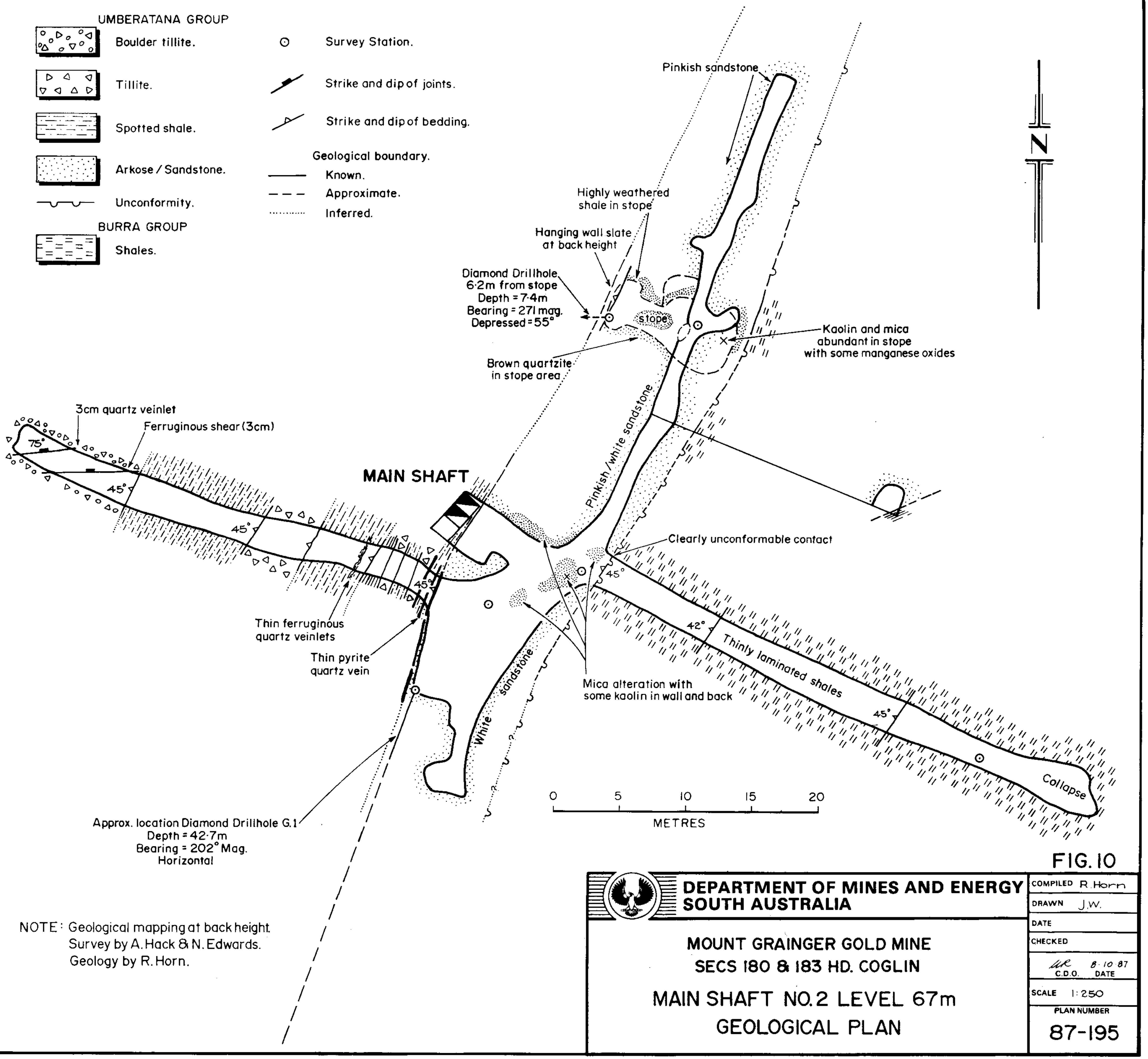


FIG. 9

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN

MAIN SHAFT NO. 1 LEVEL & MAIN STOPE GEOLOGICAL PLAN



NOTE: Geological mapping at back height. Survey by A. Hack & N. Edwards. Geology by R. Horn.

FIG. 10

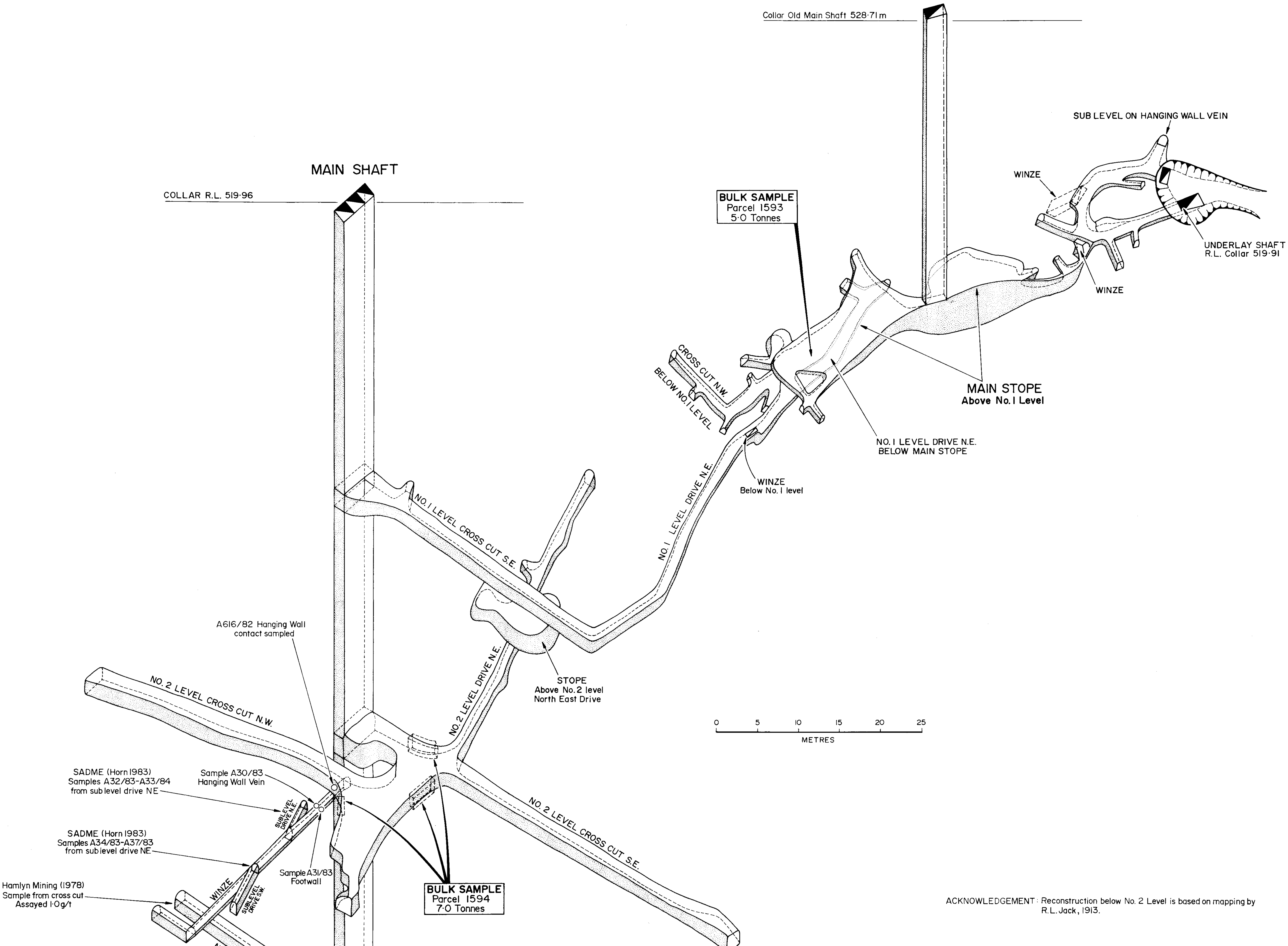
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN

MAIN SHAFT NO. 2 LEVEL 67m
GEOLOGICAL PLAN

COMPILED	R. Horn
DRAWN	J.W.
DATE	
CHECKED	
C.D.O.	8·10·87 (DATE)
SCALE	1:250
PLAN NUMBER	87-195

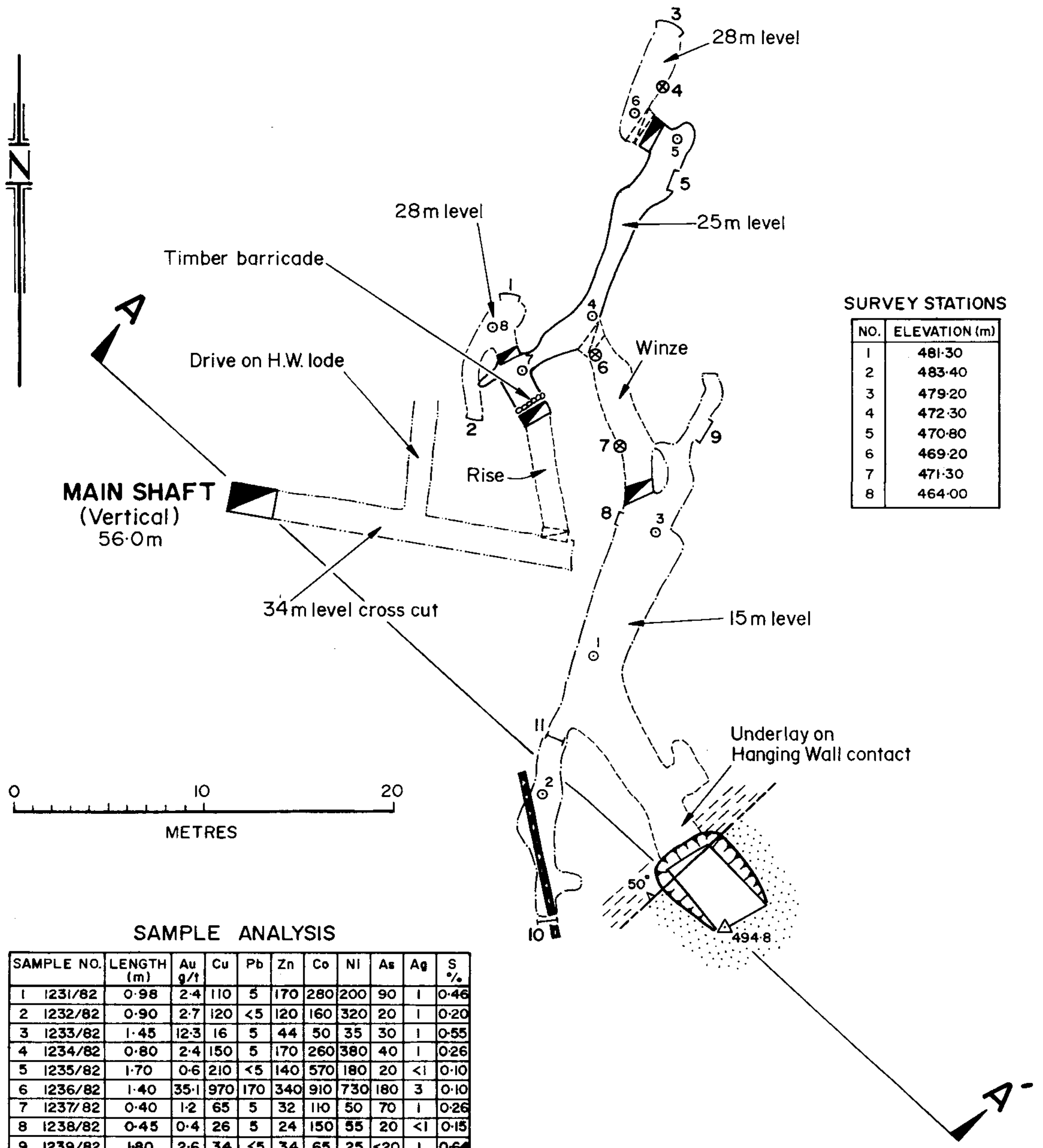
3328



ACKNOWLEDGEMENT: Reconstruction below No. 2 Level is based on mapping by R.L. Jack, 1913.

FIG. 11

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED C. M. Horn
	DRAWN J.W.
	DATE
MOUNT GRAINGER GOLD MINE SECS 180 & 183 HD. COGLIN	CHECKED
	C.D.O. 8.10.87 DATE
MAIN SHAFT & UNDERGROUND WORKINGS	SCALE 1:250
3-D CONSTRUCTION LOOKING NORTH	PLAN NUMBER 87-196



SURVEY STATIONS

NO.	ELEVATION (m)
1	481·30
2	483·40
3	479·20
4	472·30
5	470·80
6	469·20
7	471·30
8	464·00

SAMPLE ANALYSIS

SAMPLE NO.		LENGTH (m)	Au g/t	Cu	Pb	Zn	Co	Ni	As	Ag	S %
1	1231/82	0·98	2·4	110	5	170	280	200	90	1	0·46
2	1232/82	0·90	2·7	120	<5	120	160	320	20	1	0·20
3	1233/82	1·45	12·3	16	5	44	50	35	30	1	0·55
4	1234/82	0·80	2·4	150	5	170	260	380	40	1	0·26
5	1235/82	1·70	0·6	210	<5	140	570	180	20	<1	0·10
6	1236/82	1·40	35·1	970	170	340	910	730	180	3	0·10
7	1237/82	0·40	1·2	65	5	32	110	50	70	1	0·26
8	1238/82	0·45	0·4	26	5	24	150	55	20	<1	0·15
9	1239/82	1·80	2·6	34	<5	34	65	25	<20	1	0·64
10	1240/82	1·30	0·2	50	<5	20	55	20	<20	1	0·23
11	1241/82	1·40	0·8	20	5	18	35	15	<20	1	0·09

Results in parts per million unless otherwise stated

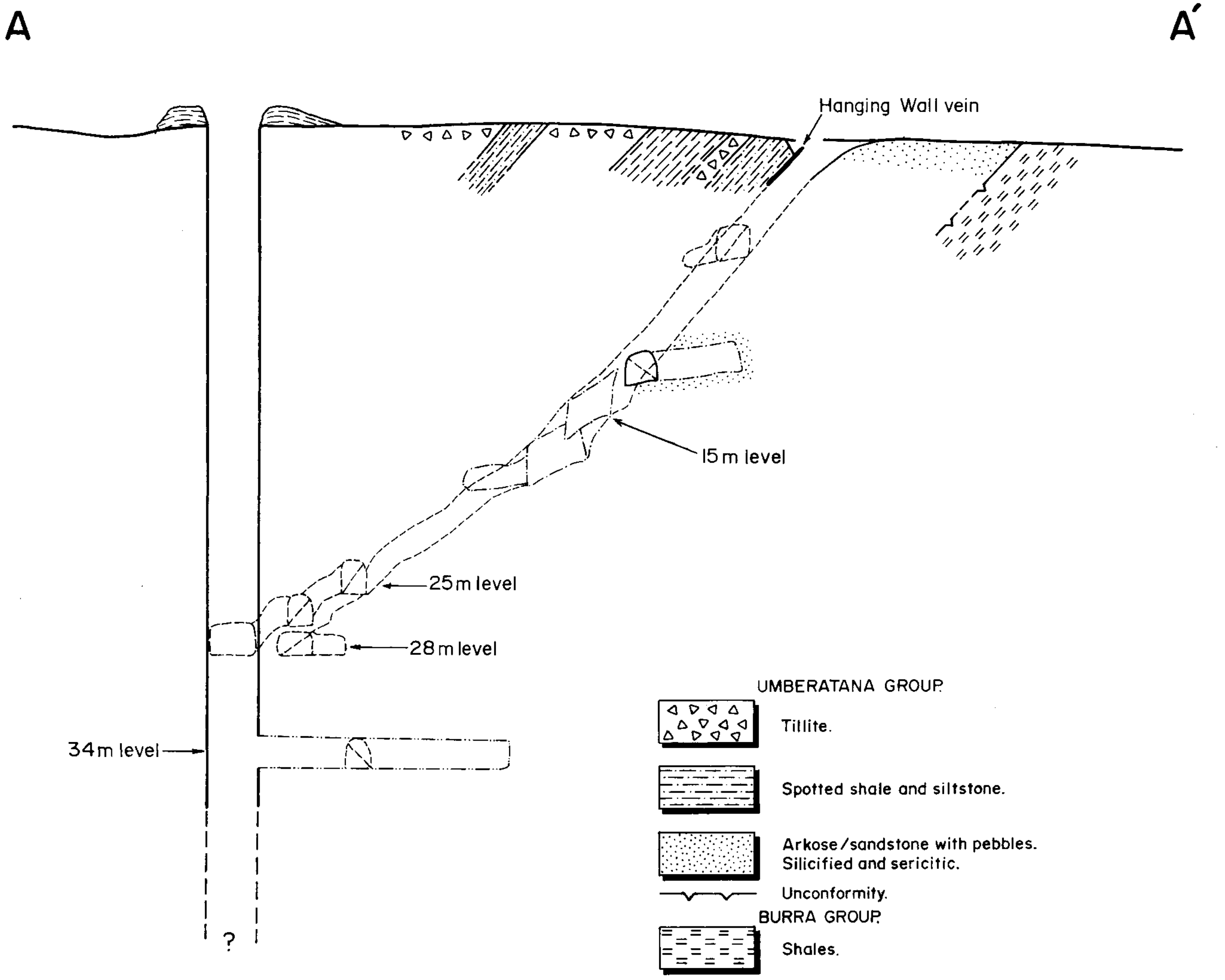


FIG.12

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN
NORTH MEDORA WORKINGS
GEOLOGY, SAMPLE LOCATIONS & ASSAY RESULTS

COMPILED	C.M. Horn	C.D.O.	DATE 8·10·87
DRAWN	J.W.	SCALE 1:250	
DATE		PLAN NUMBER	
CHECKED		87-197	

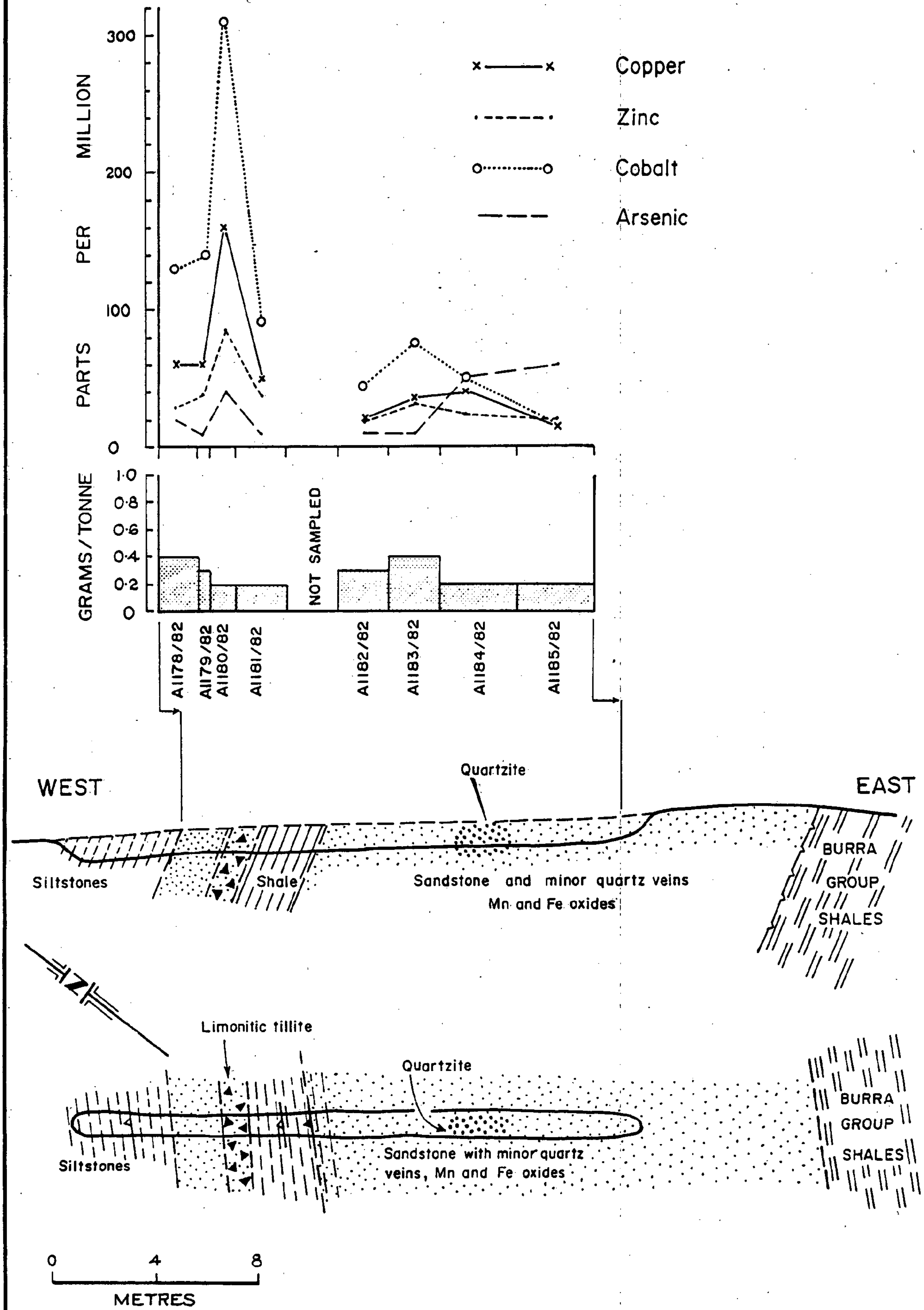


FIG. 13

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MOUNT GRAINGER GOLDFIELD
NORTH MEDORA AREA
TRENCH 1

COMPILED R. Horn	C.D.O. DATE 8·10·87
DRAWN J.W.	SCALE 1:200
DATE	PLAN NUMBER
CHECKED	S19209

3928

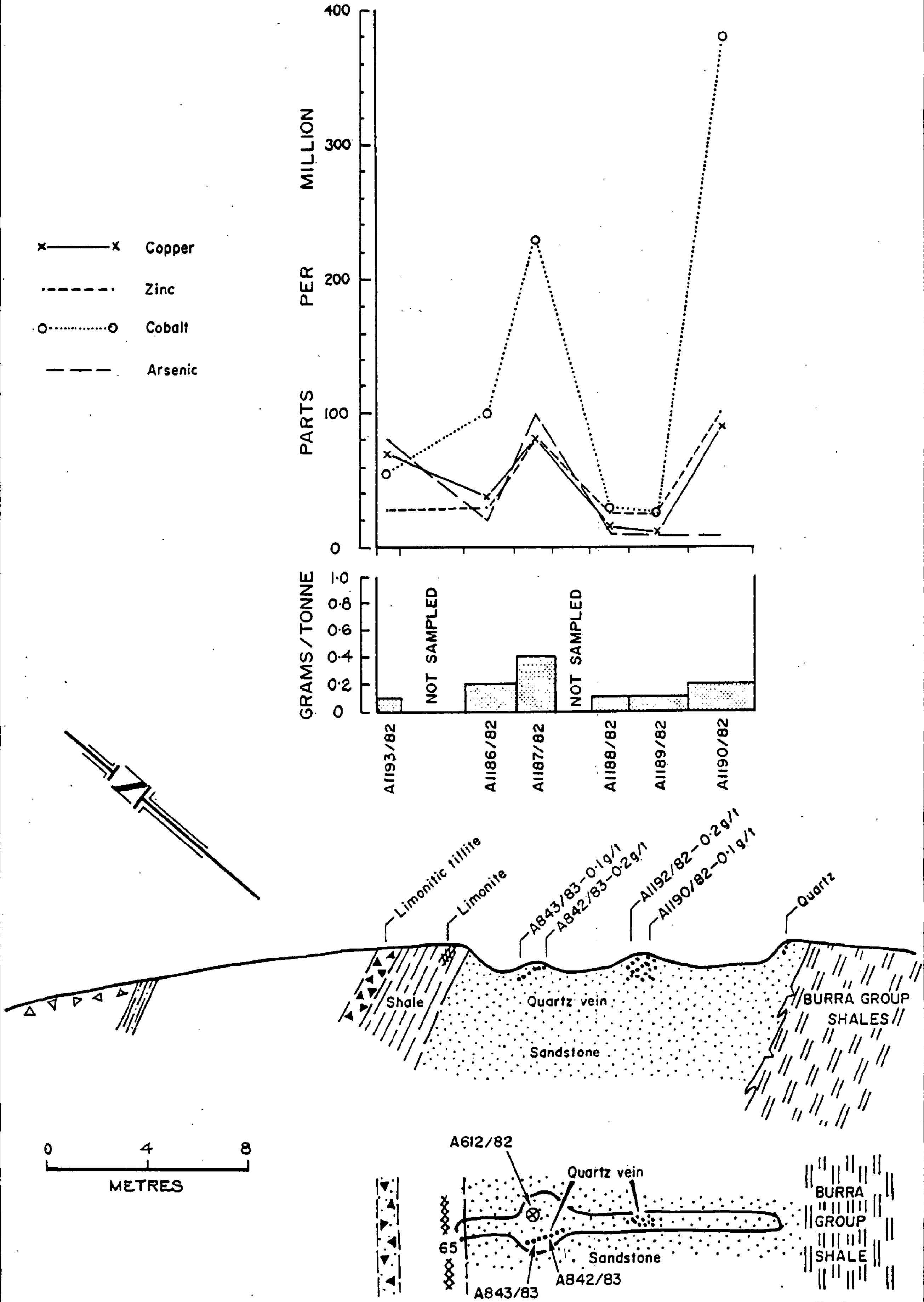


FIG. 14

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT GRAINGER GOLDFIELD
SHATTERED DREAM OPEN CUT
TRENCH NO. 2

COMPILED R. Horn	8 · 10 · 87 C D O DATE	
DRAWN J.W.	SCALE 1:200	
DATE	PLAN NUMBER	
CHECKED	S19210	

3928

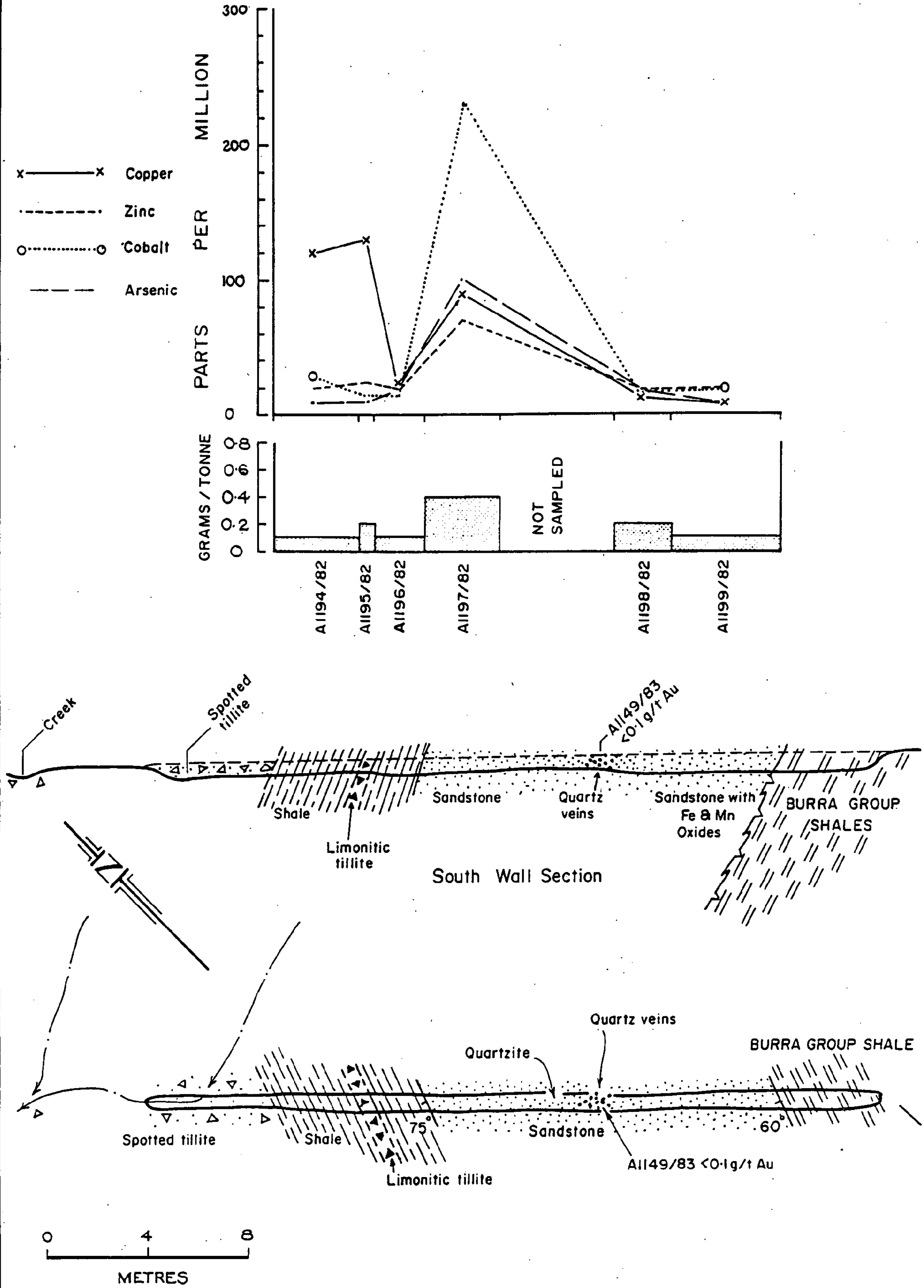


FIG. 15

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	C D O 8·10·87 DATE
MT GRAINGER GOLDFIELD NORTH MEDORA AREA TRENCH NO. 3	DRAWN J.W.	SCALE 1:200
	DATE	PLAN NUMBER
	CHECKED	S19211

3928

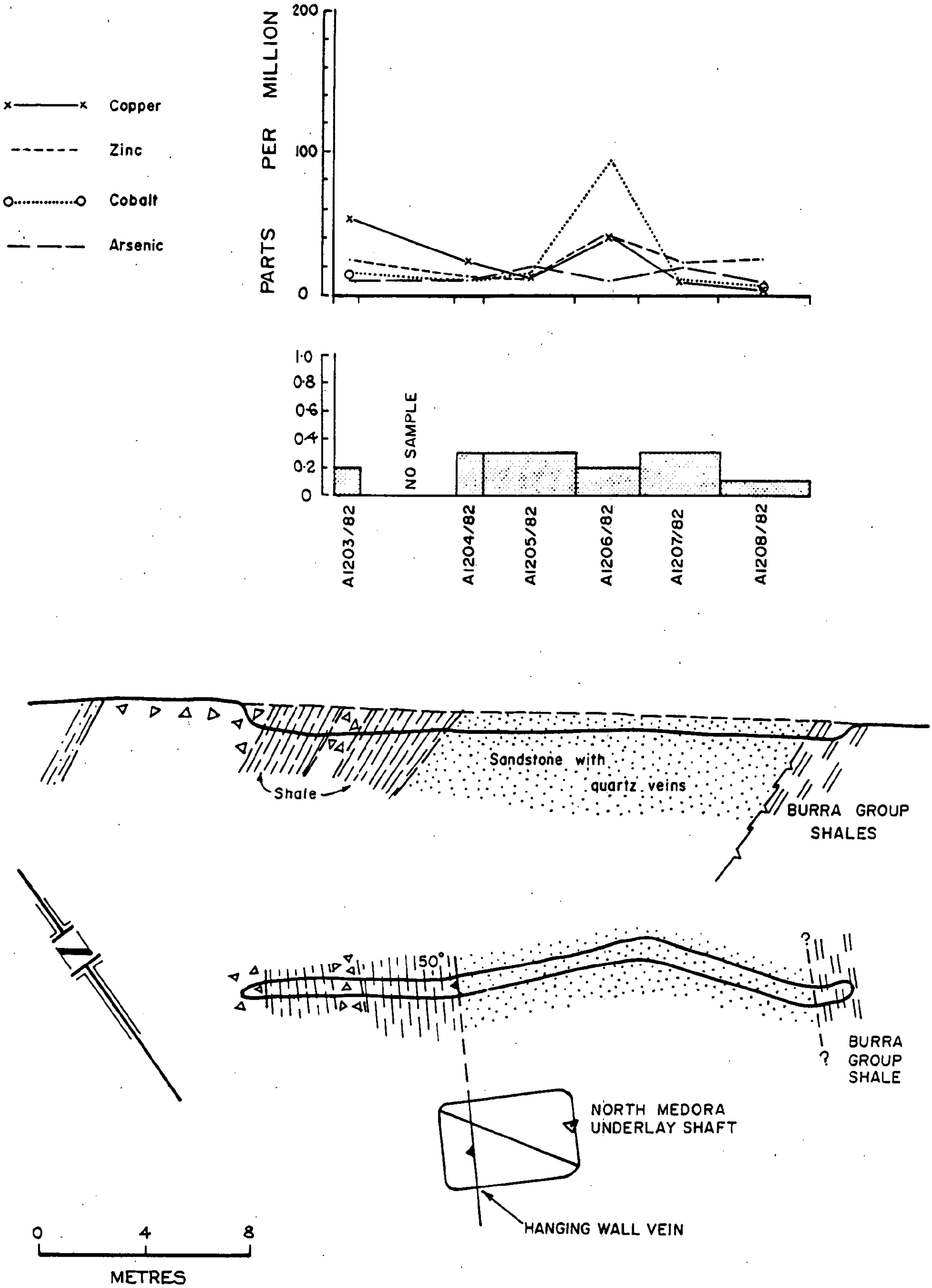


FIG.16

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT GRAINGER GOLDFIELD
NORTH MEDORA AREA
TRENCH NO. 4

COMPILED R.Horn	CDO 8·10·87 DATE
DRAWN J.W.	SCALE 1:200
DATE	PLAN NUMBER
CHECKED	S19212

3928

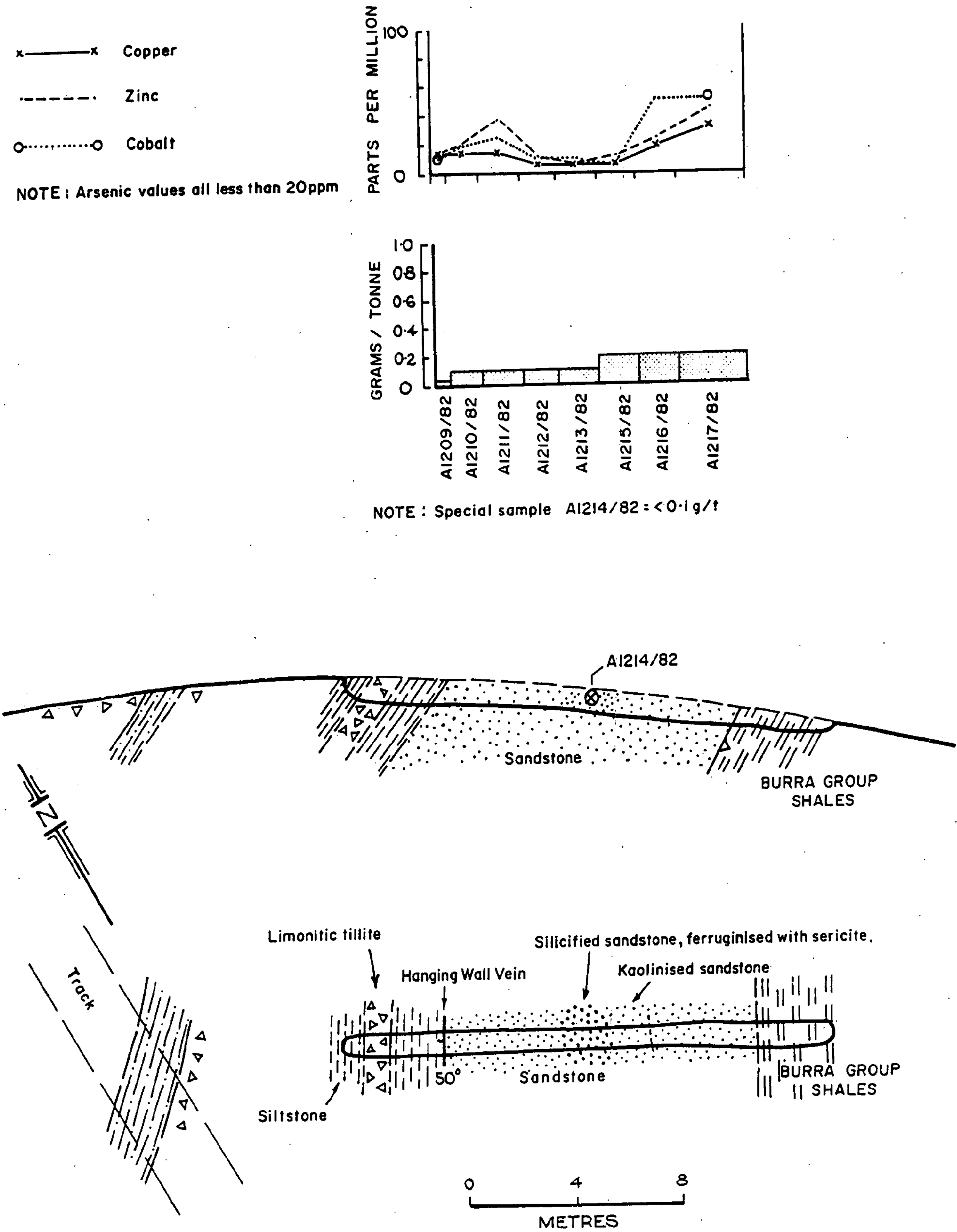


FIG.17

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	CDO	8·10·87 DATE
MT GRAINGER GOLDFIELD NORTH MEDORA AREA TRENCH NO. 5	DRAWN J.W.	SCALE 1:200	
	DATE	PLAN NUMBER	
	CHECKED	S19213	

3928

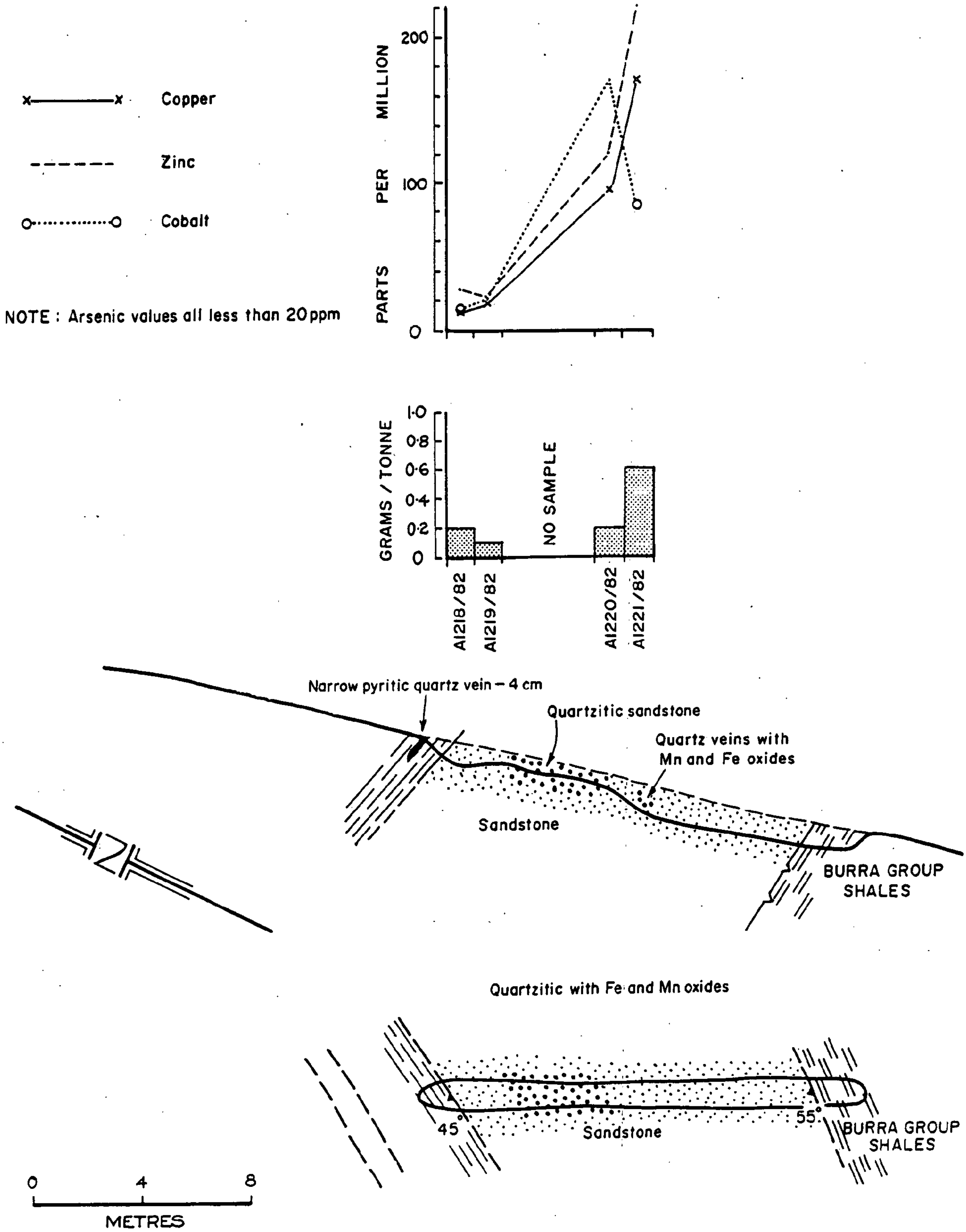


FIG. 18

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	CDO DATE 8·10·87
MT GRAINGER GOLDFIELD NORTH MEDORA AREA TRENCH NO. 6	DRAWN J.W.	SCALE 1:200
	DATE	PLAN NUMBER
	CHECKED	S19214

3920

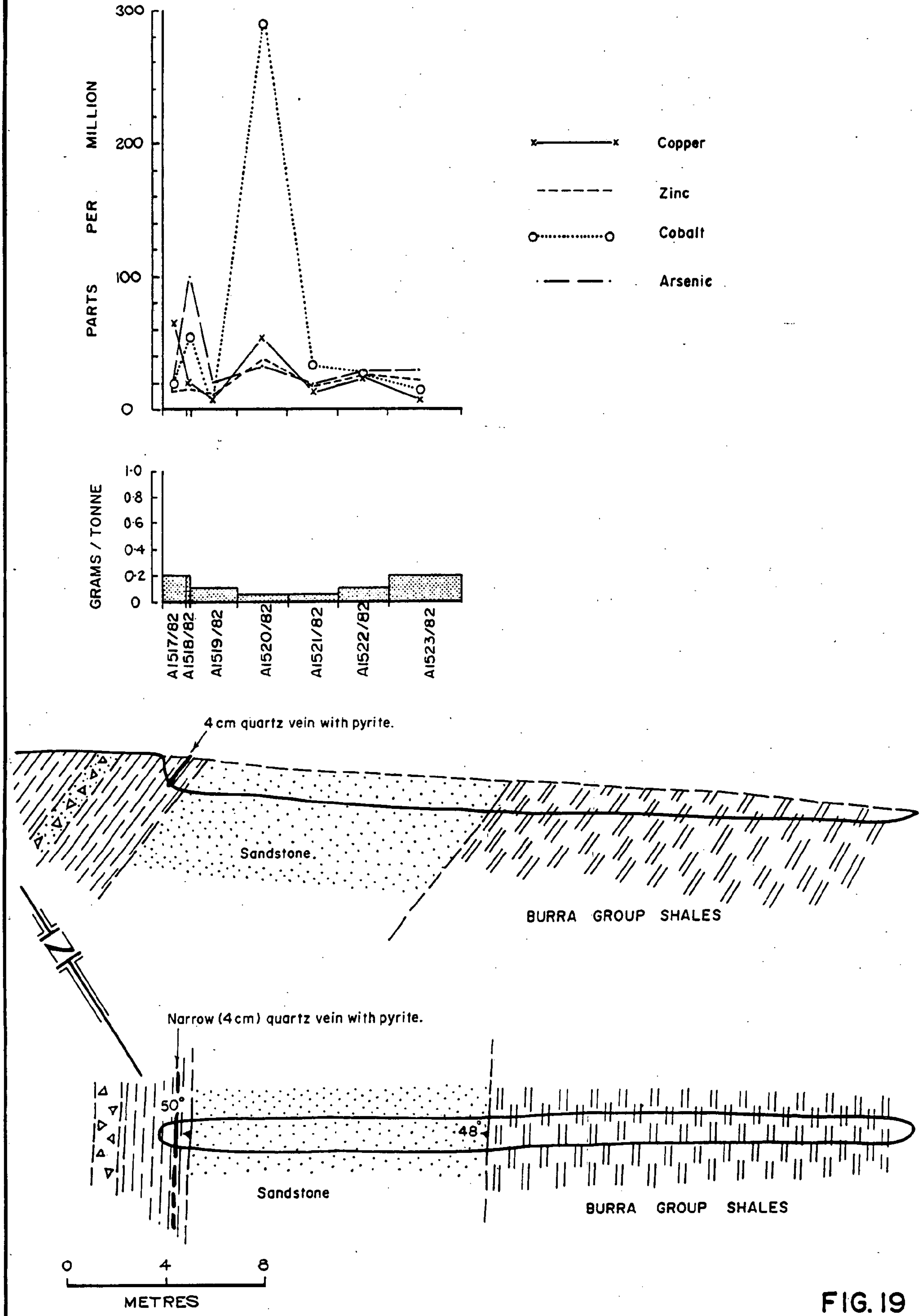


FIG. 19

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT GRAINGER GOLDFIELD
NORTH MEDORA AREA
TRENCH NO. 7

COMPILED R. Horn	CDO	DATE 8·10·87
DRAWN J.W.	SCALE 1:200	
DATE	PLAN NUMBER	
CHECKED	S19215	

3928

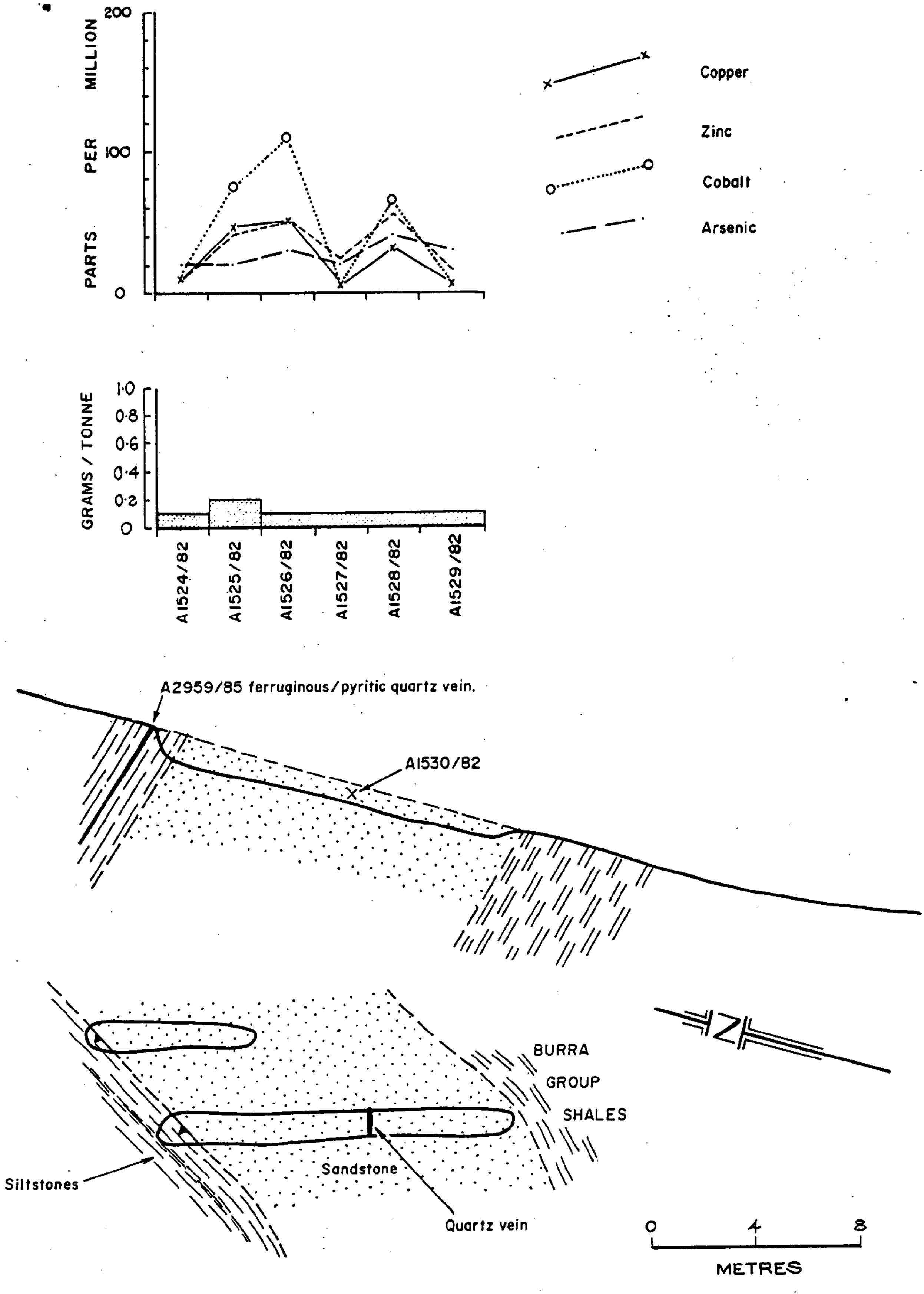


FIG. 20

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	CDO 8·10·87 DATE
MT GRAINGER GOLDFIELD NORTH MEDORA AREA TRENCH NO. 8	DRAWN J.W.	SCALE 1:200
	DATE	PLAN NUMBER
	CHECKED	S19216

3928

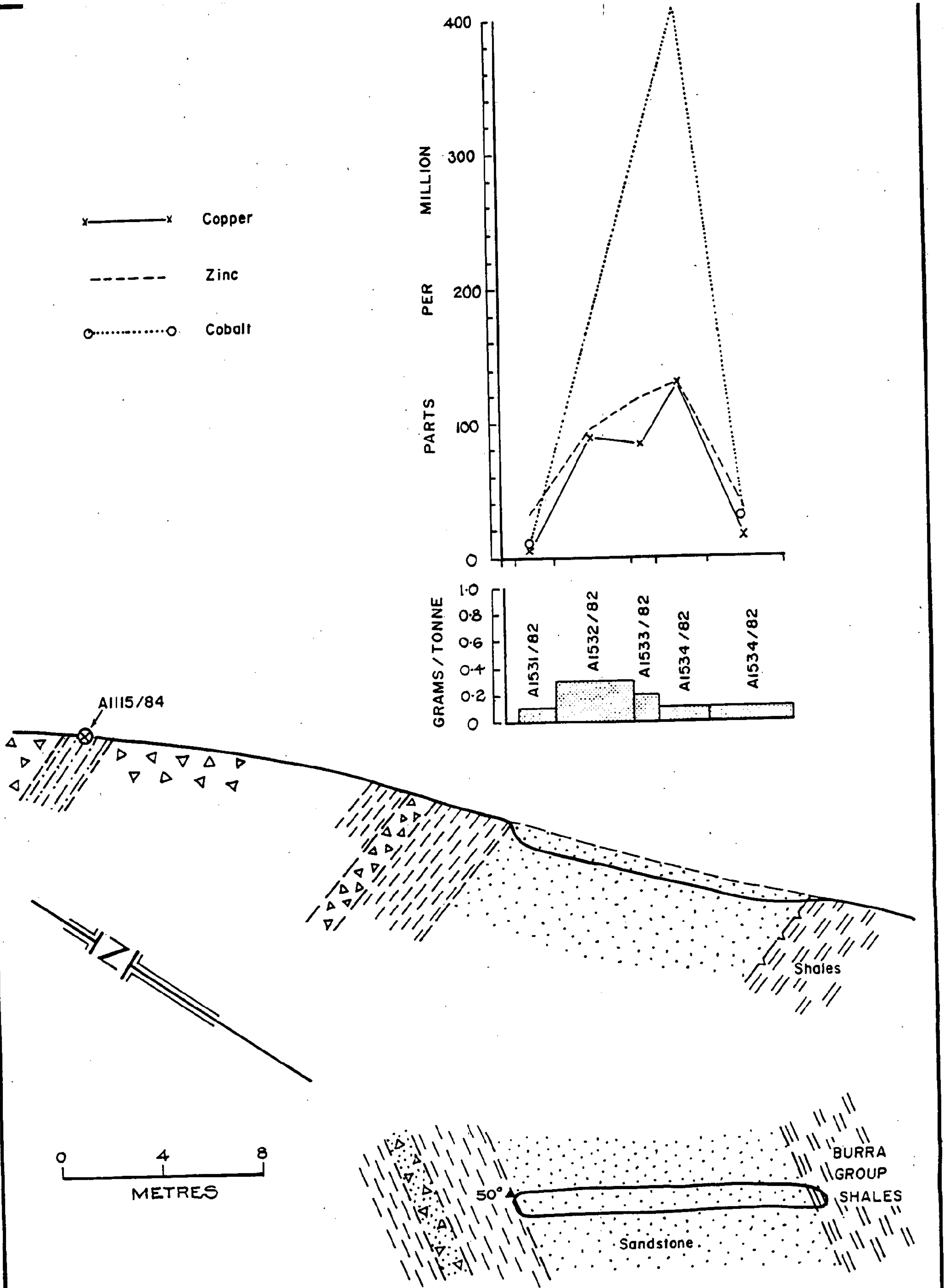


FIG. 21

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT GRAINGER GOLDFIELD
NORTH MEDORA AREA
TRENCH NO. 9

COMPILED R. Horn	C.D.O 8·10·87 DATE
DRAWN J.W	SCALE 1: 200
DATE	PLAN NUMBER
CHECKED	S19217

3928

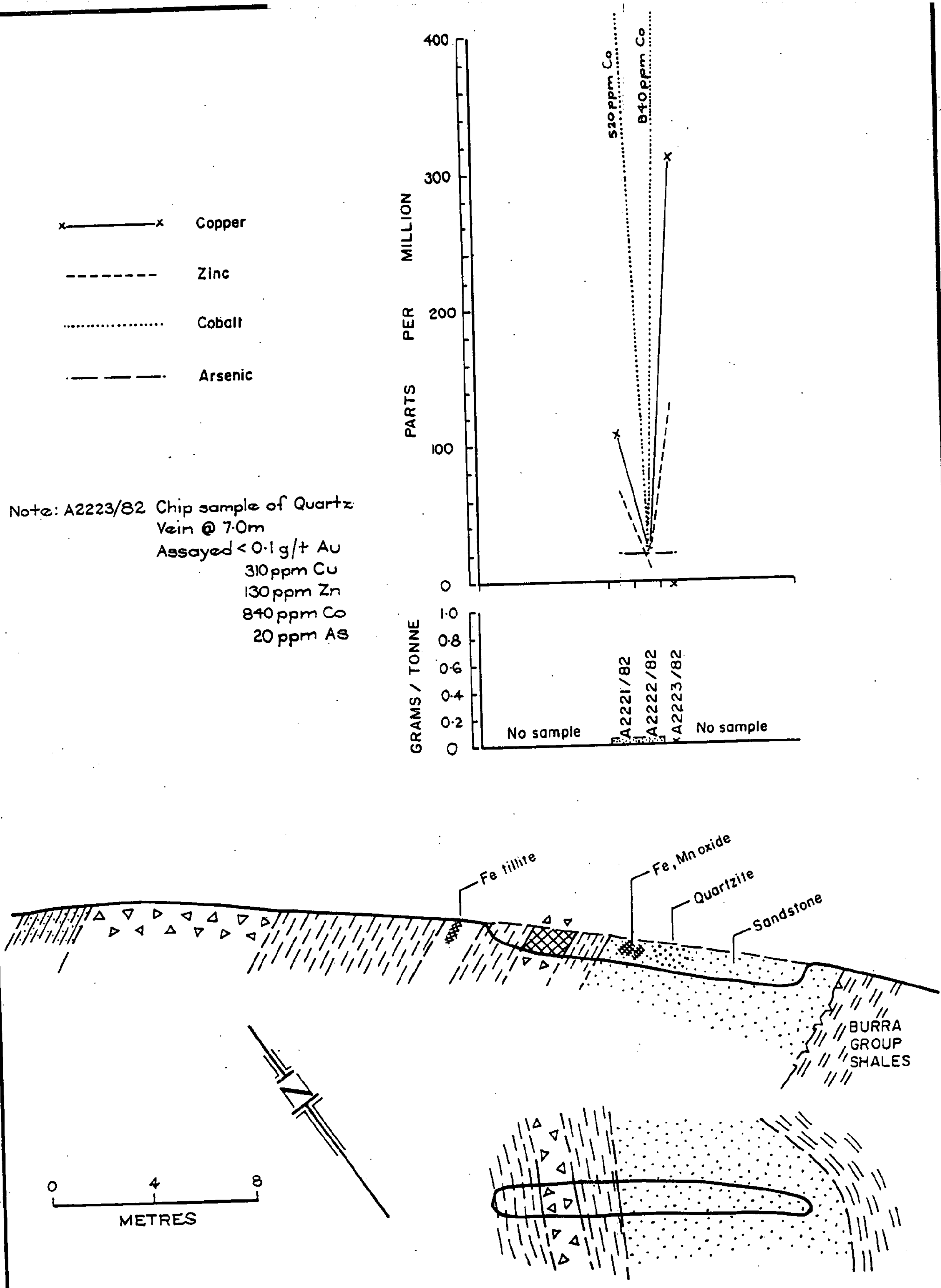


FIG. 22

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT GRAINGER GOLDFIELD
SOUTH MEDORA AREA
TRENCH NO. 11

COMPILED R. Horn	C D O 8·10·87 DATE
DRAWN J.W	SCALE 1:200
DATE	PLAN NUMBER
CHECKED	S19218

3928

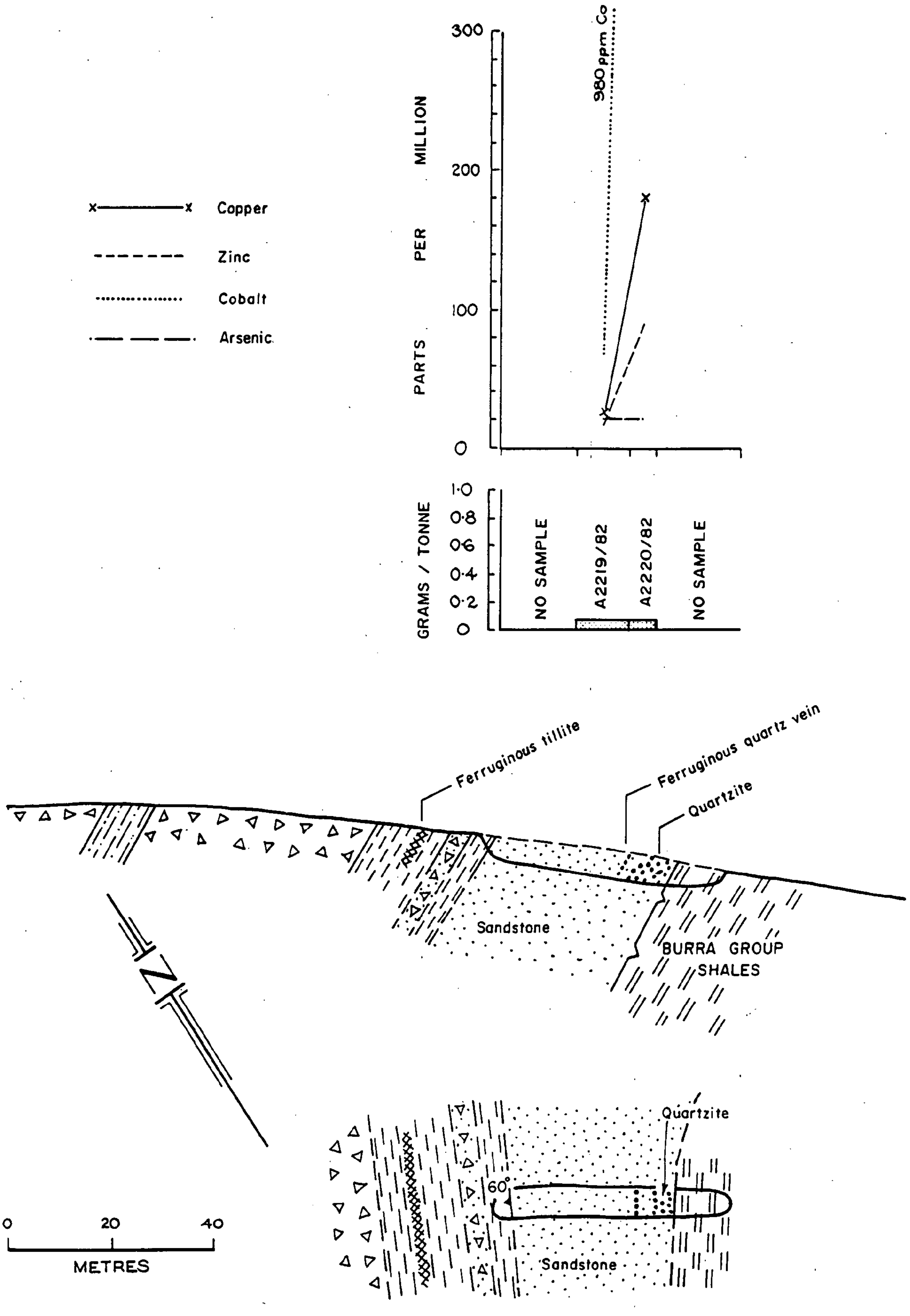
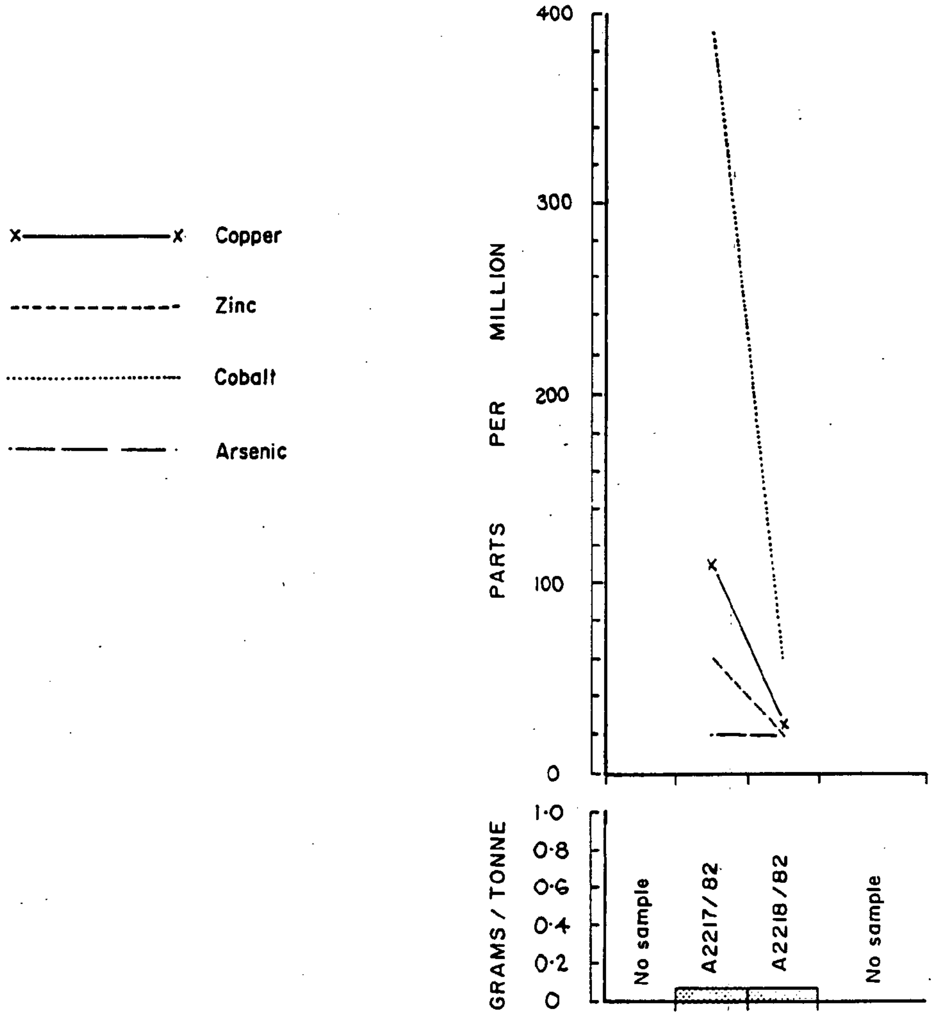


FIG. 23

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	CDO	8·10·87 DATE
MT. GRAINGER GOLDFIELD SOUTH MEDORA AREA TRENCH NO. 12	DRAWN J.W.	SCALE 1:200	
	DATE	PLAN NUMBER	
	CHECKED	S19219	

3928



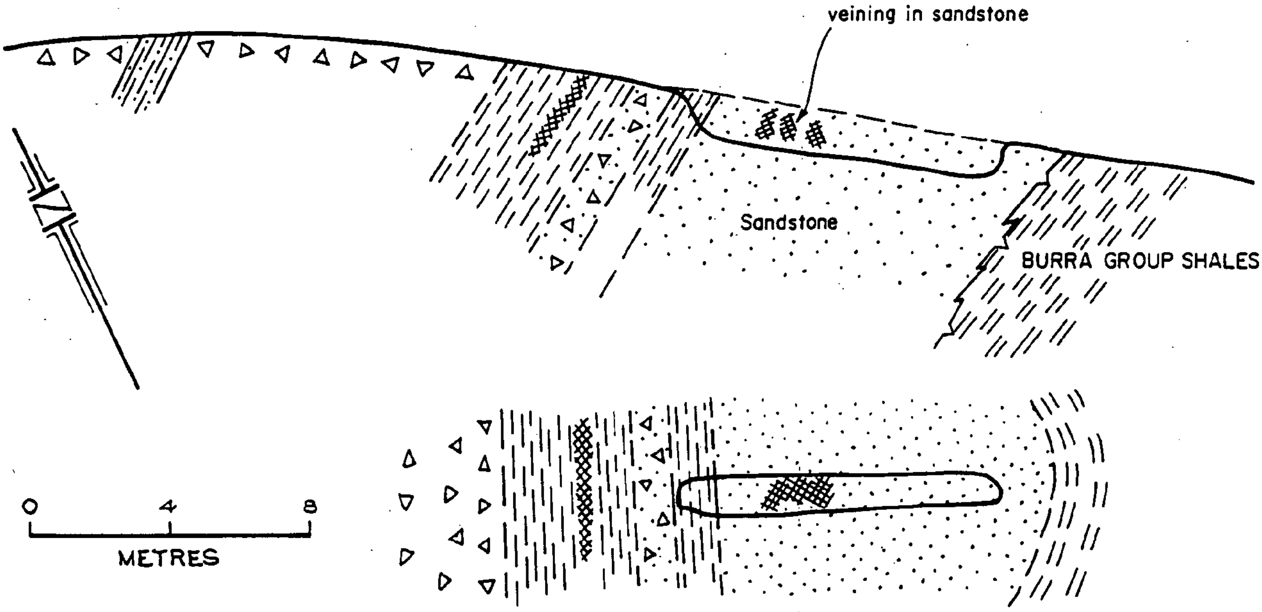


FIG. 24

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT. GRAINGER GOLDFIELD
SOUTH MEDORA AREA
TRENCH NO. 13

COMPILED R. Horn	C D O 8·10·82 DATE
DRAWN J.W.	SCALE 1 : 200
DATE	PLAN NUMBER
CHECKED	S19220

3928

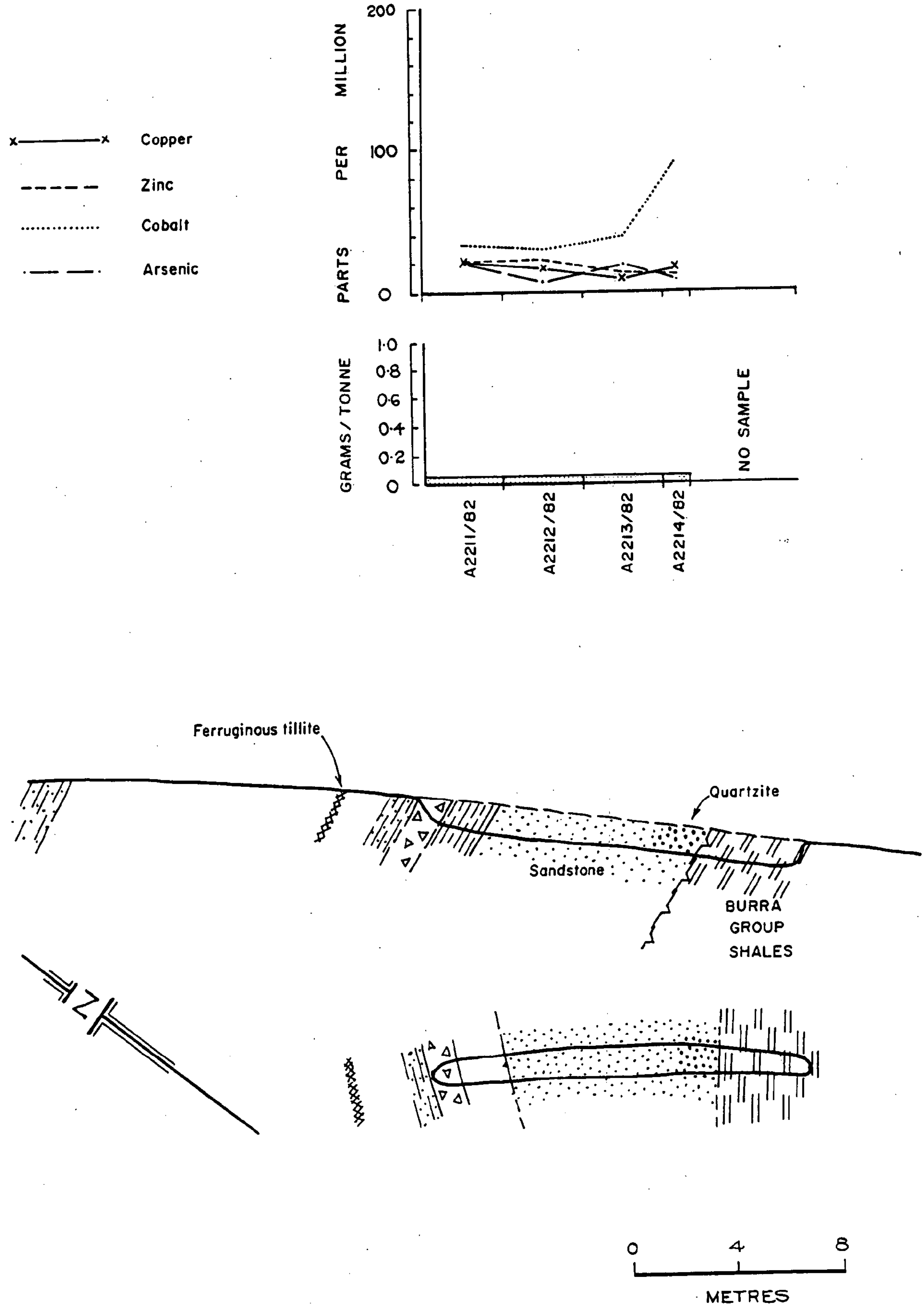


FIG. 25

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	CDO 8·10·87 DATE
MT. GRAINGER GOLDFIELD SOUTH MEDORA AREA TRENCH NO. 14	DRAWN J.W.	SCALE 1:200
	DATE	PLAN NUMBER
	CHECKED	S19221

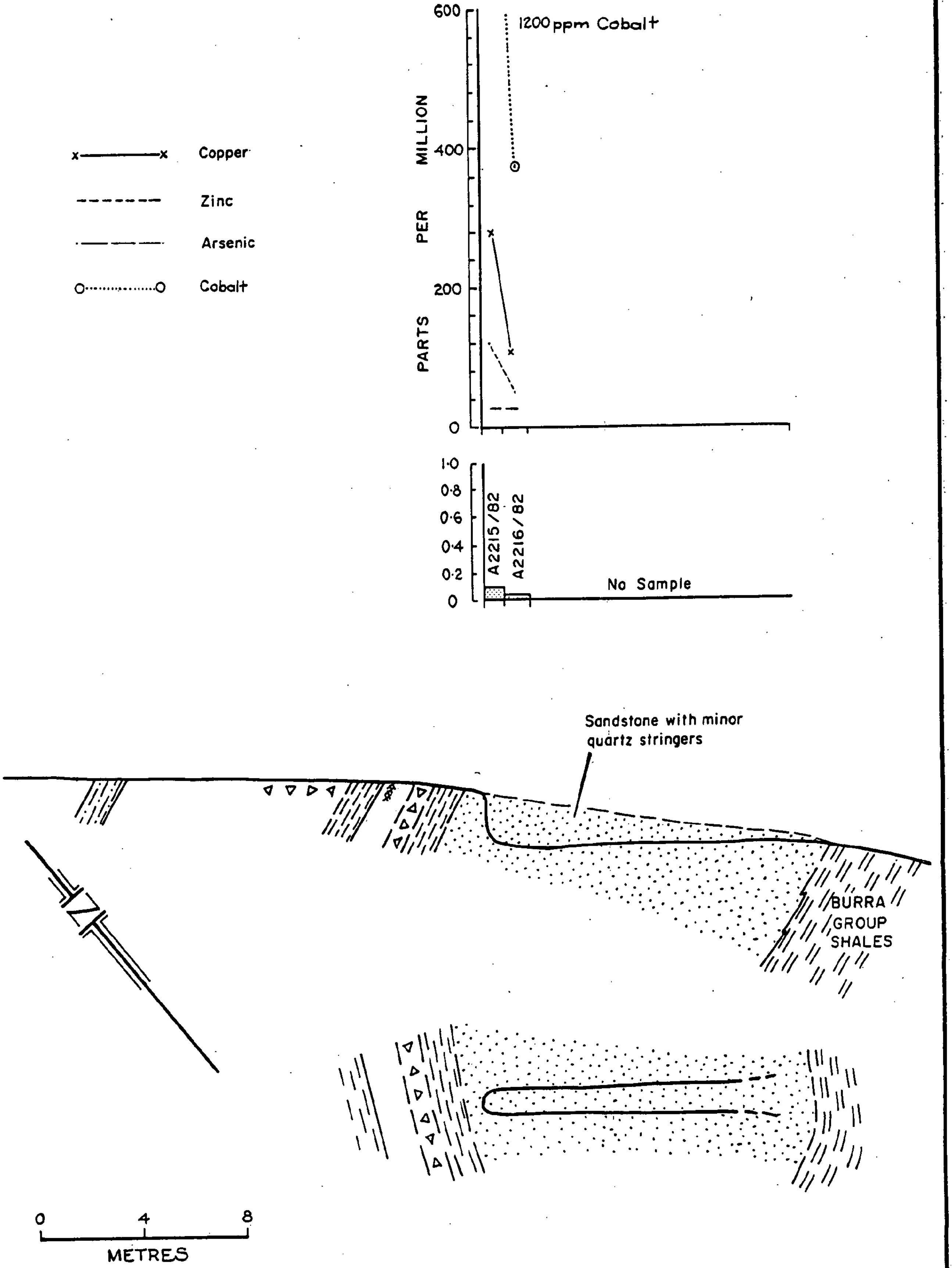


FIG. 26

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT. GRAINGER GOLDFIELD
SOUTH MEDORA AREA
TRENCH NO. 15

COMPILED R. Horn	CDO	DATE 8·10·87
DRAWN J.W.	SCALE 1:200	
DATE	PLAN NUMBER	
CHECKED	S19222	

3928

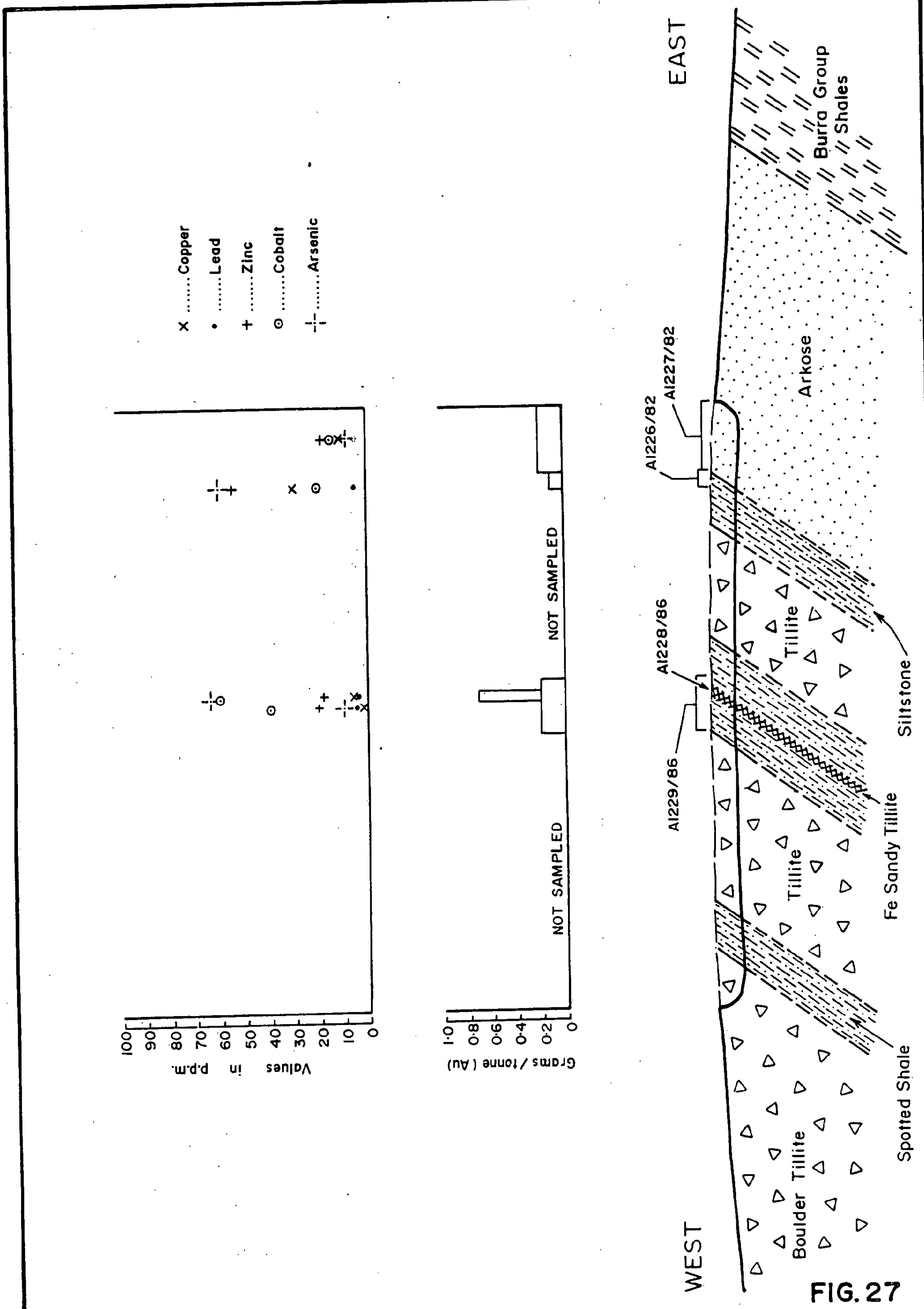


FIG. 27

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN
HEATHER BELL AREA - TRENCH NO. 16

COMPILED C.M.Horn	CDO 8·10·87 DATE
DRAWN J.W.	SCALE 1:200
DATE	PLAN NUMBER
CHECKED	S19223

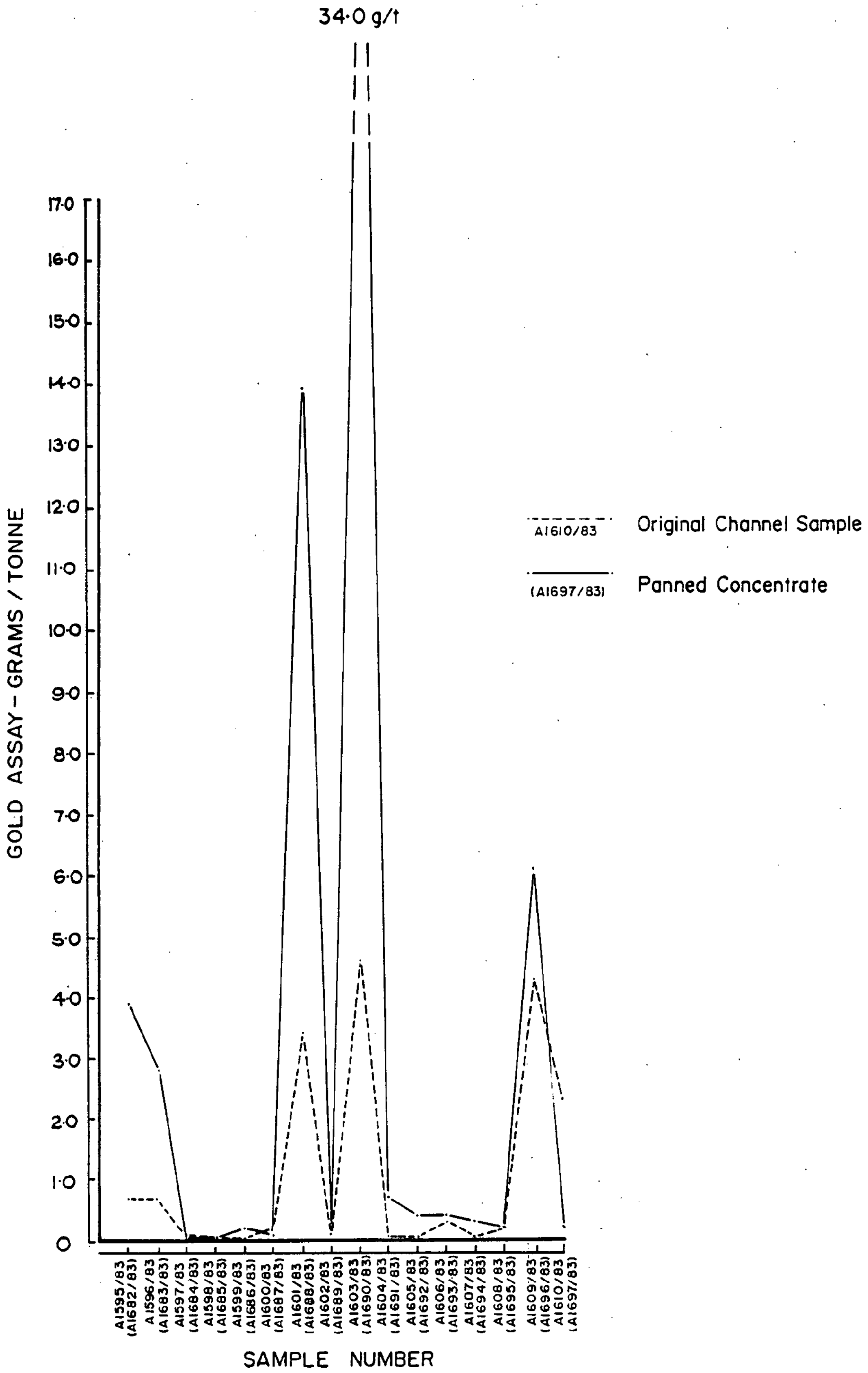


FIG. 28

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	CDO [signature] DATE 8·10·87
MOUNT GRAINGER GOLDMINE SEC. 180 AND 183 - HD COGLIN GRAPH OF AU VALUES FOR PANNED CONCENTRATE VERSUS ORIGINAL CHANNEL SAMPLES	DRAWN J.W.	SCALE
	DATE	PLAN NUMBER
	CHECKED	S19234

3928

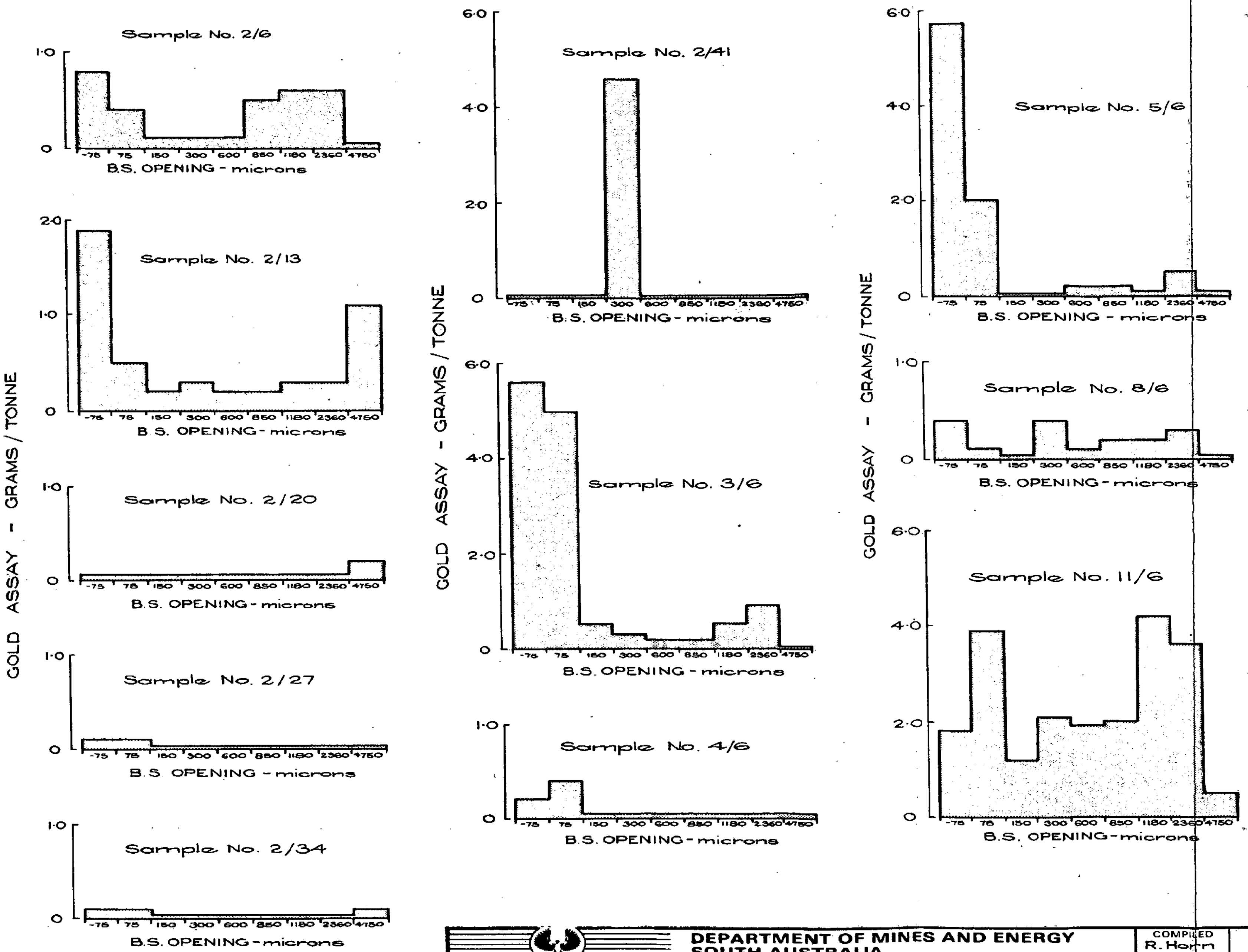


FIG. 29

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT GRAINGER GOLDMINE SECS. 180 & 183, HD. COGLIN GOLD GRAIN SIZE ANALYSIS

COMPILED R. Horn	C.D.O.	DATE 8.9.87
DRAWN J.W.	SCALE	
DATE	PLAN NUMBER	
CHECKED	87-199	

3928

SAMPLES

A1558/66 – A1574/66 .... Fairburn & Nixon (1966).
A2800/65 – A2806/65 .... Fairburn & Nixon (1966).
A5919 – A5924.............. Amax Australia Ltd. (P. Bull 1983).
MGS 1 (A2224/82) – MGS 3 (A2226/82)........... SADME (Horn 1982).
MGU 12 (A1253/82) – MGU 13 (A1254/82).......... SADME (Horn 1982).
A617/82.......................... SADME (Morris 1982).
MGU 14 (A6/84) – MGU 26 (A18/84)........... SADME (Horn 1984).

RS 66 = Rock Sample – Petrographic.
A10/84 = Sample for geochemical analysis.

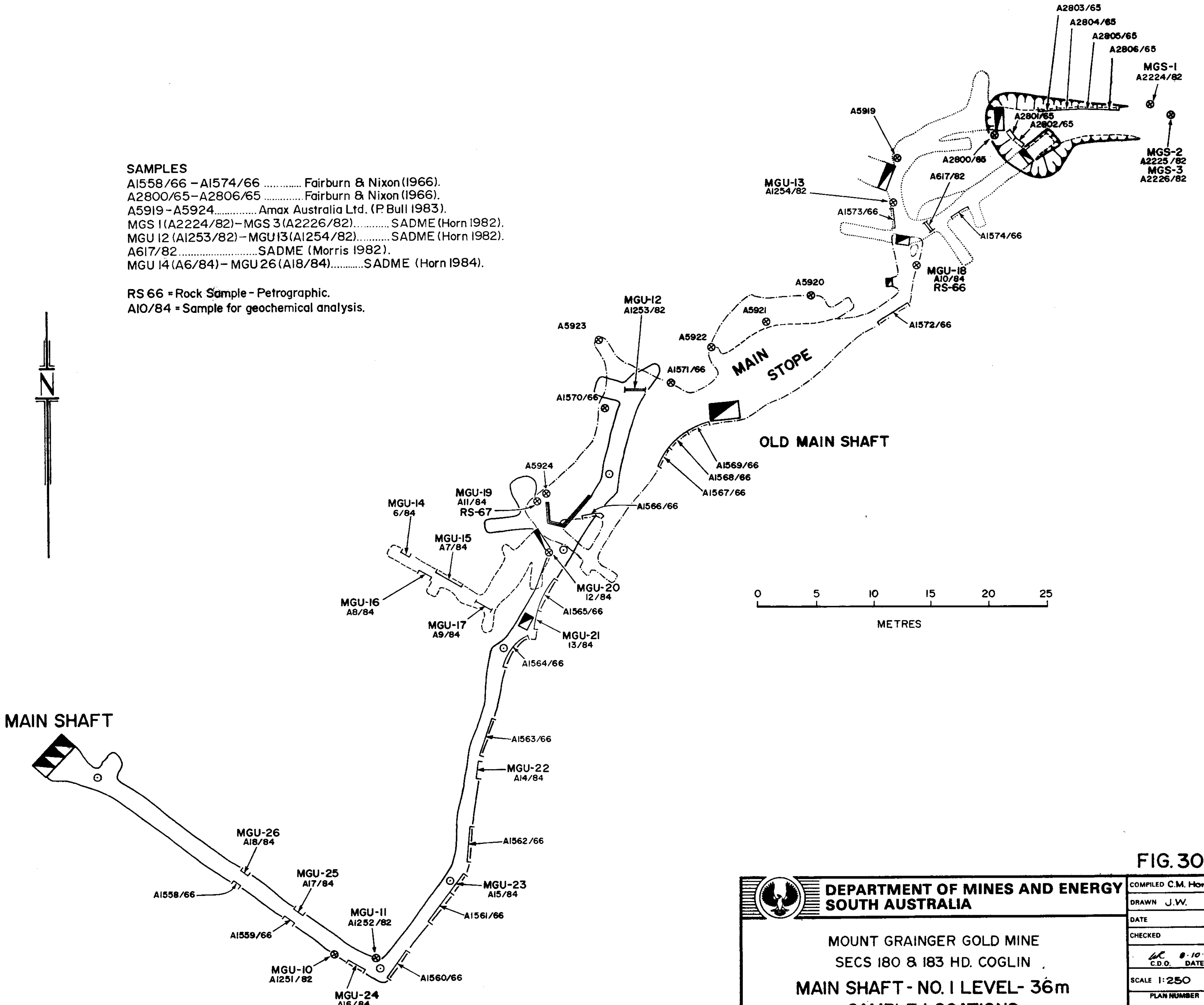


FIG. 30

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN

MAIN SHAFT - NO. 1 LEVEL - 36m SAMPLE LOCATIONS

COMPILED	C.M. Horn
DRAWN	J.W.
DATE	
CHECKED	
C.D.O.	DATE 8·10·87
SCALE	1:250
PLAN NUMBER	87-200

3928

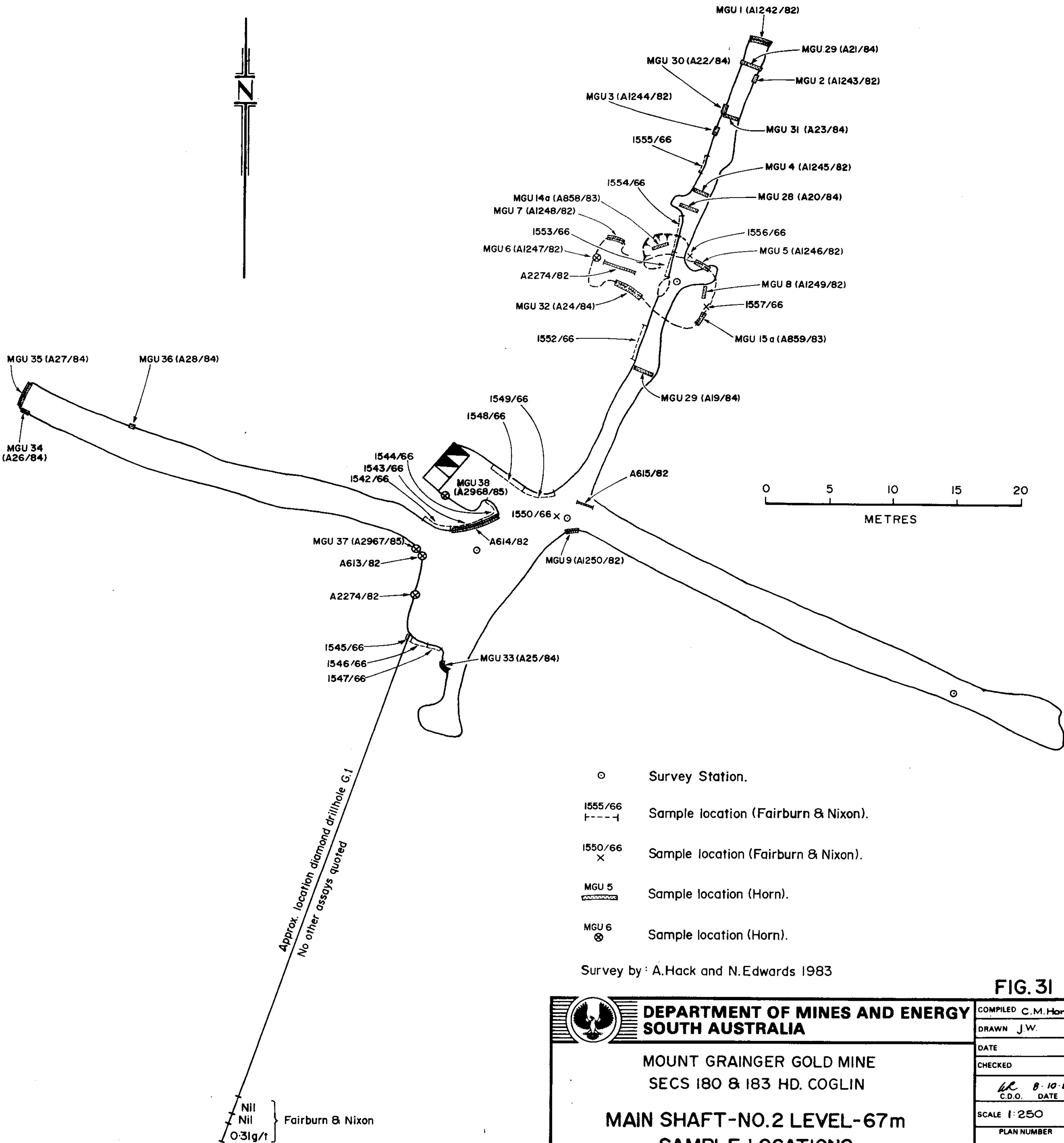


FIG. 31

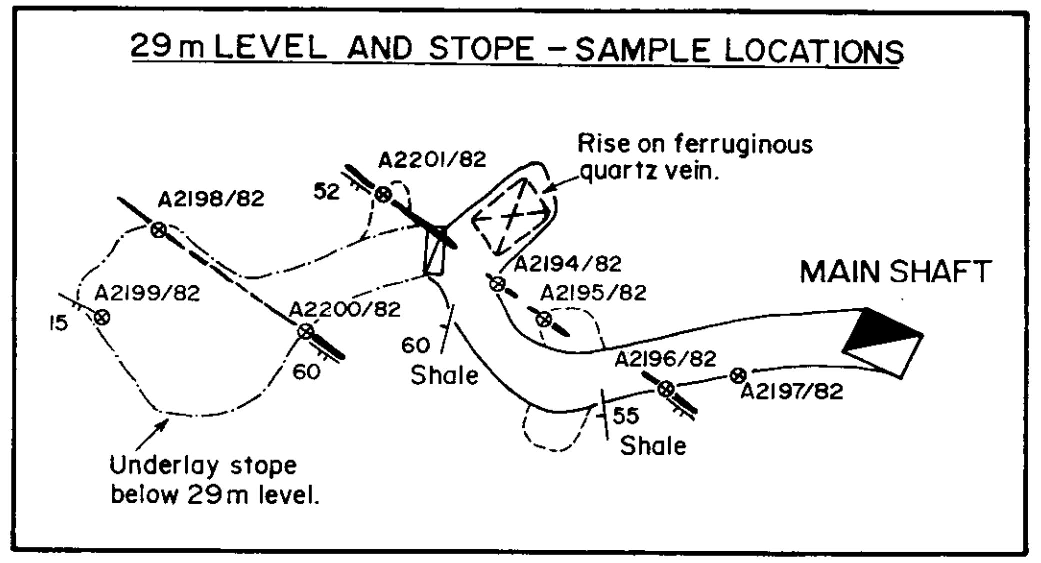
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN

MAIN SHAFT-NO.2 LEVEL-67m SAMPLE LOCATIONS

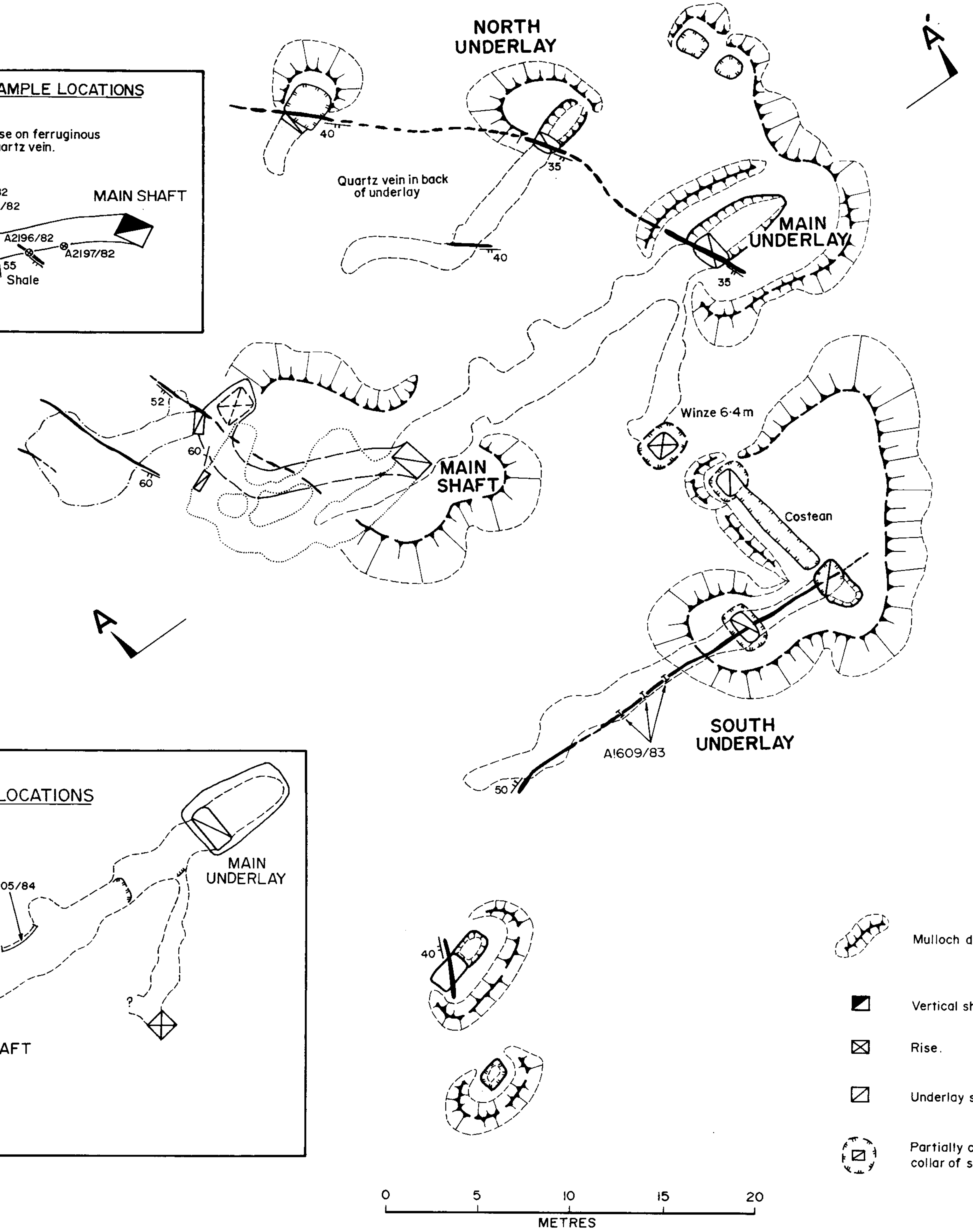
COMPILED	C.M. Horn
DRAWN	J.W.
DATE	
CHECKED	
C.D.O.	8·10·87 (DATE)
SCALE	1:250
PLAN NUMBER	87-201

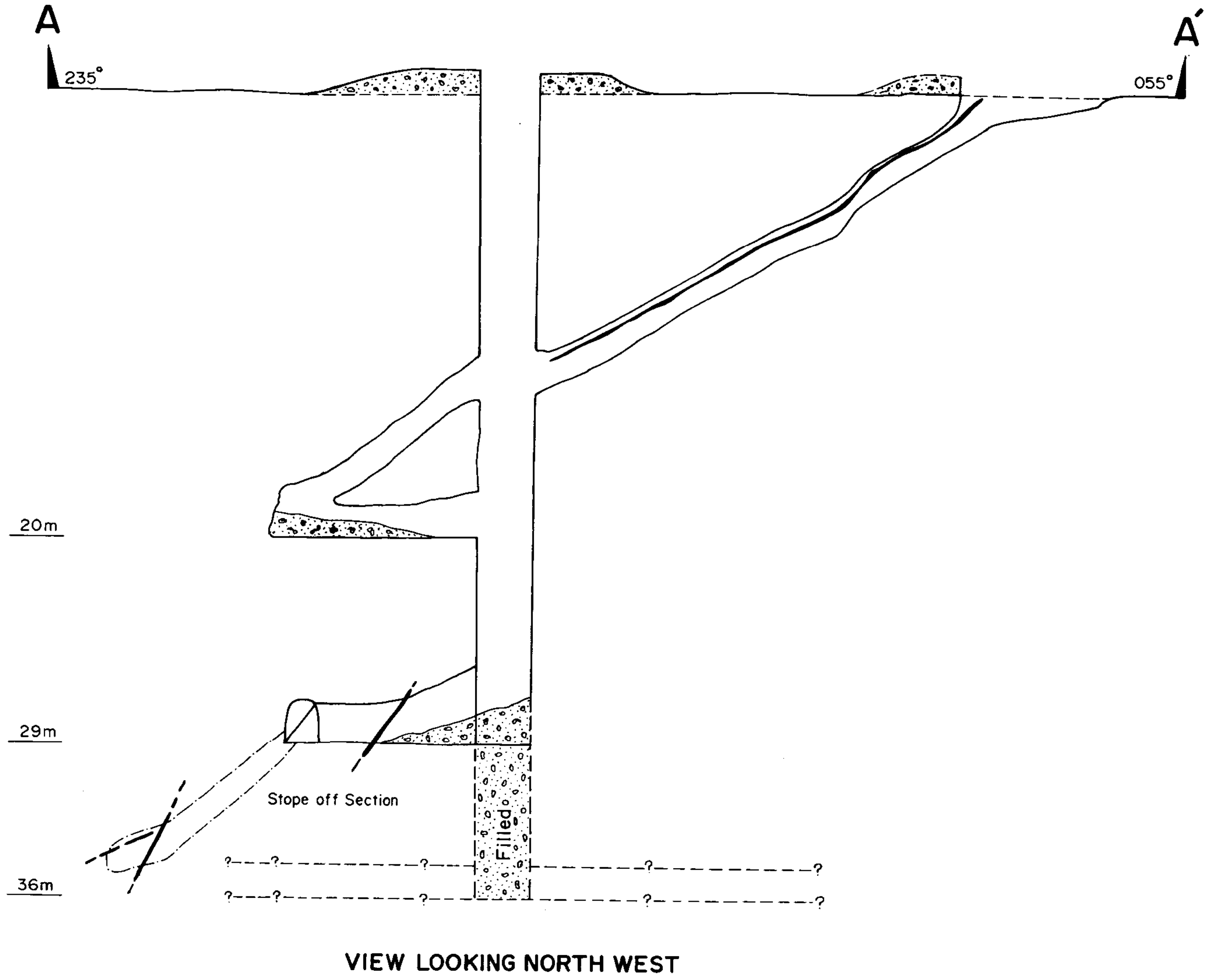
3928

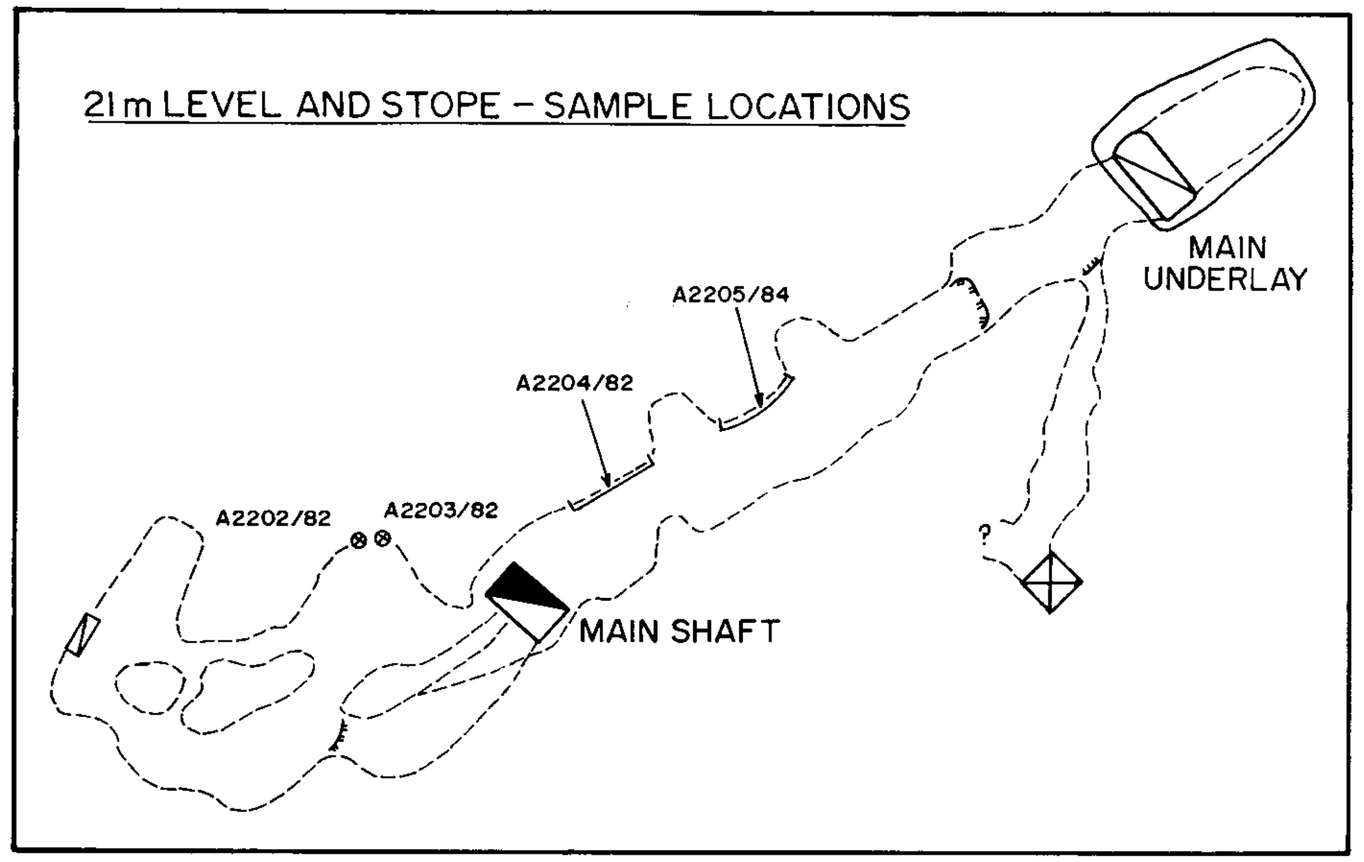


AMDEL REPORT AC 2315/83

SAMPLE NO	Au g/t	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ag ppm	As ppm
A2194/82	1·0	8	15	190	290	1	180
A2195/82	3·9	8	5	120	520	<1	190
A2196/82	0·2	20	5	170	95	<1	60
A2197/82	4·0	8	20	65	230	<1	30
A2198/82	0·8	4	10	14	20	<1	20
A2199/82	0·2	20	5	38	50	<1	40
A2200/82	1·4	10	10	70	360	<1	80
A2201/82	30·0	6	10	110	960	2	200
A2202/82	0·1	18	10	34	30	<1	20
A2203/82	0·2	70	5	46	55	<1	30
A2204/82	0·2	8	5	60	130	<1	70
A2205/82	<0·1	20	10	26	30	<1	20







Mulloch dump.

Vertical shaft.

Rise.

Underlay shaft.

Partially collapsed around collar of shaft.

55 Strike and dip of bedding.

60 Strike and dip of quartz vein

Quartz vein.

A2197/82 Sample location with number.

NOTE: All workings are within thinly laminated shales and calcareous siltstones of Burra Group (Saddleworth Formation)

FIG. 32

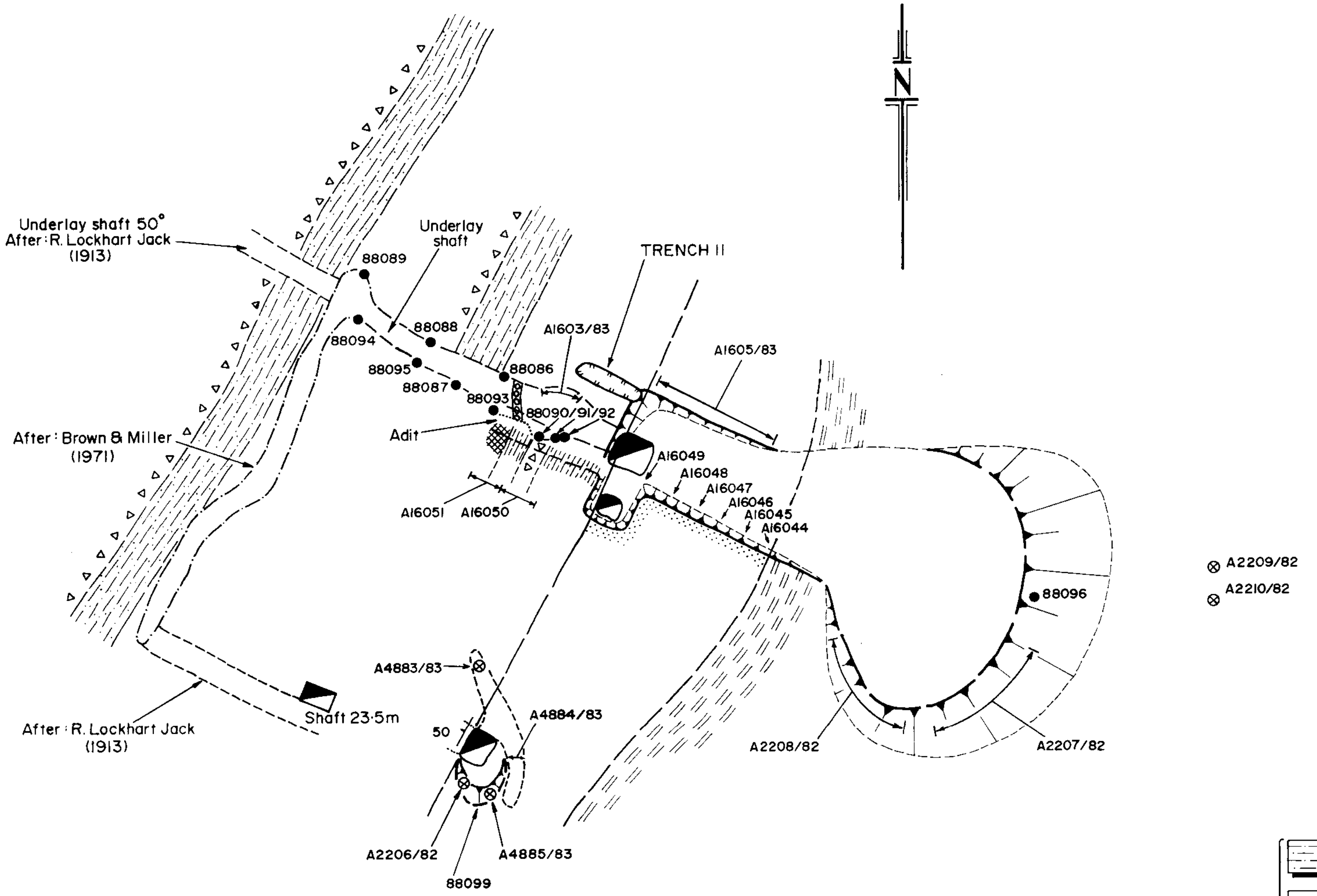
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

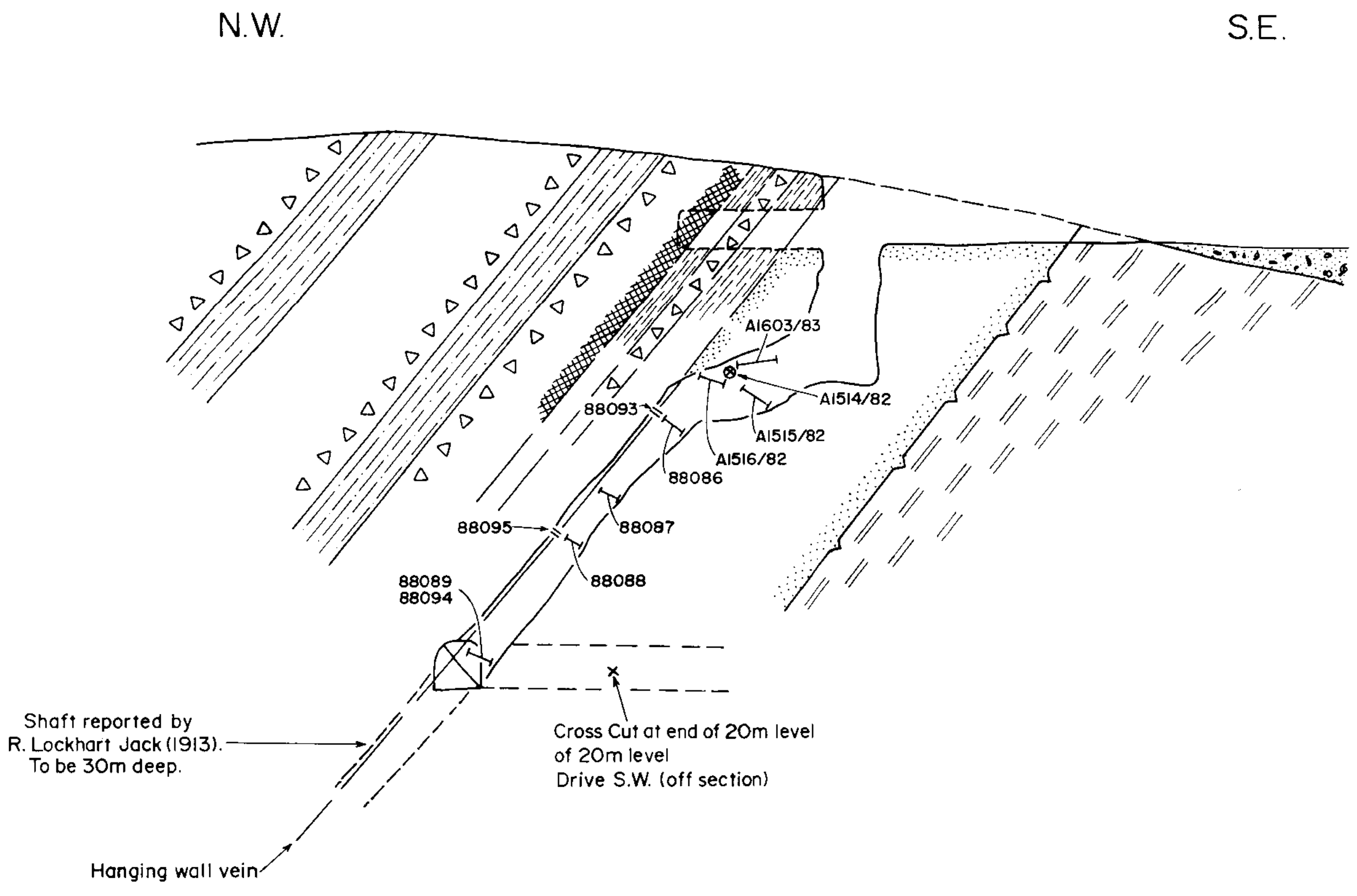
MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN

JONES SHAFT WORKINGS
GEOLOGY AND SAMPLE LOCATIONS

COMPILED C.M.H
DRAWN J.W
DATE
CHECKED
C.D.O. DATE 8·10·87
SCALE 1:200
PLAN NUMBER 87-202

3928





UMBERATANA GROUP
- Spotted shale/siltstone.
- Ferruginous grit/tillite.
- Tillite.
- Shale.
- Arkose/sandstone.

Unconformity

BURRA GROUP
- Calcareous shales.

FIG. 33

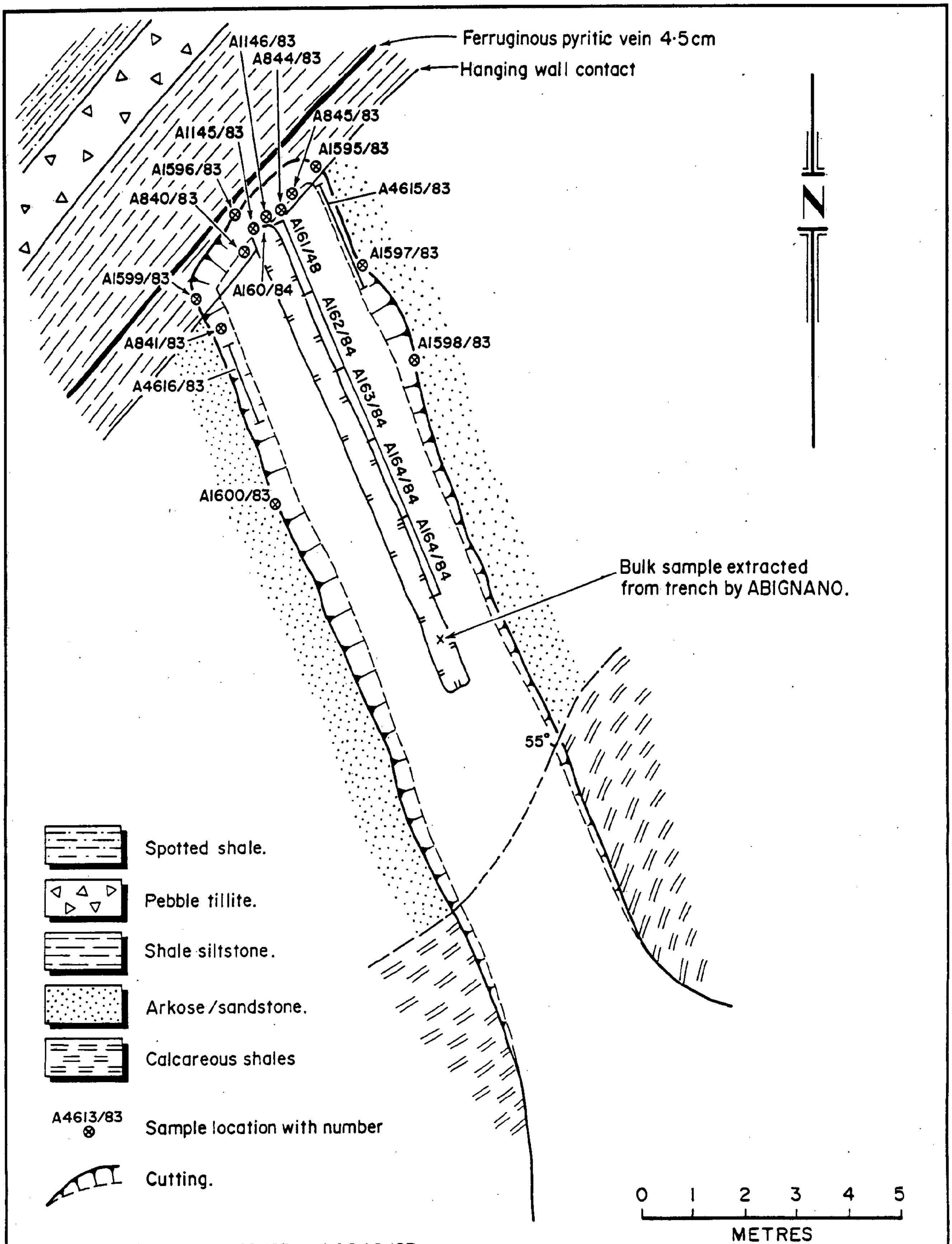
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN

NORTH MEDORA MINE WORKINGS
SAMPLE LOCATIONS

COMPILED	C.M.H
DRAWN	J.W
DATE	
CHECKED	
C.D.O.	9·10·87 DATE
SCALE	1:250
PLAN NUMBER	87-203

3928



NOTE: Samples A848/83 and A849/83
– Grabs of stockpiled ore treated as
parcel 1546.

FIG. 34

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	C.D.O. 8-10-87 DATE
MOUNT GRAINGER GOLD MINE SECS. 180 & 183 HD. COGLIN NO. 2 OPEN CUT SAMPLE LOCATIONS	DRAWN J.W.	SCALE 1:100
	DATE	PLAN NUMBER
	CHECKED	S19224

3928

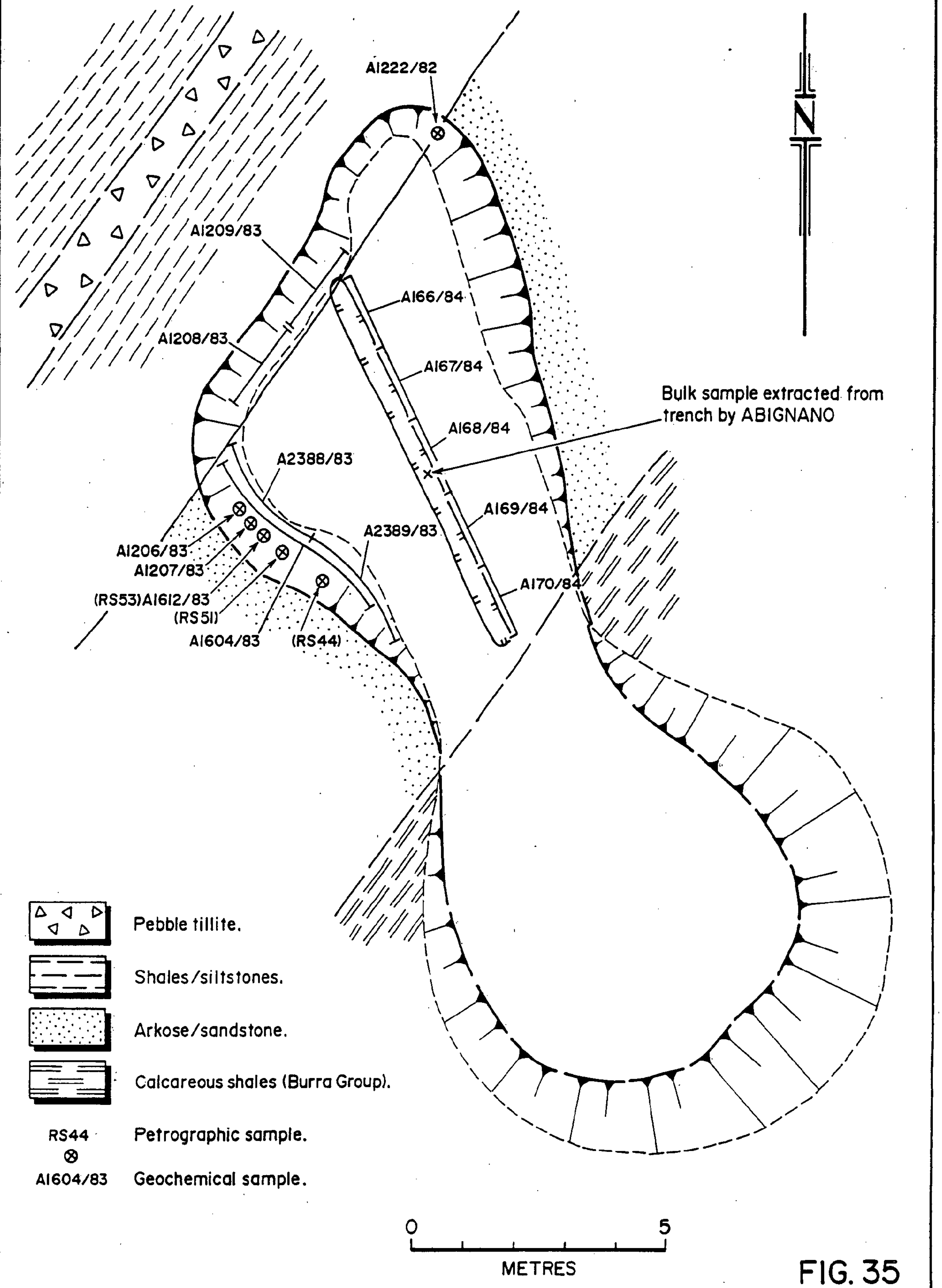
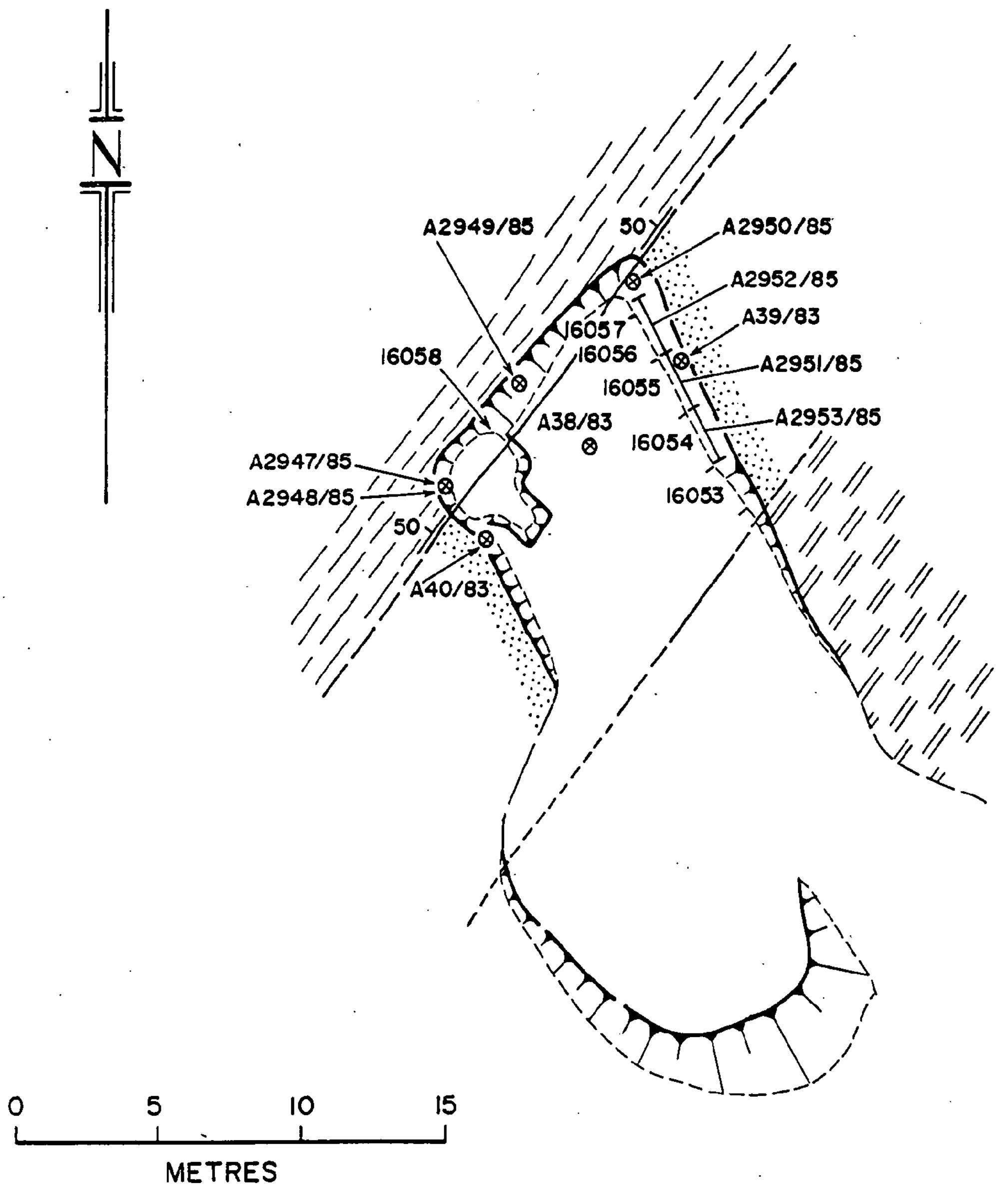


FIG. 35

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED C.M.Horn	C.D.O. 8·10·87 DATE
MOUNT GRAINGER GOLD MINE SECS 180 & 183 HD. COGLIN **NO. 3 OPEN CUT** **SAMPLE LOCATIONS**	DRAWN J.W.	SCALE 1:100
	DATE	PLAN NUMBER
	CHECKED	S19225

3928



Shales and siltstones.

Arkose/sandstone with quartz veins.

Calcareous shales.

A2948/85 SADME samples 1985.

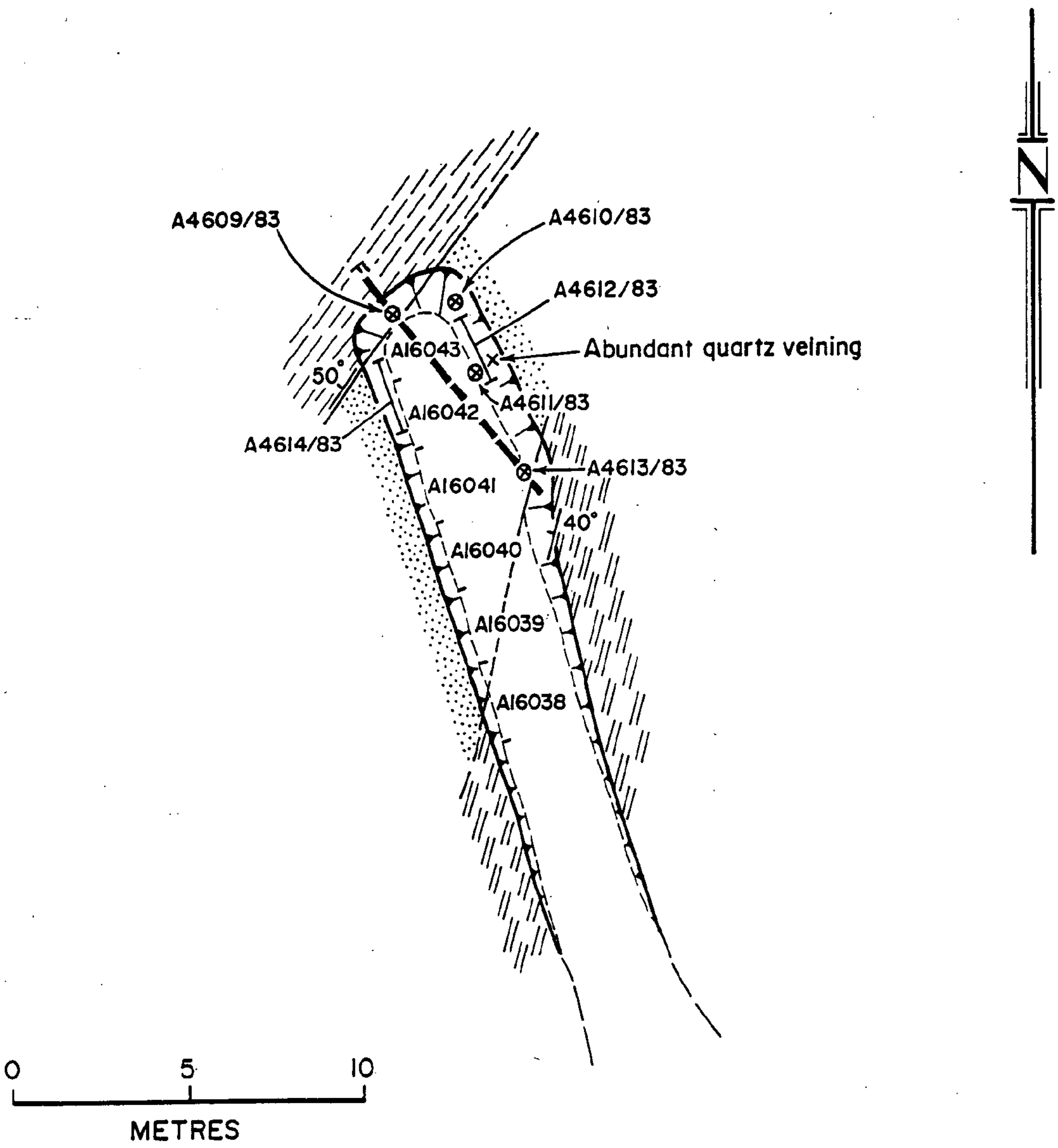
16053 AUREX samples (T.Delahunty) 1985.

FIG. 36

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN
NO. 4 OPEN CUT
SAMPLE LOCATIONS

COMPILED C.M. Horn	C.D.O. 9·10·87 DATE
DRAWN J.W.	SCALE 1:250
DATE	PLAN NUMBER
CHECKED	S19226



Shales/siltstone.

Arkose/sandstone with quartz veins.

Calcareous shales

F

A16038 AUREX P/L (T. Delahunty 1983).

⊗ A4609/83 SADME (R. Horn 1983).

FIG. 37

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MOUNT GRAINGER GOLD MINE
SECS 180 & 183 HD. COGLIN
NO. 6 OPEN CUT – ORROROO TREASURE
SAMPLE LOCATIONS

COMPILED C.M.Horn	C.D.O.	DATE 8·10·87
DRAWN J.W.	SCALE 1:200	
DATE	PLAN NUMBER	
CHECKED	S19227	

3928

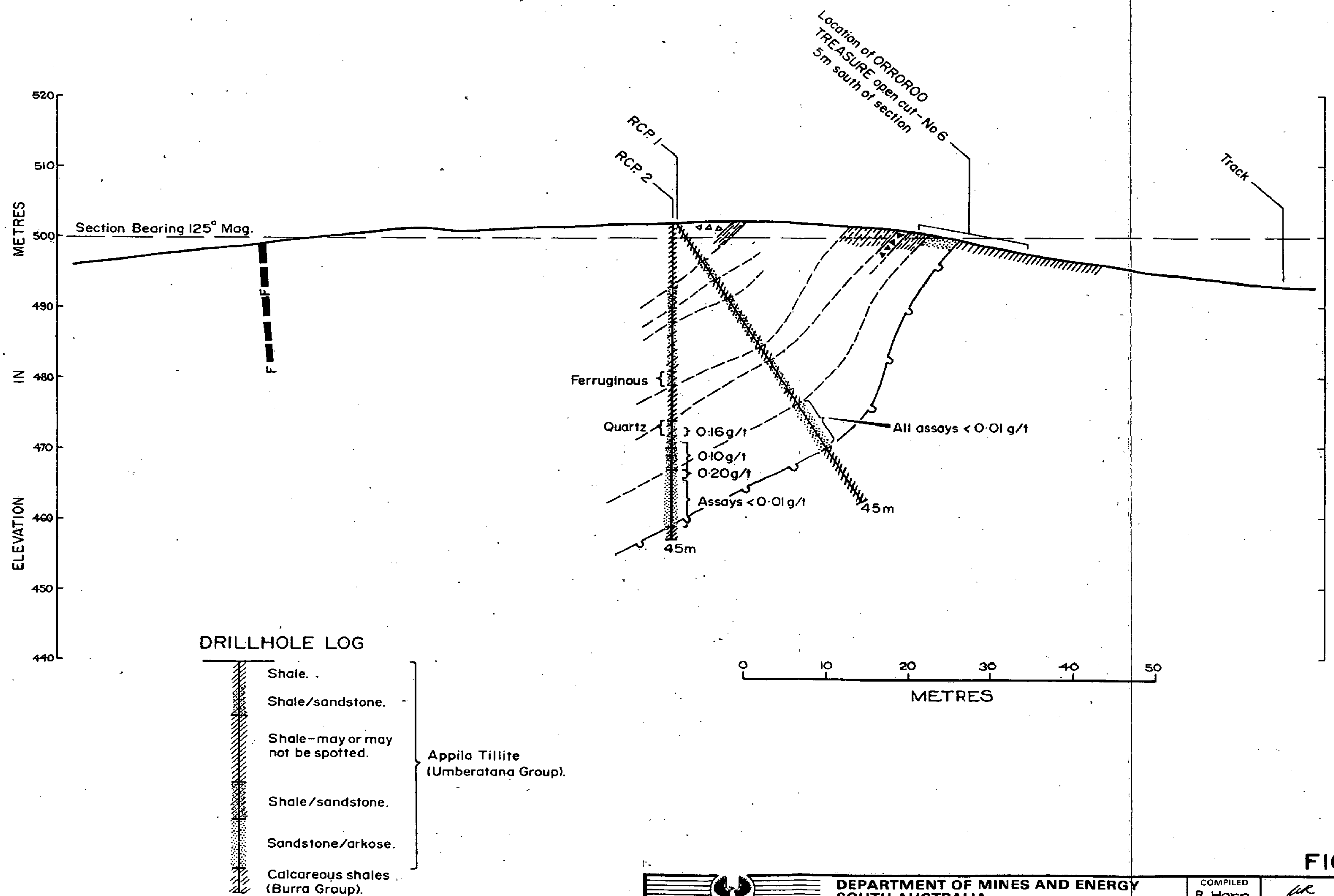


FIG.38

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	C.D.O. 8·10·87 DATE
MOUNT GRAINGER GOLDMINE SEC. 180 AND 183 - HD COGLIN SECTION THROUGH REVERSE CIRCULATION PERCUSSION DRILLHOLES 1 & 2	DRAWN J.W	SCALE 1:500
	DATE	PLAN NUMBER
	CHECKED	87-204

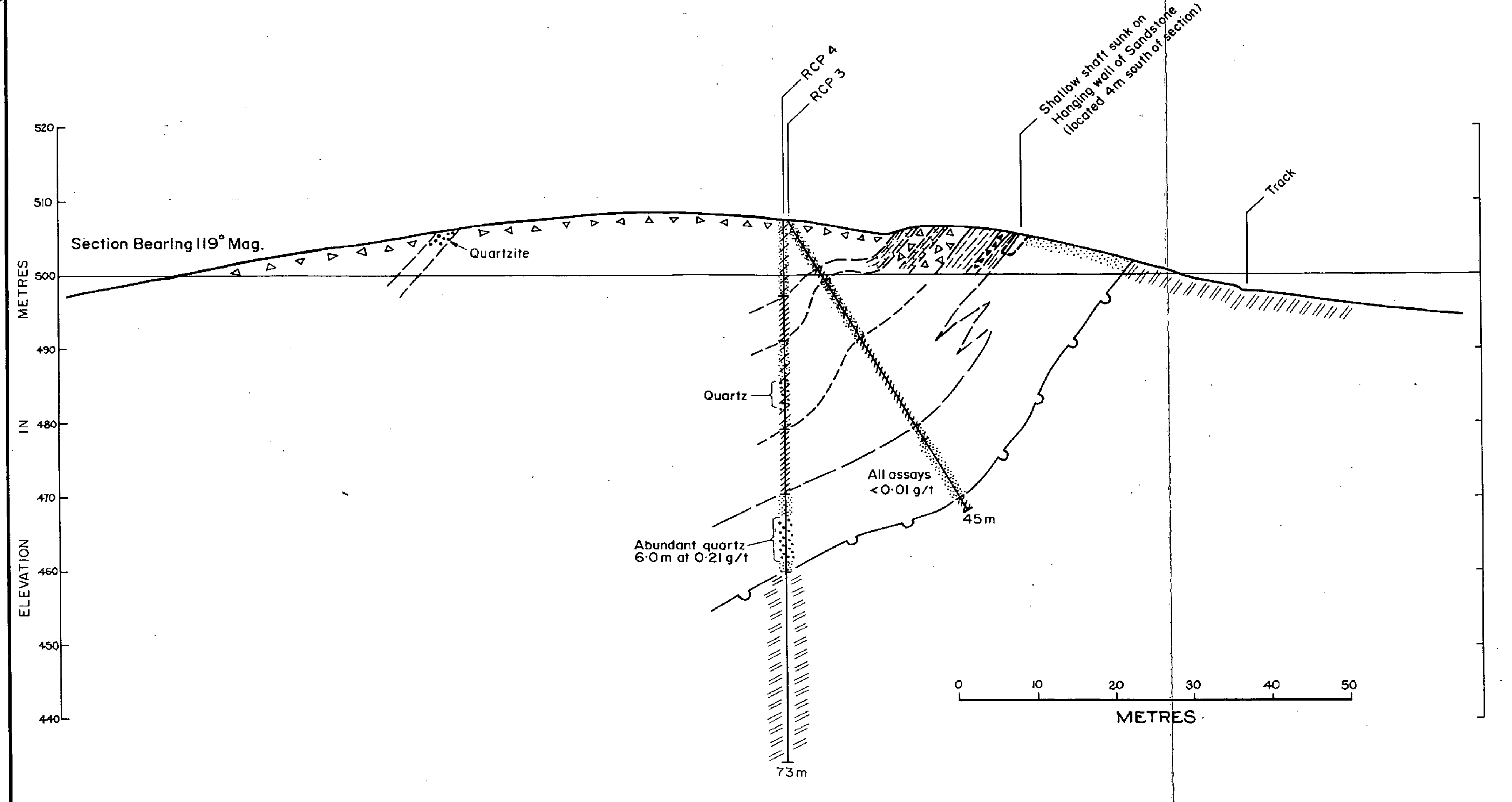


FIG. 39

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	C.D.O.	DATE 8·10·87
MOUNT GRAINGER GOLDMINE SEC. 180 AND 183 – HD COGLIN SECTION THROUGH REVERSE CIRCULATION PERCUSSION DRILLHOLES 3 & 4	DRAWN J. W.	SCALE 1:500	
	DATE	PLAN NUMBER	
	CHECKED	87-205	

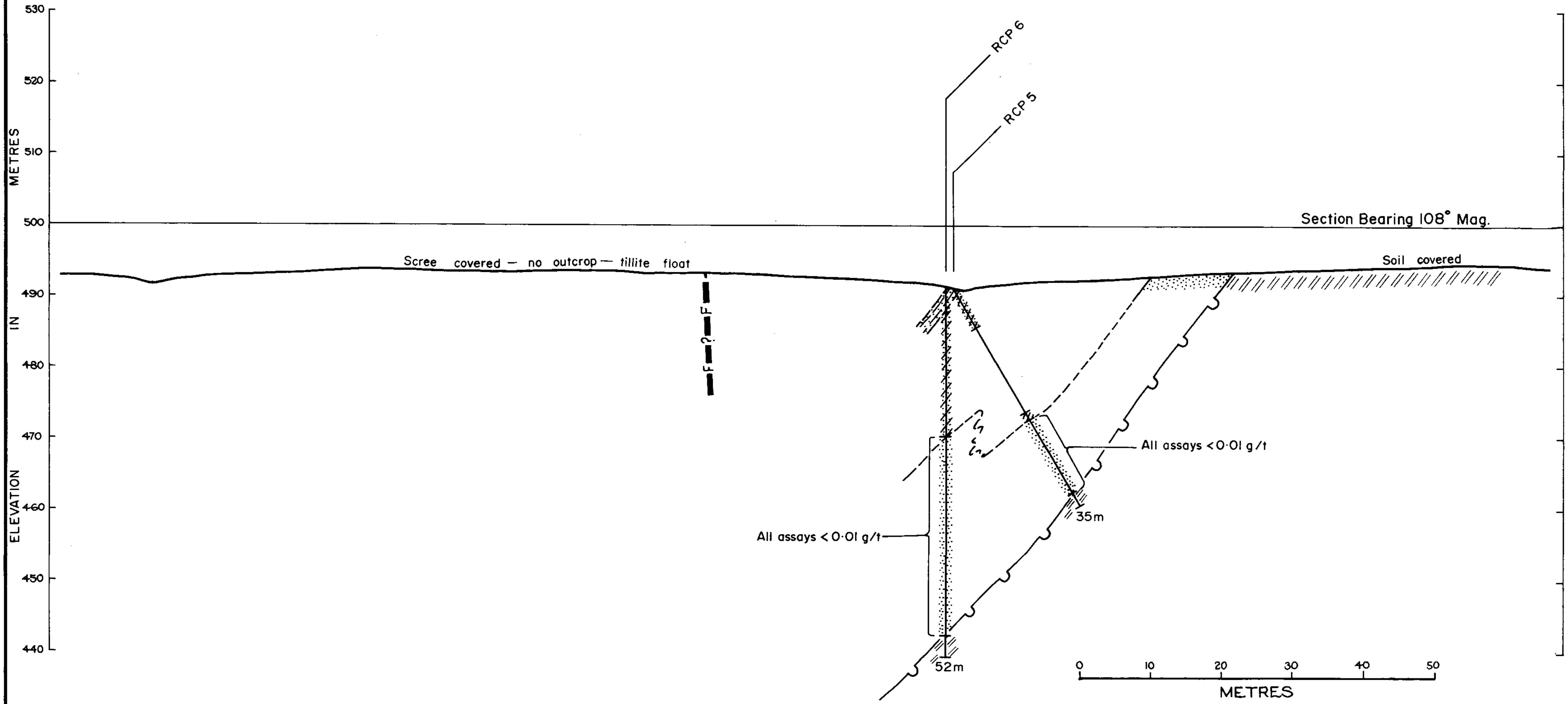


FIG. 40

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	C.D.O. DATE 8·10·87
MOUNT GRAINGER GOLDMINE SEC. 180 AND 183 - HD COGLIN SECTION THROUGH REVERSE CIRCULATION PERCUSSION DRILLHOLES 5 & 6	DRAWN J.W.	SCALE 1:500
	DATE	PLAN NUMBER
	CHECKED	87-206

3928

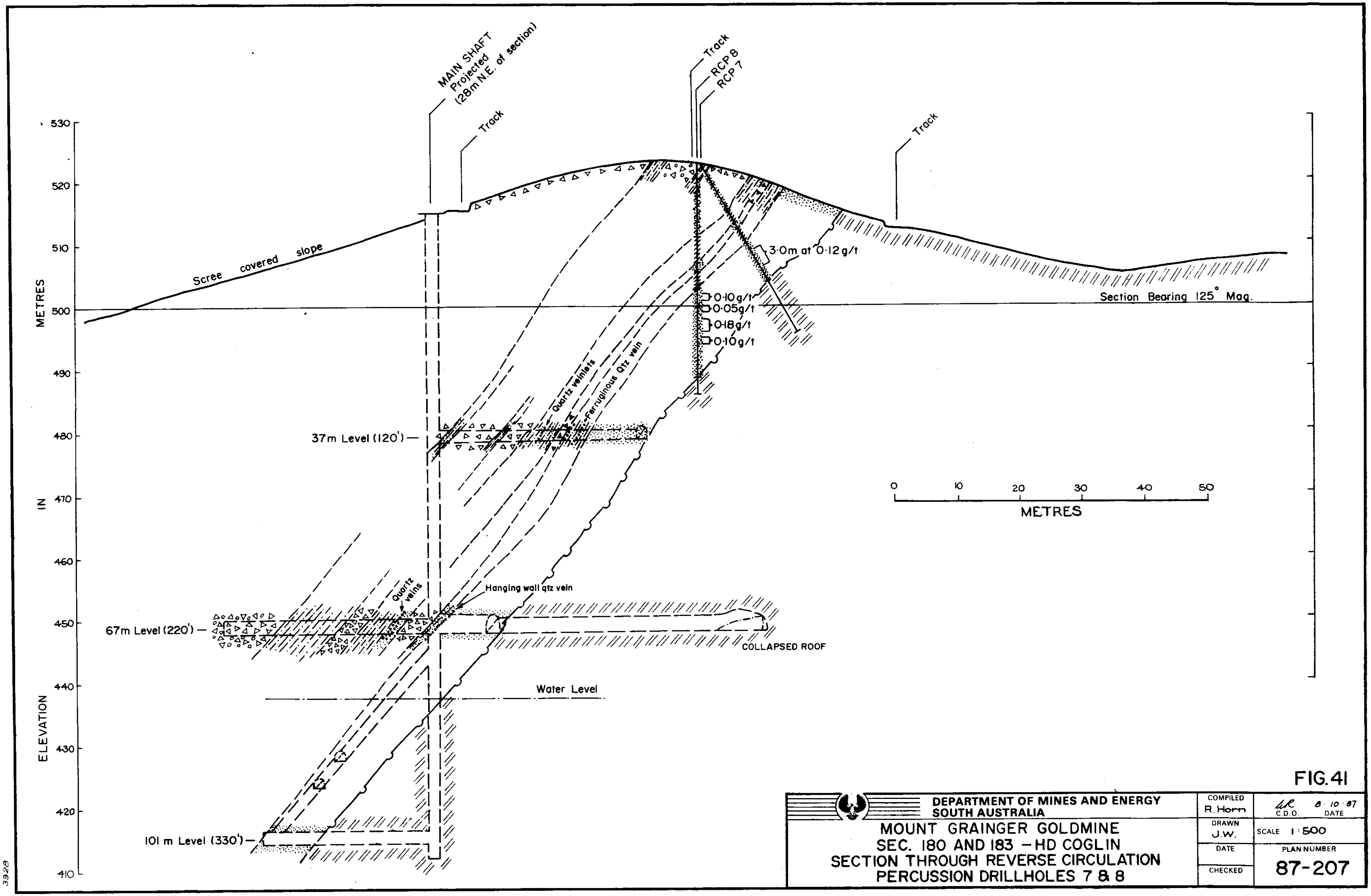

MAIN SHAFT
Projected
(28m N.E. of section)
Track
Track
RCP 8
RCP 7
Track
530
520
510
500
490
480
470
460
450
440
430
420
410
ELEVATION IN METRES
Scree covered slope
3·0m at 0·12 g/t
Section Bearing 125° Mag.
0·10g/t
0·05g/t
0·18g/t
0·10g/t
Quartz veinlets
Ferruginous Qtz vein
37m Level (120')
0 10 20 30 40 50
METRES
Hanging wall qtz vein
Quartz veins
67m Level (220')
COLLAPSED ROOF
Water Level
101 m Level (330')
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA
MOUNT GRAINGER GOLDMINE
SEC. 180 AND 183 – HD COGLIN
SECTION THROUGH REVERSE CIRCULATION
PERCUSSION DRILLHOLES 7 & 8
COMPILED
R. Horn
DRAWN
J.W.
DATE
CHECKED
C.D.O.
8·10·87
DATE
SCALE 1:500
PLAN NUMBER
87-207
3928

FIG. 41

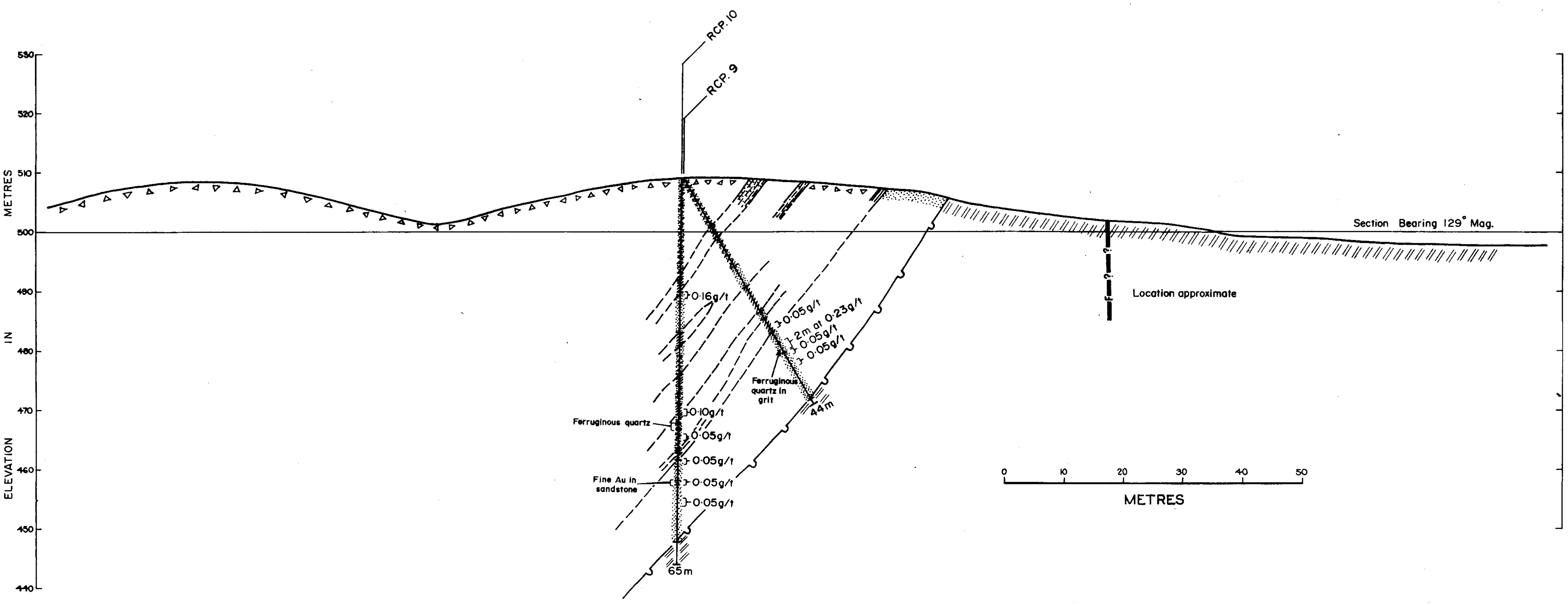
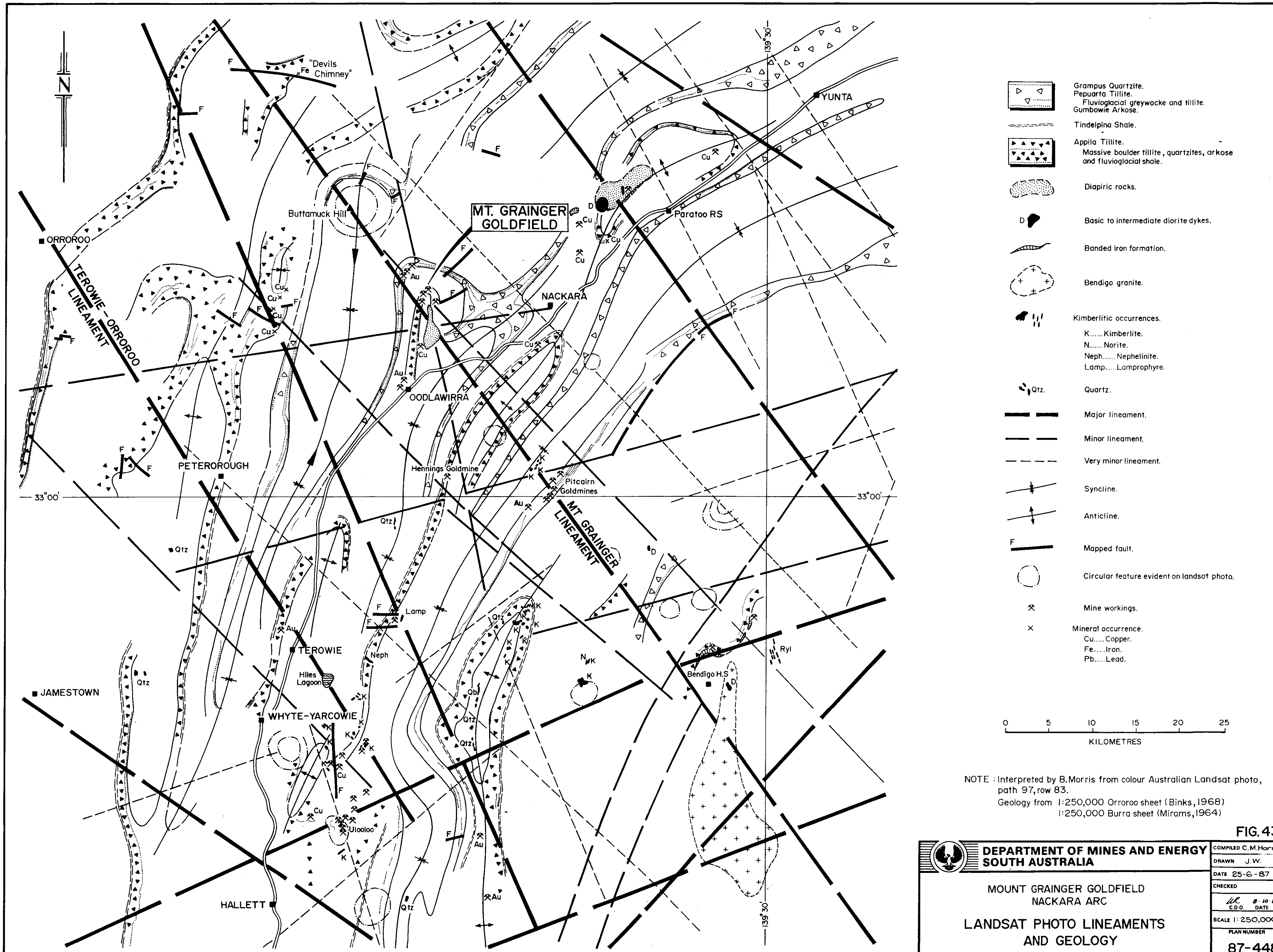


FIG. 42

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED R. Horn	C.D.O. 8·10·87 DATE
MOUNT GRAINGER GOLDMINE	DRAWN J.W.	SCALE 1:500
SEC. 180 AND 183 - HD COGLIN	DATE	PLAN NUMBER
SECTION THROUGH REVERSE CIRCULATION PERCUSSION DRILLHOLES 9&10	CHECKED	87-208

3928



NOTE : Interpreted by B.Morris from colour Australian Landsat photo, path 97, row 83.
Geology from 1:250,000 Orroroo sheet (Binks, 1968)
1:250,000 Burra sheet (Mirams, 1964)

FIG. 43

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

MOUNT GRAINGER GOLDFIELD
NACKARA ARC

LANDSAT PHOTO LINEAMENTS AND GEOLOGY

COMPILED	C.M.Horn
DRAWN	J.W.
DATE	25-6-87
CHECKED	
C.D.O.	DATE 8-10-87
SCALE	1:250,000
PLAN NUMBER	87-448

3928