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PROJECT A-78-60

DISC 73

PROGRESS REPORT

JUNE 1980 TO JUNE 1981

ZEEHAN

EXPLORATION LICENCE 4/78

TASMANIA

P.A. JONES JULY 1981 REPORT 249

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Project Location

SUMMARY AND CONCLUSIONS

Exploration Licence 4/78 was granted to Amoco Minerals Australia Company for a period of six months from June 14, 1978 with further six month renewals subject to Mines Department approval. Amoco negotiated a Joint Venture with E.Z. Industries to farm-in to Mining Lease 60M/77 embracing the southern portion of the Austral prospect. The tenement embraces potential shale or carbonate hosted, basemetal prospects.

R. Curtis and Associates compiled a detailed summary of work carried out by Zeehan Explorations during the period 1947-1950 using data acquired from North Broken Hill Ltd. Curtis concludes that the mineralization is intimately associated with drag folds and dip reversals within the Oceana environment and that these conditions along with faulting are prime requisites for ore forming channels within the Gordon Limestone.

Precambrian basement sediments are overlain by Cambrian sediments and volcanics which are localized within graben structures. These are in turn overlain by Lower Ordovician conglomerate. Transgressive upon these units are Ordovician to Devonian basinal units including sandstones, siltstones, shales, dolomites and limestones.

Significant galena-sphalerite mineralization has been encountered on the Oceana prospect within the Gordon Limestone. Gangue minerals are dolomite and siderite. Petrographic work to date suggests a combination of syngenetic and remobilized origins for the basemetal sulfides observed in a number of the drillholes (ZT-79-2, ZT-80-4, ZT-80-7, ZT-80-9).

Grids staked, restaked and extended during the period include the Austral, Nubeena, Pyramid, Sassafrass, Myrtle and Myrtle Extended, Greive, Baura and Rose Valley.

A program of detailed geological mapping was undertaken on the North Austral, Austral and Oceana prospects with the geological interpretation incorporating both costean and diamond drillhole geology.

Sixteen trenches totalling 695 meters were excavated at the Oceana and Austral prospects. The trenches, varying in depth from 0.5 to 7.0 meters were mapped in detail at a scale of 1:200 and channel sampled over widths varying from two to five meters.

Hydraulic auger sampling, using a Jackro 200 auger mounted onto a Bombadier, was initiated to alleviate the problem of thick gravels occurring in the valleys occupied by the Gordon River Limestone.

Significant results were obtained from rock chip sampling on the Austral prospect with one exceptional composite sample assaying

9% lead + 1% zinc + 46g/t silver.

An ongoing program of diamond drill core grinding to quickly scan previously unassayed core continued during the period.

Amoco contracted Wongela and Solo Geophysics to conduct gravity surveys. Thirty line kilometers of surveying was completed, the results of which were computer contoured and are presented at a scale of 1:2500. Downhole PEM surveys proved to be inconclusive as were the physical property tests carried out on selected samples of drill core. No bedrock conductors were revealed from the Dighem survey flown over the Oceana and sections of the North Austral and Austral prospects.

Amoco conducted a four hole diamond drilling program to test for extensions of mineralization outlined previously on the Oceana prospect. Drillholes ZT-80-7 and ZT-80-9 intersected encouraging lead-zinc-silver mineralization. Minor basemetal mineralization was intersected with drillholes ZT-80-6 and ZT-80-8.

Further drilling at the Austral and the Oceana prospects is recommended to test for further extensions of mineralization outlined to date as well as to test targets outlined during the past twelve months.

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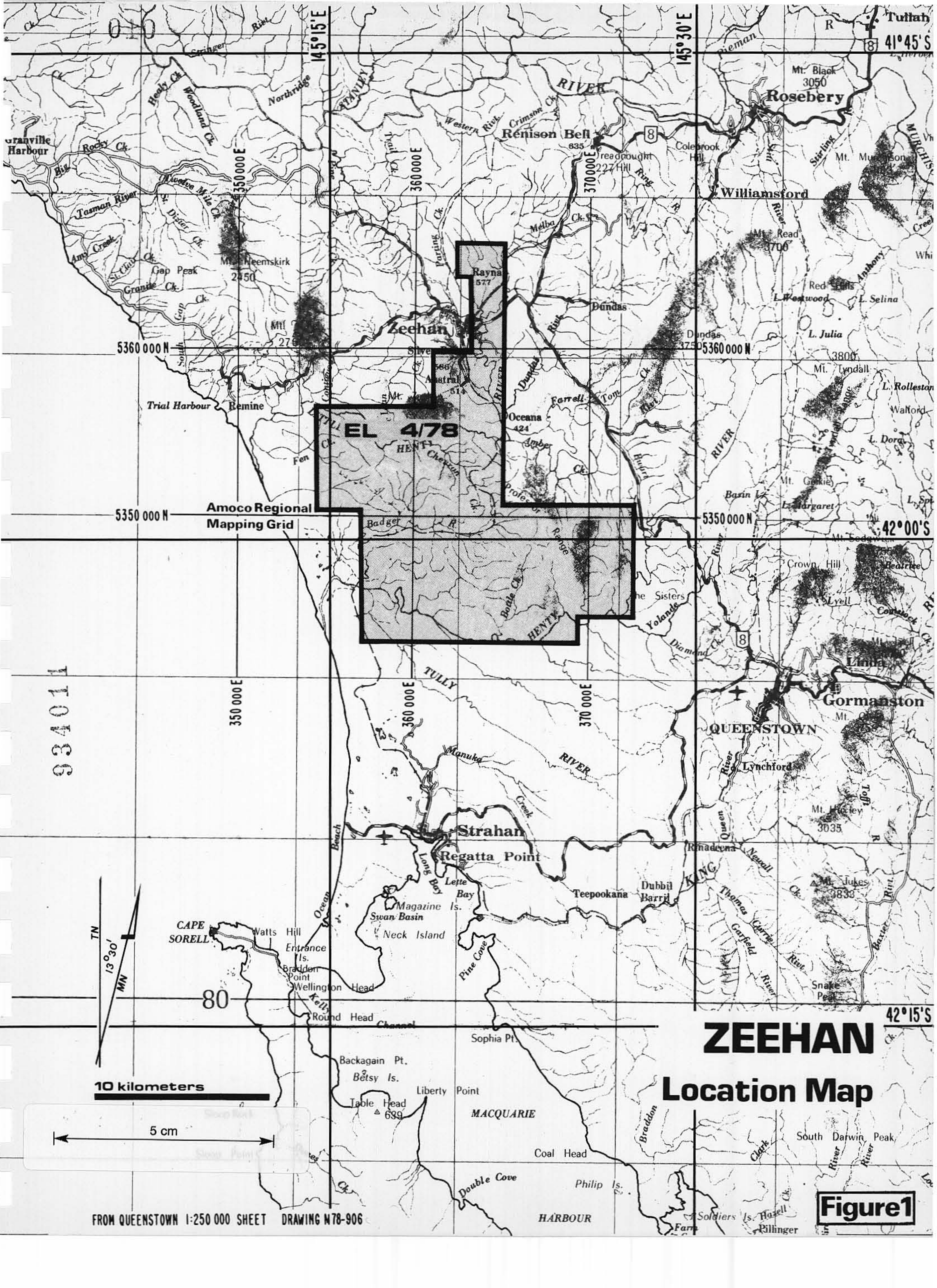
LOCATION AND ACCESS

Exploration Licence 4/78 is located immediately south of the town of Zeehan which has a population of approximately 5,000. (Figure 1). The Emu Bay Railway and a sealed road connect Zeehan with the Port of Burnie, located 140 kilometers to the north. Access within the tenement is relatively good for Western Tasmania, as a number of tracks are located along the dolomites which form topographic lows. Permission was granted by the Tasmanian Mines Department to bulldoze a number of access tracks into diamond drillhole locations.

Zeehan is the service town for the Renison Tin Mine, and no difficulties would be anticipated with respect to power, water and transport should a mine be developed. The area has an annual rainfall of 250 centimeters.



ZEEHAN
Location Map
Figure1

Main street of Zeehan 1911 (Old photos reproduced with permission of the Zeehan Mining Museum)

Main street of Zeehan 1980

DESCRIPTION OF THE PROPERTY AND OWNERSHIP

Exploration Licence 4/78 (EL 4/78) has an area of approximately 208 square kilometers, and was granted to Amoco Minerals for the period of six months from June 14, 1978. Renewal of the tenement for further periods of six months is dependent on Mines Department approval of previous exploration and proposed programs.

Amoco negotiated a joint venture with Electrolytic Zinc Company to farm-in to the Mining Licence 60M/77 embracing the southern portion of the Austral prospect. The lease is designed to cover the slag dumps from the old Zeehan smelters.

A further four mining leases are present within the tenement (Enclosure 1). Two leases granted to J.N.R. Enraght-Moony (38M/77 and 39M/77) are designed to embrace slag dumps from the

Oonah Tin Mine. Two small leases held by Tasmanian Mineral Developments cover the mine environs at the Queensberry deposit, situated 1.5 kilometers north of the southern boundary of the tenement.

The two gravel leases held by Renison Limited were relinquished during the period.

HISTORY AND EXPLORATION TO DATE

A detailed description of the mining history and exploration carried out within EL 4/78 was summarized in the previous progress report for the period June 1979 to June 1980. (Amoco Report 179).

A further summary by R. Curtis and Associates was compiled with recently acquired reports and drillhole data received from North Broken Hill. This collates the work carried out by Zeehan Explorations primarily on the Oceana prospect, from the period 1947 to 1950. The detailed report complete with sections and plans is appended. (Appendix 1)

Looking northeast across the manager's house to the Zeehan smelter (1904)

Looking northeast from a similar position at smelter ruins and dumps (1980)

Looking southwest across the Zeehan smelter to the Oceana Valley beyond

Smelter remains, Zeehan-Strahan Road with the Oceana Valley beyond the first ridge (1980)

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GEOLOGY OF THE TENEMENT

The basement complex is comprised of Precambrian schists, quartzites, siltstones, shales, spillitic or keratophyric lavas and pyroclastics and forms a stable craton to the northwest of the tenement. The Lower Cambrian units such as the Crimson Creek Formation, are predominantly shallow water sediments, including argillites, grits, and tuffaceous arenites. Cambrian sedimentation appears confined to fault bounded blocks or graben structures.

The Ordovician to Devonian strata of the Zeehan Basin occur within a series of synclinal structures with northwest axial trends. The quartzose and hematitic Owen Conglomerate at Mt. Zeehan, was deposited within a graben structure in the Lower Ordovician period and is transgressively overlain by micaceous siltstones, tubicolar sandstones, grits and minor sandstones and shales. It is the time equivalent of the Moina Sandstone which was deposited in the Zeehan Basin. The Moina Sandstone is overlain disconformably by the Ordovician Gordon Limestone. The disconformity is marked by a white conglomerate followed by an interbedded sequence of siltstones, dolomites and minor sandstone and limestones. The Gordon Limestone is comprised of interbedded limestones and dolomites with numerous breccia horizons and zones of clastic sedimentation including fossiliferous sandstones, siltstones and shales. Siluro-Devonian sediments within the basin are fossiliferous marine, coarse grained and cross bedded quartzose sandstones, siltstones, minor quartzites and dolomitic to pyritic shales and siltstones.

The western portion of the tenement has been blanketed by Permian glacials, lacustine sediments and Jurassic dolerite flows.

Extensive Tertiary and Quaternary deposits blanket much of the prospective dolomite and shale units.

The Zeehan area has been intensely disturbed by the Paleozoic Tabberaberan orogeny which caused major northwest folding and faulting. East and northwest trending fault systems are considered to have been contemporaneous. North-northeast striking faults are thought to have developed in post Permian times and are not common within the tenement area.

A geologic map of the tenement and surrounding area was included in the previous progress report for the period July 1978 to July 1979. (Amoco Report 151, Enclosure 1)

WORK CONDUCTED BY AMOCO

During the period June 1980 to June 1981, work conducted included gridding, detailed geological mapping and costeaning, geochemical and gravity surveys, core physical properties tests and down hole Pulse electromagnetic (PEM) surveys. A further four diamond holes were drilled on the Oceana prospect. A detailed report, collating and summarising exploration and mining activities at the Oceana Mine was undertaken by R. Curtis and Associates, consulting geologists.

All computer contouring of geochemical and geophysical surveys was conducted by C.E.A. of Sydney.

Gridding

An intensive program of gridding was carried out in preparation for a regional gravity survey. One hundred and eight line kilometers were staked with steel picketed baselines. The North Austral and Austral prospects were regridded to repair damage created by the bushfire which swept through the region in February.

The North Austral grid (previously known as the Maxim grid) has been extended to line 3300N from 3000N and now abuts the exploration licence boundary (Enclosure 2).

At Austral, the grid was extended south to 400N encompassing the Electrolytic Zinc joint venture area held under Mining Lease 60M/77 (Enclosure 7) and effectively covering the remainder of the Gordon Limestone sequence south of the flux quarry area.

Eleven, one kilometer long lines were staked outlining the Nubeena prospect, immediately to the west of the Austral grid, centered on numerous workings and massive concretionary ironstones up to 30 meters in width with a strike length up to 500 meters.

Approximately 13 line kilometers of gridding was completed on the Pyramid prospect. This grid ties onto the Oceana grid south of the South Oceana workings at 2700N/1400E. It then trends south to 2300N before changing bearing in a southeasterly direction and extending further south to 700N. The grid embraces the Pyramid workings which produced high grade lead/silver ore from shallow shafts early this century.

Five line kilometers of extensions were added to the Myrtle and Myrtle Extended grids to allow full coverage by the gravity survey of the Gordon Limestone sequence.

At the Greives grid, 6.5 line kilometers of extensions were added to allow gravity surveying over the total area of Gordon Limestone.

Approximatley 21 line kilometers were gridded on the Baura prospect, tying onto the southern end of the Grieve grid. The grid covers an anomalous section of the Gordon Limestone outlined by the original geochemical survey.

The Rose Valley grid, which ties onto the Buara, entailed six line kilometers of gridding.

Geological Mapping

A program of detailed geological mapping was undertaken on the North Austral, Austral and Oceana prospects with the geological interpretation incorporating both costean and diamond drillhole geology. The grids were mapped at a scale of 1:1,000 and are presented at 1:2500. (Enclosures 2, 7 and 12)

The detailed mapping has shown the area to be intensely faulted and disturbed with many of the structures manifest by large outcrops of concretionary ironstones. Numerous workings; including shafts, adits, pits and costeans, were located on all grids.

The North Austral prospect, is marked by numerous cross fractures generally having associated small mine workings. A major northwest-southeast trending linear, the Balstrup Fault, divides the eastern section of Ordovidian to Devonian basinal sediments from the Precambrian and Cambrian sequences to the west. The large residual gravity response trends through the middle of the Cambrian sequence, coincident with moderate tenor geochemistry and numerous workings.

The western flank of the Austral Valley, comprised of an interbedded sequence of conglomerates, siltstones, dolomites and minor sandstones and limestones has shown to be overturned to the west and severely cross faulted. (Enclosure 7) These conditions, according to R. Curtis and Associates are prerequisites for an ore forming environment. The unconformable boundary between the Gordon River Limestone and the Crotty Quartzite sequence was relocated 150 meters to the east after limestone was mapped in the area. Numerous strongly anomalous ironstones and mineralized outcrops occur in the southern portion of the prospect. These are semi-coincident with a large gravity response and coincident soil geochemical response.

Detailed geological mapping on the Oceana prospect has shown that faulting had a major impact on the distribution of rock types. Intersecting faults occur at the South Oceana workings as well as in the north where the Mine Fault intersects both the Oceana and South Oceana fault zones. A number of sandstone, siltstones and shale interbeds occur throughout the predominantly carbonate unit, the Gordon River Limestone.

Costeaning

Sixteen trenches totalling 695 meters were excavated at the Austral and Oceana prospects using both JCB and O & K hydraulic excavators. The trenches, varying in depth from 0.5 meters to 7.0 meters were mapped in detail at a scale of 1:200 and channel sampled over widths varying from 2 to 5 meters (Table 1).

The costeans in the Austral Valley were primarily designed to gain geological information on the overturned beds of the western flank of the valley. Those at the Oceana were designed to trace the exact position of the Oceana Fault proximal to the mineralized intercept in ZT-79-2.

Of the 11 costeans excavated on the Austral prospect, (Enclosure 8), seven had moderately to strongly anomalous bedrock geochemistry values. Widths of mineralization varied from two meters to 22 meters with analyses ranging between 1.36% and 4.2% lead, 0.28% and 9.33% zinc. A detailed geological map for each costean with accompanying assay results is appended. (Appendix 2)

The five costeans trenched in the Oceana Valley proved to be extremely difficult and dangerous to map and sample due to the thick gravel deposits. Trenches here exceeded seven meters in depth and were prone to collapse in the unconsolidated gravels. However, assays from three of the trenches proved to be strongly anomalous with results ranging from 2% lead/zinc+ 19.1g/t silver to 7.9% lead/zinc + 34.1g/t silver over widths varying from five to 27 meters. Detailed geology and accompanying assay results for each costean are appended (Appendix 3).

TABLE 1 : OCEANA-AUSTRAL COSTEANS - SIGNIFICANT ASSAY RESULTS

AUSTRAL:	A	1193-1201	= 8m	@	0.13% Pb	+ 0.07% Zn	+ 3.0g/t Ag	
	B	1168-1180	= 12m	@	0.12% Pb	+ 0.25% Zn	+ 2.8g/t Ag	
	C	1159-1169	= 10m	@	1.44% Pb	+ 0.45% Zn	+ 5.6g/t Ag	
	D	1162-1164	= 2m	@	2.61% Pb	+ 1.60% Zn	+ 15.0g/t Ag	
		1171-1185	= 14m	@	3.57% Pb	+ 0.08% Zn	+ 12.7g/t Ag	
	E	1154-1156	= 2m	@	4.20% Pb	+ 1.12% Zn	+ 9.0g/t Ag	
		1171-1181	= 10m	@	0.24% Pb	+ 0.21% Zn	+ 5.0g/t Ag	
	F	1148-1158	= 10m	@	3.10% Pb	+ 0.82% Zn	+ 28.4g/t Ag	
	G	1144-1152	= 8m	@	0.98% Pb	+ 0.53% Zn	+ 20.1g/t Ag	
		1159-1163	= 4m	@	0.80% Pb	+ 0.46% Zn	+ 6.5g/t Ag	
	H	1100-1104	= 4m	@	4.01% Pb	+ 9.33% Zn	+ 28.0g/t Ag	
		1124-1136	= 12m	@	3.91% Pb	+ 0.28% Zn	+ 17.7g/t Ag	
	I	1304-1310	= 6m	@	2.07% Pb	+ 1.23% Zn	+ 31.0g/t Ag	
	J	1280-1284	= 4m	@	No significant Pb/Zn		+ 13.0g/t Ag	
	K	1124-1128	= 4m	@	1.36% Pb	+ 1.04% Zn	+ 7.0g/t Ag	
		1140-1162	= 22m	@	2.71% Pb	+ 1.63% Zn	+ 9.2g/t Ag	

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Excavating costeans on the Oceana prospect

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Jacro 200 auger mounted onto the JS Bombadier
used for the auger sampling program

OCEANA:	A	No significant assays
	B	No significant assays
	C	3717-3722 = 5m @ 0.65% Pb + 2.40% Zn + 10.0g/t Ag
	D	3671-3684 = 13m @ 5.30% Pb + 0.46% Zn + 10.2g/t Ag
		3694-3706 = 12m @ 2.87% Pb + 0.43% Zn + 44.8g/t Ag
	E	1326-1337 = 10m @ 1.88% Pb + 0.07% Zn + 38.5g/t Ag
		1386-1398 = 12m @ 2.06% Pb + 0.51% Zn + 53.3g/t Ag
		1412-1426 = 14m @ 2.09% Pb + 0.45% Zn + 19.1g/t Ag
		1436-1442 = 6m @ 3.20% Pb + 0.47% Zn + 41.3g/t Ag
		1445-1472 = 27m @ 6.21% Pb + 1.69% Zn + 34.1g/t Ag

Geochemistry

An hydraulic auger sampling program using a Jacro 200 auger mounted onto a JS Bombadier was initiated to penetrate the thick talus blanketing much of the prospective Gordon River Limestone sequence. Holes were drilled to an average depth of five meters with top bedrock samples being obtained at 25 meter intervals along grid lines. Areas unable to be sampled with the Jacro/Bombadier combination due to steep slopes or very boggy areas, were sampled using a Stihl power auger. The North Austral, Austral and Oceana grids have been sampled using these methods with the results being remarkably different to those obtained using a hand auger.

Samples are dried, crushed and pulverised before being split and despatched to Comlabs Pty. Ltd. in Adelaide where they are analysed for copper, lead, zinc and silver. Analysis for basemetals was by AAS after hydrochloric acid digestion. Selected lines were tested for mercury and sent to Lowder Geoscience in Sydney where the -80 mesh fraction was analysed using a technique of combusting the sample, collecting the mercury vapour on a wheatstone bridge which is then electrically released onto gold film and measured by a digital galvonometer.

Rockchip samples are prepared in the same manner as the soils but are analysed for an additional ten elements: bismuth, nickel, gold, molybdenum, vanadium, cadmium, tin, tungsten, antimony and cobalt.

Contoured soil geochemical results for the North Austral, Austral and Oceana prospects are presented at a scale of 1:2500.

North Austral: A high tenor lead/zinc, minor copper (+500 ppm lead, +1000 ppm zinc, +100 ppm copper) anomaly strikes grid east obliquely from 2100N/1300E to 2400N/1700E. The anomaly has a strike length of 600 meters and a width of 100 meters and is manifest by a number of workings. (Enclosures 3,4,5)

Semi coincident, strongly anomalous lead/zinc (+500 ppm lead, +500 ppm zinc) geochemistry occurs over the intense 2.5 milligal gravity response. Late channel, strong, PEM responses occur coincident with the responses.

Coincident with the Montagu Mine is a 300 by 100 meter strongly anomalous lead/zinc geochemical response with values ranging up to 1.9% lead and 0.76% zinc.

A further strongly anomalous zone of lead/zinc geochemistry occurs coincident with a strongly anomalous, 6 channel, PEM conductor centered on line 2500N at 1350E.

Numerous small, nebulous, copper/lead/zinc, strong tenor responses occur throughout the remainder of the grid with numerous percentile values being obtained. The anomalous zones generally occur in close proximity to small workings.

Austral : A strong, coincident, lead/zinc anomaly outlined by previous hand augering proximal to the flux quarry, increased in length and tenor by the Jackro sampling. The geochemistry was detailed further, by costeaning. (See Appendix 2)

A further zone of anomalous lead/zinc geochemistry trends northwards from 450N to 2000N between eastings 1350 and 1550. The zone is characterised by a number of spot highs generally coincident with ironstones or minor workings. The anomaly averages 0.1% lead + 0.25% zinc with a number of analyses in the percent range. (Enclosures 8 and 9)

The area bounded by 450N and 700N between 1350E and 1550E has strongly anomalous geochemistry, up to 0.6% lead + 1.6% zinc and highly anomalous rockchip geochemistry with numerous ironstones in the vicinity.

Oceana : A strong anomaly outlined in the previous hand augering program, north of the Oceana Mine was delineated further using the Jacro auger. The anomalous zone, with dimensions of 175 meters by 125 meters at its widest point, averages 0.1% lead + 0.25% zinc, however, analyses ranged up to 8.9% lead, 3.21% zinc and 78g/t silver. A further moderately strong, 100 by 125 meter, coincident lead/zinc anomaly was outlined south of the Oceana Mine with values assaying up to 3.12% lead, 3.69% zinc and 62g/t silver. (Enclosures 13 and 14)

Nebulous but strong lead/zinc responses were obtained proximal to the South Oceana workings, between lines 2700N and 2900N. Augering here was hampered by glacial erratics? and a number of samples were taken using an hydraulic excavator to sample the bedrock.

A number of strong, but limited sized anomalies were also observed on lines 3650N, 3700N and 3200N averaging 0.1% lead and 0.25% zinc.

Rockchip Geochemistry

Austral : A total of 41 composite rockchip samples have been taken from outcropping ironstones, ferruginous dolomite breccias, other rock types and dump material from small workings (locations are shown on Enclosure 7 and rock types and assay results are summarized in Table 2).

Results from dump material varied from 10% lead to 67% lead, 0.76% zinc to 13.0% zinc and 116g/t silver to 580g/t silver. Ironstone samples assayed up to 3.40% lead, 1.35% zinc and 8g/t silver. Numerous mineralized outcrops and ironstones occur in the area bounded by 450N and 700N between 1350E to 1550E with associated strong tenor gravity and soil geochemical responses. Here values consistently assayed between 1% and 3.5% lead, 0.25% to 2% zinc with one exceptional value assaying 9.3% lead + 1.0% zinc + 46g/t silver.

Diamond Drill Core Filleting

An ongoing program of diamond drill core filleting to quickly scan previously unassayed material continued during the period with some zones assaying from 0.1% to 0.2% zinc. These were generally associated with brecciated and weakly to moderately siderite veined zones within massive limestones. Holes ZT-79-1 and ZT-80A-2 from the Austral prospect are complete with hole ZT-80A-3 being only partially assayed.

Holes ZT-79-2, ZT-80-5, 6, 7, 8 and 9 from the Oceana prospect are complete with holes ZT-80-3 and 4 being partially assayed.

Geophysics

Geophysical surveys included 30 line kilometers of gravity surveying, down hole Pulse electromagnetic (PEM) surveys by Crone Geophysics, and drill core physical property tests by Geoterrex.

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TABLE 2 - AUSTRAL ROCK CHIP RESULTS CONTINUED

NO.	COORDINATES	ROCK TYPE	ASSAY RESULTS (Cu,	Pb,	Zn,	Ag,	Au)
29744	545N:1540E	Ferruginous dolomite and ironstone, concretionary.	16	2550	1.35%	2	
29745	545N:1545E	Ferruginous dolomite & ironstone	12	2250	3500	2	
29746	538N:1546E	Concretionary ironstone	14	2250	1.00%	6	
29747	520N:1555E	Black interbedded dolomite minor pyrite near breccia contact	36	1.03%	9700	28	
29748	500N:1575E	Black grey dolomite breccia or fault breccia	65	3.30%	1.95%	32	
29749	590N:1480E	Massive coarse grained galena - small prospecting pit	680	67.0%	0.79%	580	
29750	700N:1460E	Pyritic slimes from Argenton Smelter	750	1.40%	6500	75	4.2
21086	1885N:1145E	Massive ironstone	61	1.05%	6190	<0.5	
21087	1858N:1100E	" " (flux quarry)	94	3.40%	4010	4.7	
21088	1845N:1122E	" "	60	1.05%	3830	1.9	
21089	1840N:1104E	" "	32	1.60%	5380	7.2	
21090	1780N:1134E	" "	64	1.82%	2640	1.9	
21734	1718N:1380E	Ironstone near Austral Creek	<5	631	9350	0.7	
21735	1734N:1372E	" " " "	5	576	9690	1.2	
21736	1758N:1365E	" " " "	5	610	9290	1.3	
21737	1765N:1374E	" " " "	5	310	8200	0.9	
21933	1030N:1285E	Coates workings - ore sample	260	13.60%	13.00%	116	
21934	1110N:1286E	Ironstone	31	1.67%	1.83%	7.6	
21935	1255N:1250E	Ironstone	34	1.15%	6540	7.9	
21936	1305N:1284E	Ironstone	<5	8660	3530	4.6	
21937	1390N:1295E	Ironstone	<5	628	231	2	
21938	1585N:1144E	Austral Mine - ore sample	520	9.90%	0.95%	162	
29883	650N:1525E	Ironstone	48	9300	8300	7	
29884	650N:1525E	Ironstone	85	1.10%	1.05%	14	
29885	650N:1525E	Ironstone	110	7500	7800	4	
29886	625N:1525E	Ironstone breccia	65	5100	1200	102	

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TABLE 2 - AUSTRAL ROCK CHIP RESULTS

NO.	COORDINATES	ROCK TYPE	ASSAY RESULTS (Cu, Pb, Zn, Ag)			
			Cu	Pb	Zn	Ag
36233	510N:1480E	Dark grey dolomitic siltstone foliated, mineralized (Gn)	40	1.10%	1700	21
36234	580N:1430E	Calcite healed brecciated Lst Minor diss. Gn, Sl & Py. A cross cutting feature	4	8500	1350	7
36235	550N:1440E	Dark brown/black ferruginous dolomite. Coarse grained Gn averaging 5% Pb?	50	9. 30%	1.00%	46
36236	550N:1440E	Dark grey xtline ankeritic limestone breccia. Minor calcite vughs. Trace diss Gn	20	4700	2600	5
36237	415N:1425E	Laminar, micaceous grey cleaved shale	46	330	540	<1
36238	425N:1425E	Black massive pyritic cherty siltstone. Tr Gn	22	730	270	3
36239	425N/1425E	Laminar, micaceous, grey cleaved shale	34	560	510	<1
36240	475N/1418E	Mottled brown/yellow micaceous shales and interbedded siltstones	28	100	420	<1
36241	485N/1421E	Interbedded ferruginous massive black silic. sltn and marly limestone	18	500	2500	1
36242	492N/1435E	Calcite veined silty Lst breccia (rounded frags of calclutite & calcarenite)	8	590	3600	1
36243	492N:1452E	Interbedded fossiliferous silty marly calclutite	12	25	820	<1
36244	506N:1465E	Strongly calcite veined limey siltstone	32	410	1500	1
36425	504N:1482E	Interbedded black/grey shaley marls & ferruginous silty dolomites. Mineralized shales & massive dark grey dolomitic siltstones	40	2.00%	2500	27
36247	590N:1522E	Strongly calcite veined and brecciated interbedded calclutites dd. siltstones	16	480	1200	<1

Also ten lines (each three kilometers in length) of Dighem Helicopter-borne EM were conducted.

All gravity data were computer contoured by C.E.A. in Sydney.

Gravity Results : A total of 30 line kilometers of gravity surveying was conducted by Wongela Geophysical Pty. Ltd. and Solo Geophysics Pty. Ltd. The survey was undertaken with a 50 meter station interval on lines 100 meters apart and represents a total of approximately 2750 stations.

Preliminary interpretation of the results is currently underway. This comprises the removal of a regional trend where possible and a search for zones of anomalously high gravity where these zones have dimensions of 500 to 1000 meters. This procedure is complicated by the large background variations in gravity response due to variations in hostrock densities and variable weathering. Results from Austral and Oceana grids were corrected for terrain effects, but as this correction did not significantly effect the final interpretation, this correction was not applied on the North Austral grid.

Preliminary results of this interpretation are as follows:

North Austral Grid

This grid is dominated by a single large two milligal anomaly centered at 2700N:1400E. Comparison of the fine detail of this anomaly with mapped geology indicates that it may be in part due to litholgical density variations. The favorable geological position of this anomaly however, recommends it for further investigation. Interpretation indicates a depth of 150 meters.

Austral Grid

A large one milligal anomaly lies at 1300E from 700N to 1300N. Depth interpretation though complicated by a strong regional trend indicates a depth in excess of 100 meters. As this anomaly is truncated in the south by the Oceana Fault, it is in a highly prospective geological position for being a continuation of the Oceana mineralization.

Oceana Grid

A 0.6 milligal anomaly lies over the known mineralization of hole ZT-80-9. This anomaly extends across the Oceana Fault to the north and thus its relationship to the mineralization is unknown. A broad one milligal anomaly is centered on 3350N:1350E. A depth of approximately 150 meters is indicated. This anomaly correlates well with minor mineralization encountered in holes ZT-79-4 and ZT-80-7.

PEM Results : Results of the downhole PEM surveys in holes ZT-80-7, 8 & 9 at Oceana (Appendix 4) proved to be inconclusive. Minor anomalies along the profiles are consistent with intersected mineralization in holes ZT-80-7 and ZT-80-9.

Physical Property Tests : Eight selected samples of drillcore from the Oceana prospect showed a wide variation in their electrical properties and density. None of the samples showed any measurable magnetic susceptibility. A more comprehensive report on their properties is appended. (Appendix 5)

Dighem Results : No bedrock conductors were revealed in this survey which covered the central section of the North Austral Valley, the northern part of the Austral Valley and entire Oceana Valley. Surficial apparent resistivity lows are shown in valleys indicative of swamp conditions. Apparent resistivities are consistent with the surficial lows of the Oceana I.P. survey. A more detailed report by Dighem Limited is appended. (Appendix 6)

Diamond Drilling

Four holes totalling 1008 meters were drilled, at the Oceana prospect, two of which ZT-80-7 and ZT-80-9, intersected encouraging lead-zinc-silver mineralization. Drilling details and assay results from Oceana and from previous drilling at Austral are summarised (Tables 3 and 4). Drillhole locations are plotted (Enclosure 12) and drill sections and logs are included. (Appendix 7)

- ZT-80-6

Location	:	3650N : 1350E
Declination	:	60°
Azimuth	:	37°T
Total Depth	:	330 meters

ZT-80-6 was sited to test the massive galena-sphalerite mineralization encountered in ZT-79-2, 50 meters to the south in addition to a coincident strong lead/zinc geochemical response. The hole was terminated at 330 meters in black interbedded dolomite and micritic limestones having cut four zones of minor mineralization within siderite/ankerite/dolomite breccias (assaying from 1.5% to 3% combined lead/zinc).

The interval 112 to 134 meters, assaying approximately 1.5% combined lead/zinc represents the weakly mineralized envelope surrounding the lower most intersection of ZT-79-2 (assaying 7 meters of 8.37% lead + 2.95% zinc + 1.82 oz silver/tonne). The zone from 69-72 meters, assaying 3 meters of 1.52% lead + 0.3% zinc + 13.3g/t silver coincides with a siderite/ankerite dolomite breccia similar to that from 112 to 134 meters. An eight meter zone from 212 to 220 meters assaying 0.45% lead + 1.40% zinc is the weakly mineralized expression of the Oceana Mine Fault.

TABLE 3 - AUSTRAL PROSPECT - SUMMARY OF DRILLING

HOLE	CO-ORD	BEARING	DECLIN	DEPTH (M)	COORDINATES AZIMUTH DEFLECTION (at terminal depth)	RESULTS (* including)
ZT-79A-1	1800N	270°G	-50°	163	Unknown	76- 82= 6m @ 1.06% Pb + 1.66% Zn + 1.6g/t Ag
	1225E				(acid)	130-143=13m @ 2.61% Pb + 0.62% Zn + 13.8g/t Ag
ZT-80A-2	1850N	270°	-60°	331	1850N	40- 46= 6m @ 0.69% Pb + 1.62% Zn + 5.8g/t Ag
	1300E				1135E	284-299=15m @ 0.80% Pb + 0.86% Zn + 4.8g/t Ag
						*284-290= 6m @ 1.44% Pb + 0.65% Zn + 5.1g/t Ag
						and 294-299= 5m @ 0.29% Pb + 1.40% Zn + 3.8g/t Ag
ZT-80A-3	1610N	270°	-65°	373.50	1535N	294-296= 2m @ 0.42% Pb + 2.05% Zn + 15.5g/t Ag
	1300E				1097E	341-355=14m @ 0.86% Pb + 0.23% Zn + 4.4g/t Ag
						*347-351= 4m @ 2.25% Pb + 0.28% Zn + 9.0g/t Ag

03.

TABLE 4 - OCEANA PROSPECT - SUMMARY OF DIAMOND DRILLING

HOLE	CO-ORD	BEARING	DECLIN	DEPTH (m)	COORDINATES AZIMUTH DEFLECTION (at terminal depth)	RESULTS (* including)
ZT-79-2	3700N 1500E	270°G	-60°	235.90	Unknown (acid)	65-218=153m @ 5.10% Pb + 3.50% Zn + 41.7g/t Ag
						* 65- 96= 31m @ 0.66% Pb + 3.28% Zn + 1.0g/t Ag
						96-122= 26m @ 22.26% Pb +11.69% Zn + 203.4g/t Ag
						*103-118= 15m @ 33.29% Pb +19.22% Zn + 336.7g/t Ag
						122-204= 82m @ 0.68% Pb + 1.01% Zn + 3.0g/t Ag
						*204-218= 14m @ 8.37% Pb + 2.95% Zn + 56.7g/t Ag
ZT-80-3	3200N 1515E	270°G	-60°	399.70	3075N 1335E	237-238= 1m @ 8.25% Pb + 0.39% Zn + 73.6g/t Ag
ZT-80-4	3420N 1490E	270°G	-66°	360.30	3370N 1350E	247-258= 11m @ 12.00% Pb + 4.0% Zn + 89g/t Ag
						*250-258= 8m @ 15.00% Pb + 5.40% Zn + 113g/t Ag
						302-307= 5m @ 22.30% Pb + 1.99% Zn + 323g/t Ag
						*304-307= 3m @ 36.0% Pb + 3.2% Zn + 530g/t Ag
ZT-80-5	3600N 1590E	270°G	-65°	475.30	3530N 1350E	No visible mineralization
ZT-80-6	3650N 1350E	90°G	-60°	330		69- 72= 3m @ 1.52% Pb + 0.28% Zn + 13.3g/t Ag
						112-117= 5m @ 1.76% Pb + 1.20% Zn + 6.6g/t Ag
						126-134= 8m @ 1.22% Pb + 0.24% Zn + 5.5g/t Ag
						212-220= 8m @ 0.45% Pb + 1.39% Zn + 1.0g/t Ag
ZT-80-7	3420N 1250E	037°G	-50°	250		167-169= 2m @ 12.0% Pb + 11.0% Zn + 70g/t Ag
ZT-80-8	3700N 1575E	270°G	-55°	228		160-167= 7m @ 0.6% Pb + 3.12% Zn + 13.7g/t Ag
						*165-167= 2m @ 1.7% Pb + 7.7% Zn + 29.0g/t Ag
ZT-80-9	3600N 1400E	@6°G	-50°	200.20		1- 24= 23m @ 2.82% Pb + 2.12% Zn + 9.9g/t Ag
						* 4- 9= 5m @ 7.30% Pb + 1.88% Zn + 16.8g/t Ag
						120-186= 66m @ 2.45% Pb + 0.82% Zn + 12.5g/t Ag
						*148-162= 14m @ 3.25% Pb + 0.4% Zn + 8.7g/t Ag
						172-186= 14m @ 5.80% Pb + 1.28% Zn + 21.7g/t Ag
						*182-186= 4m @ 12.95% Pb + 3.09% Zn + 76.0g/t Ag

- ZT-80-7

  Location : 3420N : 1250E

  Declination : 50°

  Azimuth : 37°T

  Total Depth : 250 meters

ZT-80-7 was collared to test the up dip extension, approximately 120 meters vertically above, of the mineralization encountered in ZT-80-4 (11 meters of 12% lead + 4% zinc + 89g/t silver and 5 meters of 22.30% lead + 2% zinc + 323g/t silver). The hole passed through interbedded calclutites, calcarenites, dolomites, fossil breccias, slump breccias and calcareous sandstones, after cutting a two meter section assaying 12% lead + 11% zinc + 70g/t silver. This correlates with the 11 meter intercept from ZT-80-4 indicating the mineralized zone widens at depth. The five meter lead/zinc intercept from ZT-80-4 was not intersected in ZT-80-7, however, a zone of high geochemistry occurs proximal to its projected updip position.

- ZT-80-8

  Location : 3700N : 1575E

  Declination : 55°

  Azimuth : 217°T

  Total Depth : 228.6 meters

ZT-80-8 was sited to test the down dip extension of the 15 meter wide mineralized zone (assaying 33.3% lead + 19.2% zinc + 337g/t silver) encountered in the upper most section of ZT-79-2. The hole was terminated prematurely at 228 meters, having cut a two meter section of sphalerite/galena mineralization assaying 1.7% lead + 7.7% zinc + 29g/t silver. It was designed to cut the mineralized zone in ZT-79-2 at a vertical depth of 175 meters below surface but passed out of the prospective Gordon Limestone sequence into the Moina Formation. A flat lying fault dipping gently westwards and abutting the Mine fault, encountered at 167 meters down hole, is envoked to bring the Moina Formation into position cutting off the mineralized section at a depth of approximately 175 meters.

- ZT-80-9

Location	:	3700N : 1575E
Declination	:	55°
Azimuth	:	217°T
Total Depth	:	228.6 meters

ZT-80-9 was collared to ascertain the nature of the mineralization observed in ZT-79-2 in respect to the Oceana Fault system and was therefore oriented grid south-north.

The hole was terminated at 200.2 meters after passing through two mineralized zones within sideritic/ankeritic/dolomite breccias. The hole cut mineralization; 1-24 meters of 2.82% lead + 2.12% zinc + 10g/t silver and 120-186 meters of 2.45% lead + 0.82% zinc + 12.5g/t silver, correlating with the lower massive sulfide intersection in ZT-79-2 having passed through the zones twice due to the folded nature of the beds. Core recovery within the badly fractured 66 meter wide mineralized zone was extremely poor (seven meters of no core recovery between 175 and 182 meters being flanked above by three meters of 9.8% lead and below by one meter of 44% lead + 9.75% zinc + 8.03oz silver/tonne). The lower section of core assaying 44% lead + 9.7% zinc showed signs of grinding by the diamond bit.

PROPOSED PROGRAM

Geochemical surveys, using the Bombadier mounted Jacro 200 auger rig will be conducted on the Nubeena, Pyramid and Myrtle grids in addition to detailing gravity responses. The bedrock auger sampling program has been designed to overcome the presence of Quaternary gravels and talus within the tenement.

Coincident soil geochemical, rock chip and gravity anomalies outlined on the North Austral, Austral and Nubeena prospects are to be diamond drilled. Further holes will be drilled to delineate the lateral and down dip tensions of the mineralization intersected in ZT-80-4 and ZT-80-7. Downhole geophysical surveys will be carried out on all diamond drillholes.

The Nubeena and Pyramid grids will be geologically mapped in detail.

Costeaning will be carried out where necessary to aid the geological interpretation and elucidate the extent and type of mineralization observed at or near the surface on all the grids.

PEM surveys will be initiated on the North Austral, and Nubeena.

A stream sediment sampling program will be conducted to sample the previously reported Western Limestone areas as well as the prospective Bell Shale lithology. Both these areas lie within heavily rainforested zones requiring helicopter assistance to adequately negotiate the terrain.

SIGNED :

P.A. JONES

FOR

AMOCO MINERALS AUSTRALIA COMPANY

EXPENDITURE FOR THE YEAR JULY 1, 1980 TO JUNE 30, 1981

EXPLORATION LICENCE 4/78

Salaries and Wages	92,290.75
Drafting	3,406.15
Field Office Rent	3,247.56
Cookery	16,912.29
Field Supplies	19,000.22
Freight	3,721.52
Aircraft Charter	1,649.20
Travel and Entertainment	15,105.50
Communications	7,653.41
Geophysics	33,132.83
Consultants	21,758.01
Other Contractors	23,753.17
Assays	4,377.54
Equipment Rental	26,020.29
Equipment Operation & Maintenance	23,626.52
Drilling	96,825.94
Property Payments	6,831.78
	399,312.68
Overhead	93,896.54
	$493,209.22

T.J. CONQUEST
Accountant

APPENDIX 1

REVIEW OF THE OCEANA MINE AREA, ZEEHAN, TASMANIA
by R. Curtis and Asociates

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CONSULTING GEOLOGISTS

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Phone Priv.: 440 8670

Telex: AA25078
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REVIEW OF THE OCEANA MINE AREA, ZEEHAN, TASMANIA

Prepared for
AMOCO MINERALS AUSTRALIA COMPANY

R. Curtis

R. Curtis
May, 1981

934045

R. CURTIS & ASSOCIATES

045

SUMMARY

Diamond drill hole data from 38 holes put down by North Broken Hill, and eight holes put down by Amoco, at the Oceana Mine, have been used to construct a set of 15 sections and 14 plans.

From old mining records, massive Pb/Zn mineralization at the Oceana is known to occur in two semi-parallel bedding plane shears, 2m to 5m apart. North of the mine, three north north westerly trending zones of mineralization have been defined, two of which contain massive Pb/Zn at depth.

An 11m true width intersection of high grade Pb/Zn in Amoco's DDHZT-79-2 is the widest orebody of this type known in the Zeehan Field. The massive, shear hosted Pb/Zn is surrounded by an envelope of disseminated low grade, zinc rich mineralization.

From the sections and plans it is concluded that the high grade mineralization is located in a gentle dip inflexion in the westerly dipping overturned limb of the Zeehan Syncline, and that the thickest zones are in the area where the beds revert from a westerly dip to an easterly dip.

Recommendations for further exploration are made, based on the above conclusions.

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CONTENTS

LIST OF FIGURES

LIST OF FIGURES (continued)

APPENDIX

Note on the Austral Prospect.

R. CURTIS & ASSOCIATES

REVIEW OF THE OCEANA MINE AREA, ZEEHAN, TASMANIA

1. INTRODUCTION

This report discusses the data generated by Amoco and previous workers in the Oceana Mine area, within Amoco's EL4/78 at Zeehan. A short note appended to this report comments on exploration at the Austral, 1.5km north of the Oceana. These prospects have been the main focus of Amoco's exploration of mineralization within the Gordon Limestone (Figure 1).

The early history of development in the Zeehan area has been described by Blissett (1962). After the discovery of Pb/Ag/Zn mineralization in 1882, activity increased to a peak in the early 1890's, declining thereafter, until by 1913 virtually all systematic mining had ceased.

Exploration, as distinct from prospecting, for base metals in the areas appears to have been non-existent until the late 1940's when North Broken Hill (NBH), in joint venture with Broken Hill South, commenced a programme of assessment.

Garretty (1947), the regional manager for NBH at the time, summarized the work carried out by the Company and commissioned Loftus Hills (1947) to report on the more prominent early mines in the Company's concessions. Loftus Hills was able to construct the step by step development of various mines, sometimes in remarkable detail, from old newspaper issues. Those mines within the limestone received particular attention, and as a result NBH decided to dewater the Oceana to follow up a previously completed five diamond drill hole programme.

Dewatering was also recommended for the Spray, King and Bell Mines.

During the early diamond drill programme frequent problems arose when drilling in the limestone.

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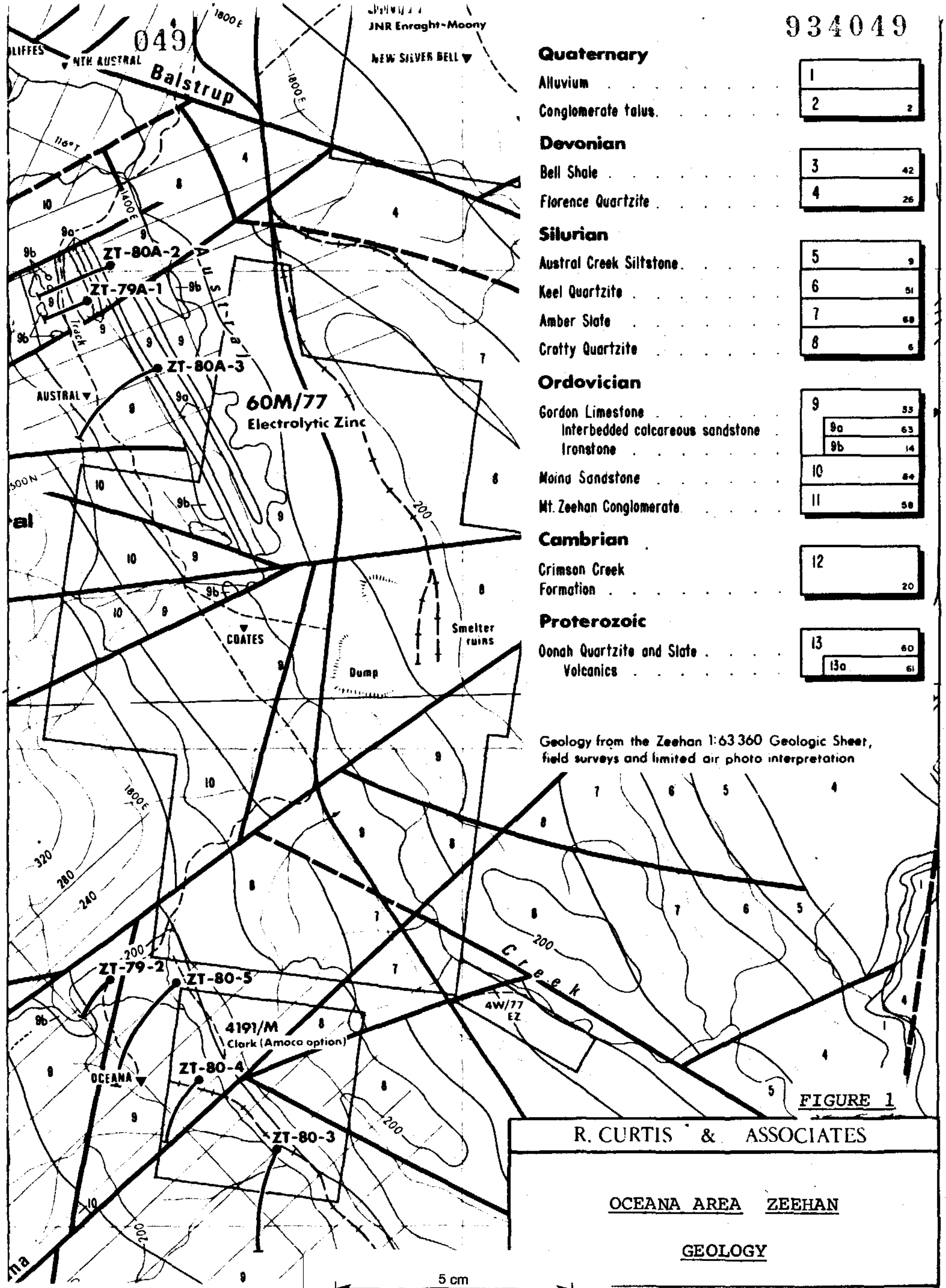

FIGURE 1

R. CURTIS & ASSOCIATES

OCEANA AREA ZEEHAN

GEOLOGY

Recovery in the pug weathering product was negligible, and often non-existent, and the fresh limestone is cavernous, which gave circulation problems. This caused NBH to attempt better definition of diamond drill targets by considering further exploration techniques.

Garretty (1947) approached the Bureau of Mineral Resources, who on studying the diamond drill data suggested that:

> "there is a very good chance that both the gravity meter and electrical method might solve our problems inasmuch as they would indicate the existence of ore at or near the surface".

The Bureau carried out the geophysical surveys in late 1947, early 1948 (Figure 2), concentrating on gravity. Well defined anomalies were established at the Oceana which appeared to outline the mineralization, however, subsequent drilling showed the anomalism to be mostly due to large quantities of siderite, which comprises the gangue.

> "All other local anomalies were tested by drilling, but no mineralized bodies were revealed......The electrical surveys at Oceana failed to give distinct indications over the known mineralization and elsewhere" (Langron, 1966).

During the period 1948 to 1953 NBH sunk a new shaft and rehabilitated the Oceana Mine, drilling a further 34 diamond drill holes from the surface and 58 diamond drill holes from underground. Also during this period NBH was engaged in drilling various other old mines around Zeehan and details of these activities are given below:

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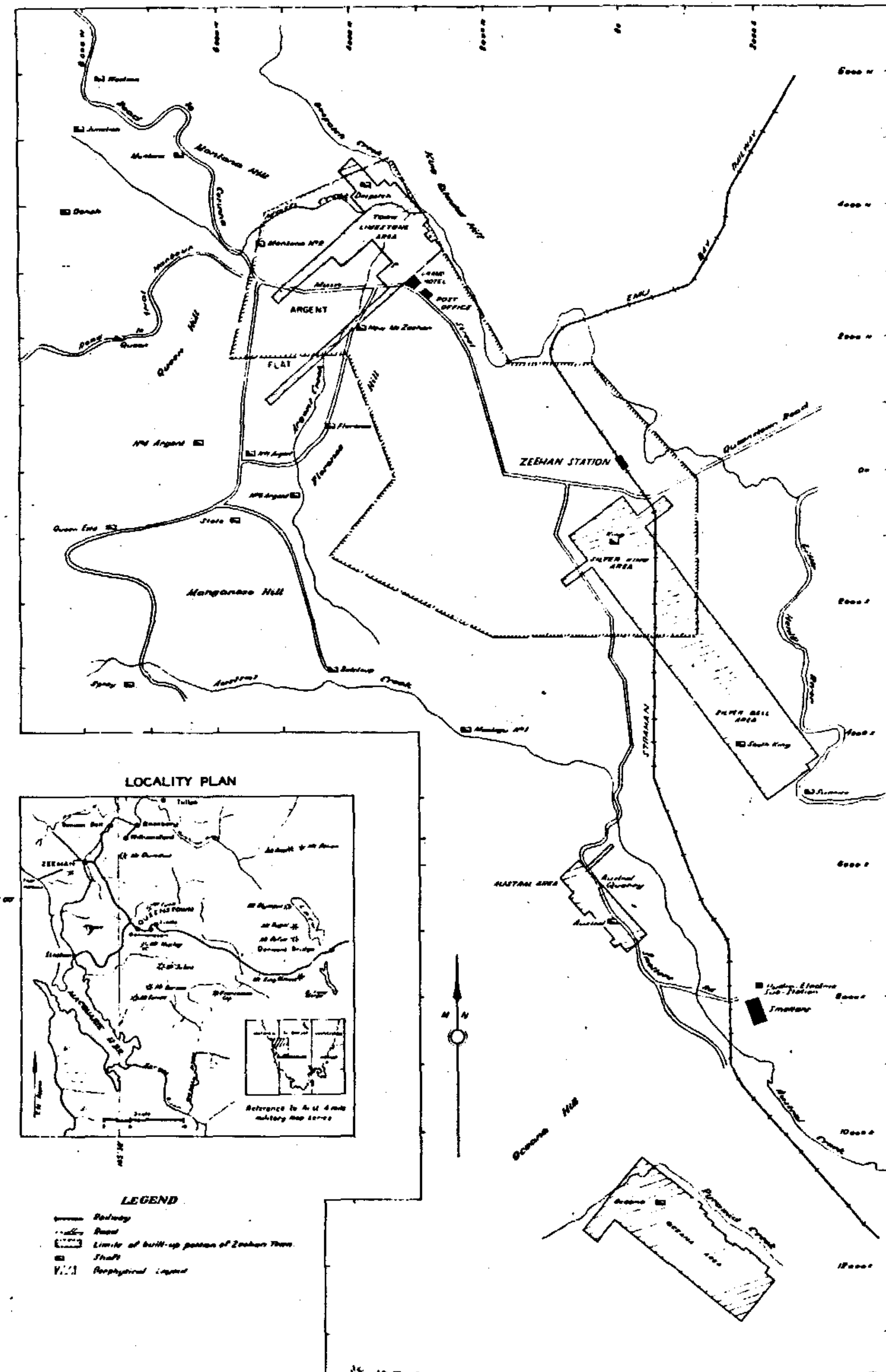


FIGURE 2

R. CURTIS & ASSOCIATES

BMR GEOPHYSICAL SURVEYS

ZEEHAN AREA

5 cm

MINE	HOST ROCK	NO OF DIAMOND DRILL HOLES
Oceana	Gordon Limestone	97
South Oceana	Gordon Limestone	9
Pyramid	Gordon Limestone	5
Austral Flux Quarry	Gordon Limestone	7
Despatch	Gordon Limestone	4
Tasmanian Crown	Gordon Limestone	2
King	Bell Shale	3
South King	Bell Shale	1
Bell	Bell Shale	6
Nike	Oonah Quartzite	2
Spray	Oonah Quartzite	3
		139

After 1953 NBH's efforts were directed at mining the Oceana, and when production ceased in 1960 some 128,177 tons off ore at an average grade of 11.6% Pb and 4.79ozs Ag/t had been mined.

No further work of significance appears to have been carried out in the Oceana/Austral area until the commencement of Amoco's exploration in 1978.

The results of Amoco's exploration in the Zeehan area are presented in Company Reports No's 151 and 179, and it is unnecessary to repeat any descriptive detail in this report. For sake of completeness however, the exploration programmes are listed below:

(i) Reconnaissance soil sampling resulted in the establishment of four grids. Three of these grids, namely the Austral, Oceana and Grieve are located on Gordon Limestone, and the fourth, the Maxim, covers Cambrian Crimson Creek Formation.

(ii) Each grid area was covered by gradient array IP, ground magnetic, detailed soil sampling and geological surveys with pulse electromagnetics carried out along selected lines.

(iii) Reconnaissance soil sampling over Gordon Limestone outcrops outside the above grid areas resulted in the establishment of a fifth grid, the Myrtle, over a Pb/Ag/Hg anomaly.

(iv) Follow up ground work was carried out on three Turair anomalies outlined by previous workers in the Grieve Valley area, and two Input EM traverses were flown to test responses in the area.

(v) The Baura Grid was established over a Gordon Limestone outcrop in the south of the licence area.

(vi) Auger sampling at Oceana was followed by IP, PEM and Mise a la Masse geophysical surveys, the results of which were considered to be not useful.

(vii) Four diamond drill holes were put down at Oceana and three at Austral. After assessment of the results a further four holes were drilled at Oceana.

The pug, derived from the weathering of much of the Gordon Limestone succession, has resulted in the outcrop of this formation being covered by swamps and button-grass plains. Exposure is at a minimum and often non-existent, and most electrical geophysical techniques are rendered ineffective.

Away from areas of known mineralization, geochemical surveys provide a broad basis on which to plan exploration. However, much of the Gordon Limestone succession contains minor disseminmated Pb/Zn mineralization and the weathering characteristics create considerable dispersion of the elements, so it is generally recognised that it is unsatisfactory to use geochemical anomalism as the sole basis for drilling. Unfortunately there is often little alternative.

Apart from Amoco's surface explorations and diamond drilling, the information available on the Oceana comprises Mine Managers' reports for the period 1948-1953, with brief logs on the diamond drilling carried out during this time, and a number of plans showing surface data, and outlines of the first three levels.

It was evident therefore that of the limestone hosted mines in the Zeehan area, detailed study was possible only on the Oceana, and that such work might hopefully lead to a better understanding of the parameters controlling mineralization. As a result, the greater part of the time devoted to this report was spent on the Oceana, and this work is described below.

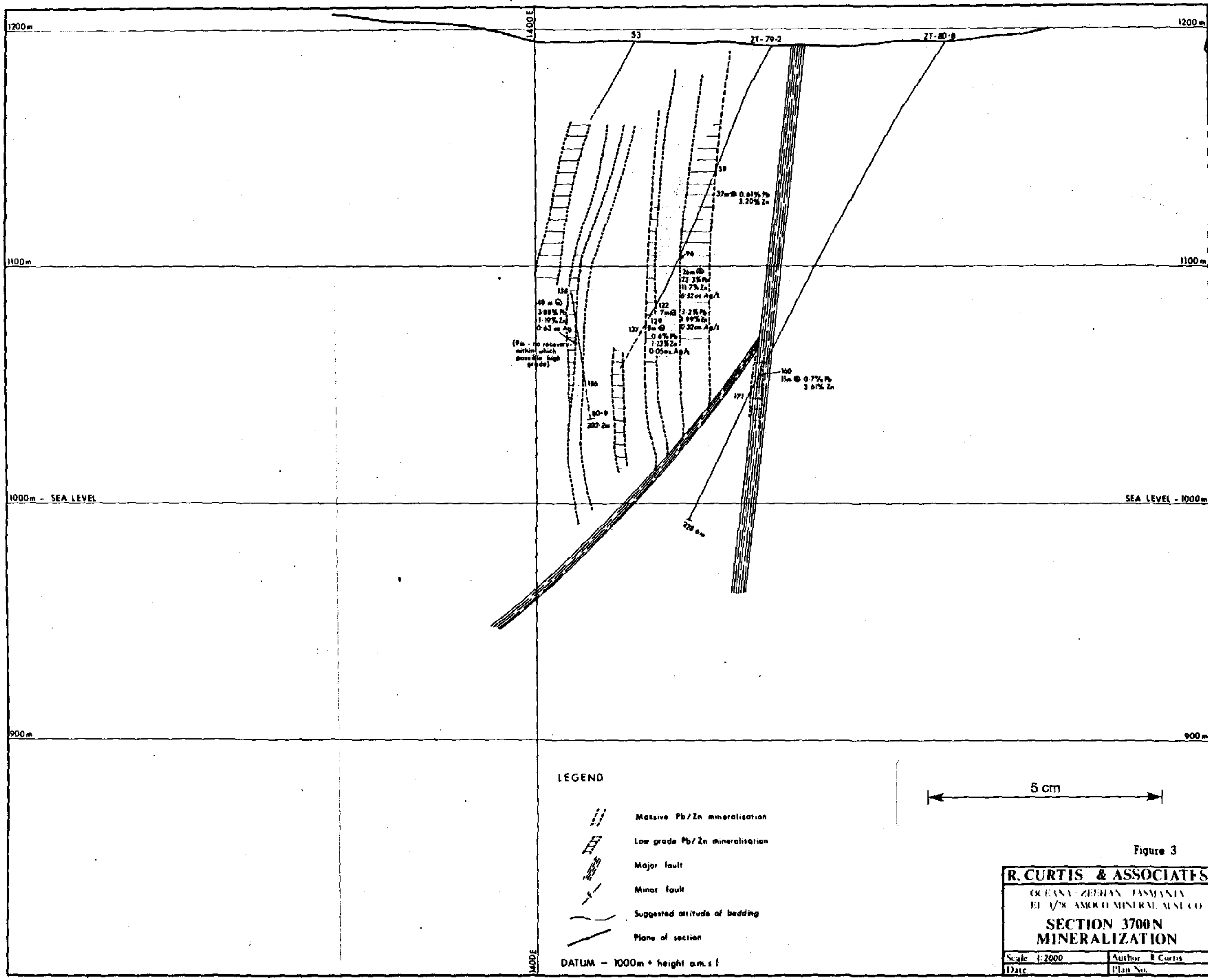
2. OCEANA MINE AREA

2.1 Preliminary Statement

In order to resolve as accurately as possible the attitude of the mineralization at the Oceana Mine, all data on the 39 surface collared drill holes put down by NBH, and on the Amoco drill holes, have been used to construct a set of 15 sections and 14 plans at a scale of 1:1,000, through the Oceana Mine.

The sections are aligned along Amoco's grid east-west (228° true), face north and have a 25m north south separation between 3700 N and 3400 N inclusive. One further section is provided for 3200 N to illustrate data from DDH ZT-80-3 (Figures 3-17)

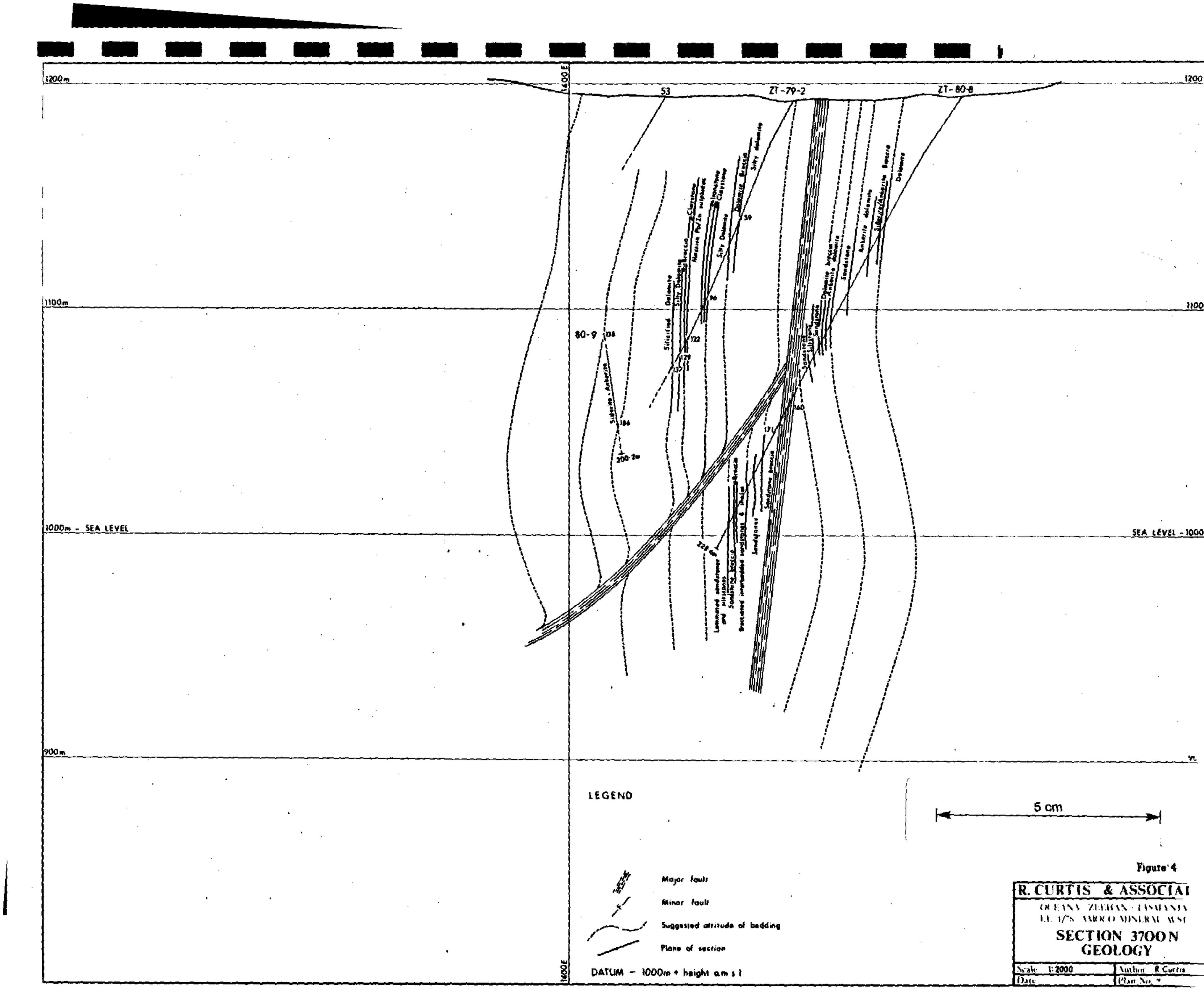
The plans have a 25m vertical separation from the 1200m to the 900m reference levels inclusive, and a surface plan is provided showing a projection of all the diamond drilling. Datum is taken as 1000m plus height above mean sea level (Figures 18-31).



1200m
1400 E
53
ZT-79-2
ZT-80-8
1200m
39
37m @ 0.61% Pb
3.20% Zn
96
1100m
26m @
22.3% Pb
11.7% Zn
6.52oz Ag/t
136
48 m @
3.88% Pb
1.19% Zn
0.63 oz Ag
122
7m @
3.2% Pb
3.99% Zn
0.32oz Ag/t
129
137
8m @
0.6% Pb
1.12% Zn
0.05oz Ag/t
(9m - no recovery - within which possible high grade)
1100m
160
11m @ 0.7% Pb
3.61% Zn
171
186
80-9
200.2m
1000m - SEA LEVEL
SEA LEVEL - 1000m
228.6m
900m
900m
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM - 1000m + height a.m.s.l
1400E
5 cm

Figure 3

R. CURTIS & ASSOCIATES
OCEANA - ZEEHAN - TASMANIA
EL 1/78 AMOCO MINERAL AUST CO
SECTION 3700N
MINERALIZATION
Scale 1:2000
Author R Curtis
Date
Plan No.


1200m
1100m
1000m - SEA LEVEL
SEA LEVEL - 1000m
900m
1600E
53
ZT-79-2
ZT-80-8
80-9
Siliceous Dolomite
Silty Dolomite
Breccia
Claystone
Massive Pb/Zn sulphides
Siltstone
Claystone
Silty Dolomite
Dolomite Breccia
Silty dolomite
Sandstone
Siltstone
Dolomite breccia
Ankerite dolomite
Siderite/Ankerite Breccia
Dolomite
Siderite - Ankerite
Laminated sandstones and siltstones
Sandstone breccia
Brecciated interbedded sandstones & shales
Sandstones
Sandstone breccia
LEGEND
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM - 1000m + height a.m.s.l
5 cm
Figure 4
R. CURTIS & ASSOCIAT
SECTION 3700 N
GEOLOGY
Scale 1:2000
Author R Curtis
Date
Plan No.

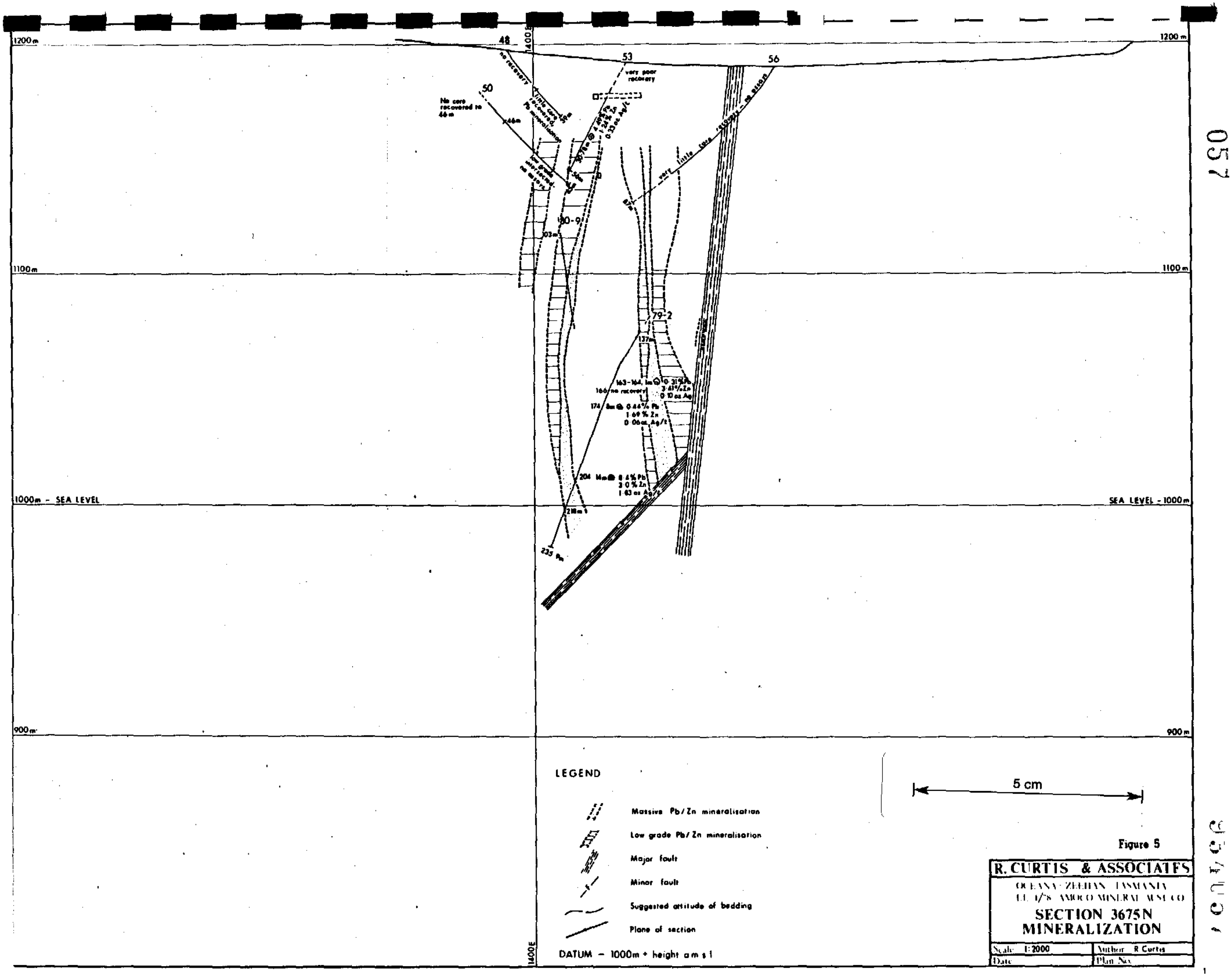


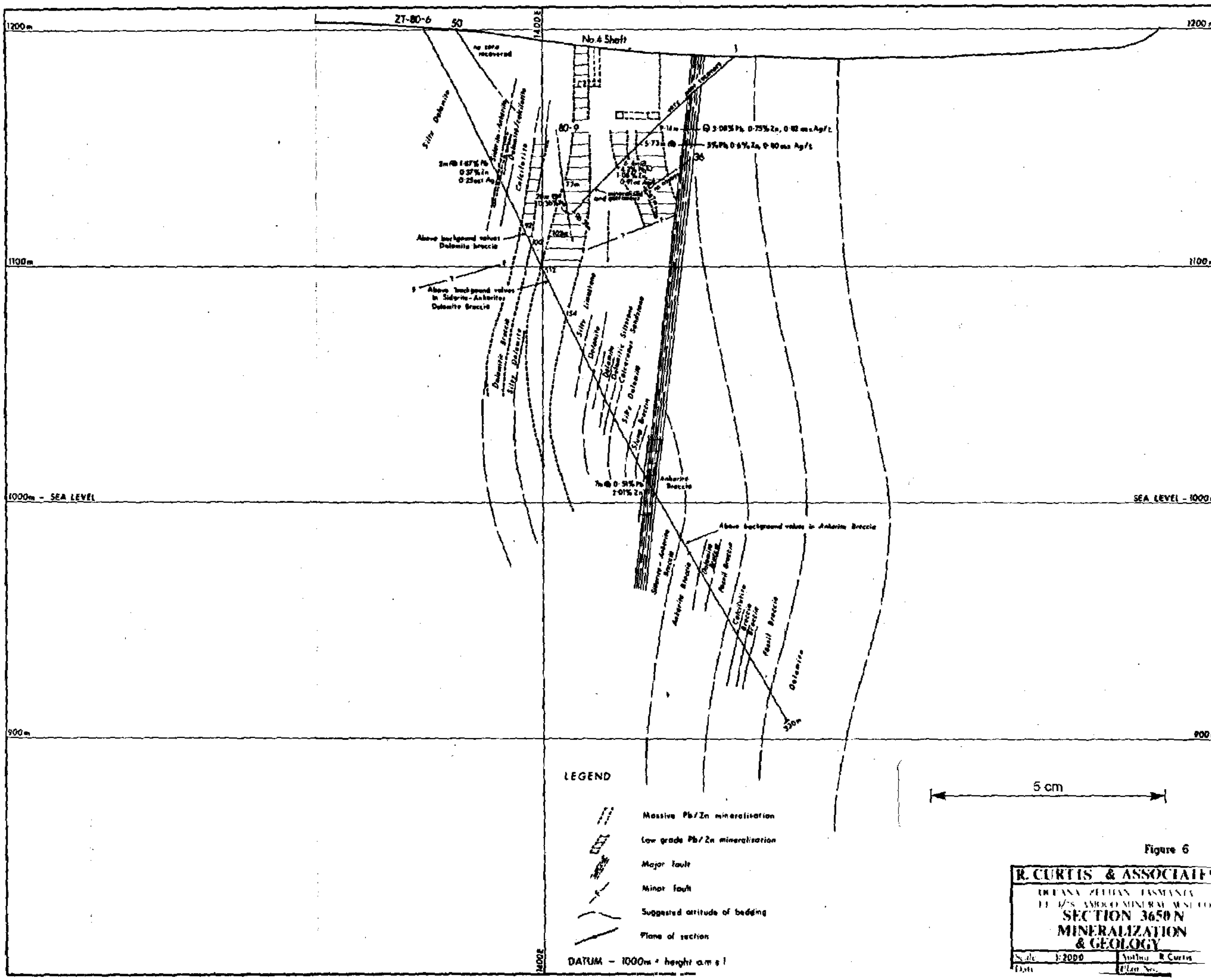
Figure 5

R. CURTIS & ASSOCIATES

OCEANA - ZEEHAN TASMANIA
EL 1/78 AMOCO MINERALS AUST CO

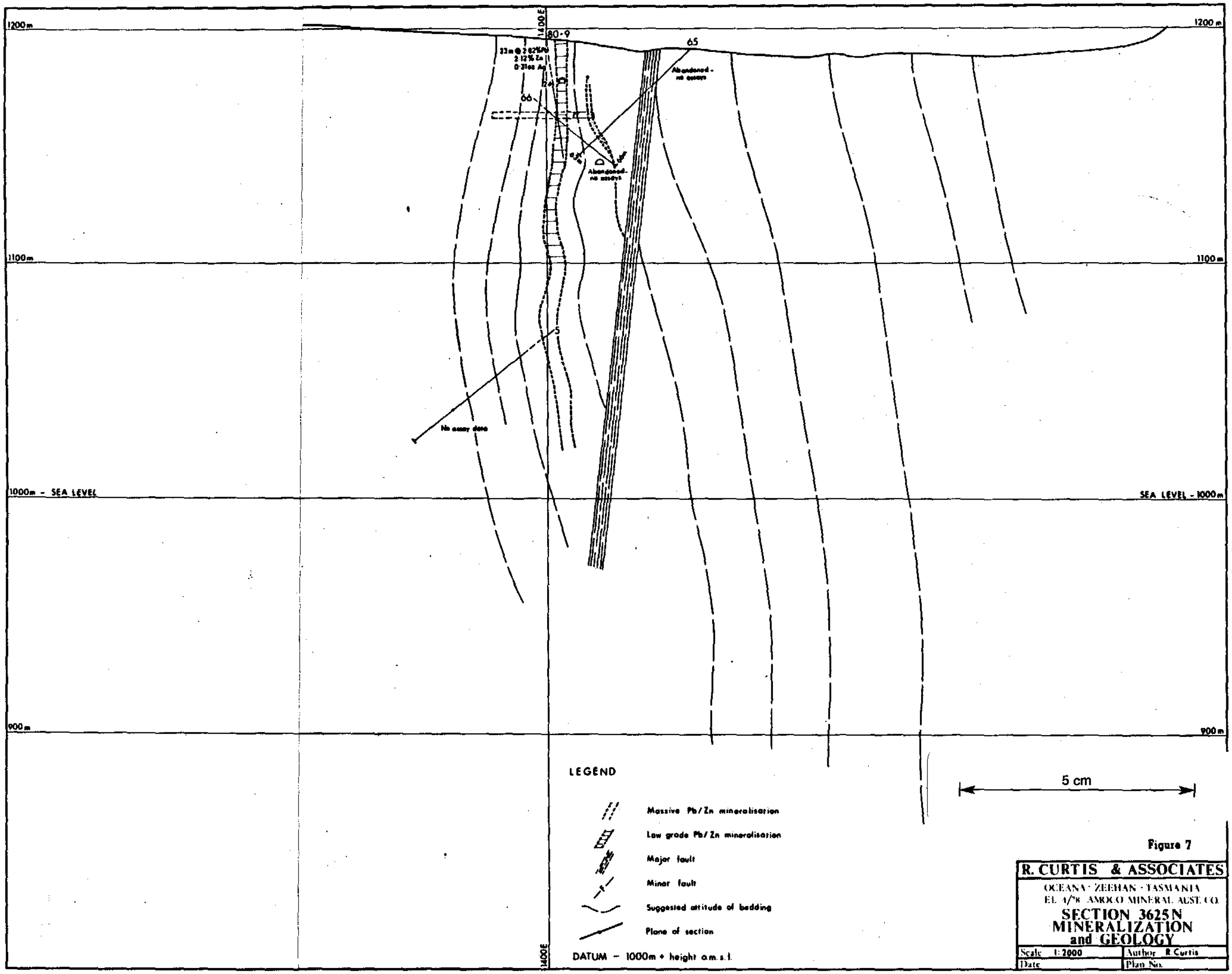
SECTION 3675N
MINERALIZATION

Scale 1:2000	Author R Curtis
Date	Plan No.

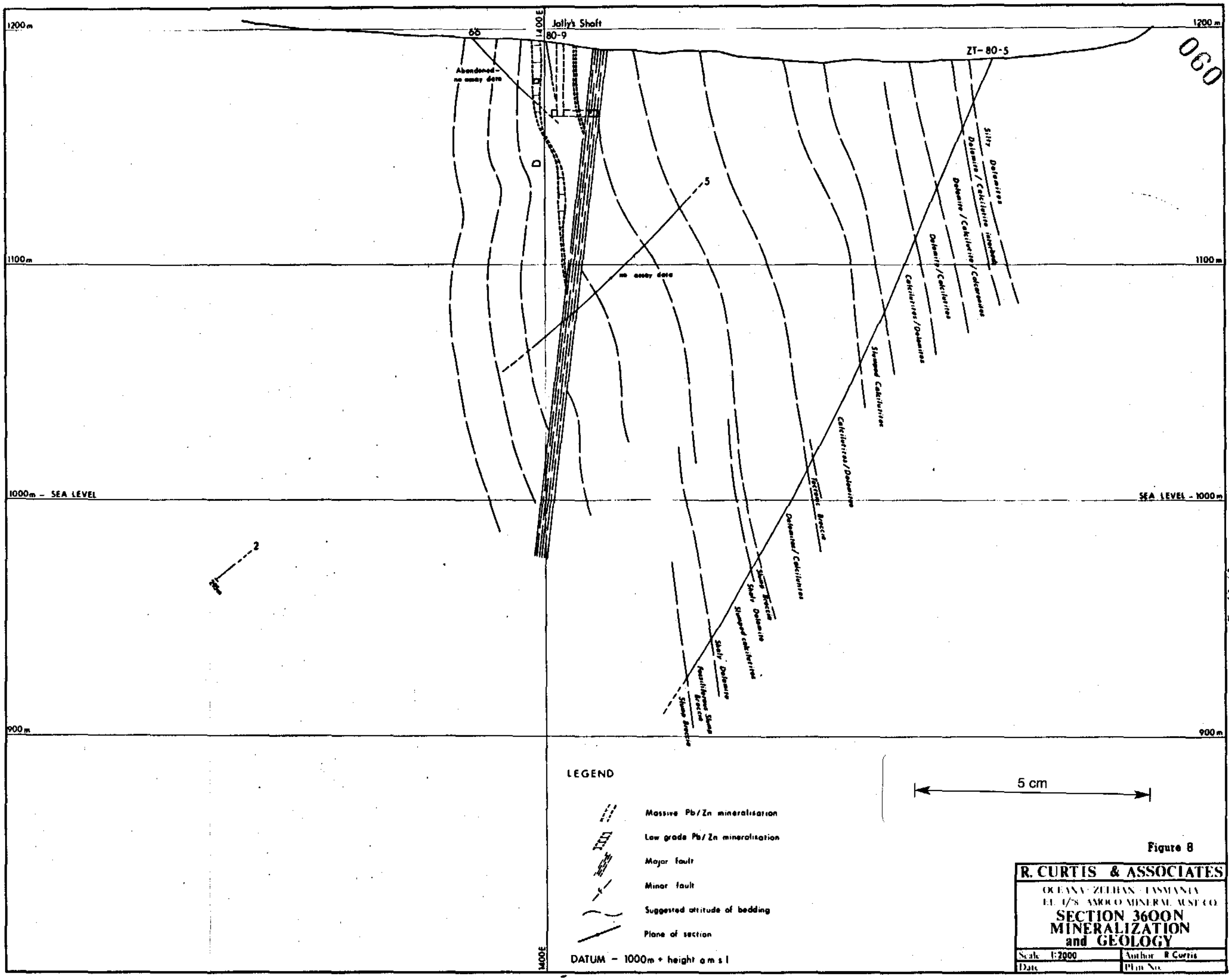


ZT-80-6
50
No.4 Shaft
1400E
1200m
1100m
1000m - SEA LEVEL
SEA LEVEL - 1000m
900m
no core recovered
Silty Dolomite
Calcilutite
80-9
3m @ 1.67% Pb 0.37% Zn 0.25oz Ag/t
9.14m @ 3.08% Pb, 0.75% Zn, 0.80 ozs Ag/t
5.73m @ 5% Pb 0.6% Zn, 0.80 ozs Ag/t
36
Above background values Dolomite breccia
Above background values in Siderite-Ankerites Dolomite Breccia
154
Silty Limestone
Dolomitic Breccia
Silty Dolomite
Dolomite
Dolomitic Siltstone
Calcareous Sandstone
Silty Dolomite
Anker Breccia
7m @ 0.51% Pb 2.01% Zn
Ankerite Breccia
Above background values in Ankerite Breccia
Ankerite Breccia
Fossil Breccia
Calcilutite
Dolomite
330m
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM - 1000m + height a.m.s.l
5 cm
R. CURTIS & ASSOCIATES
SECTION 3650 N
MINERALIZATION & GEOLOGY
Scale 1:2000
R Curtis
Date
Plan No.

Figure 6



1200m
1100m
1000m - SEA LEVEL
SEA LEVEL - 1000m
900m
1400E
80·9
65
66
33m @ 2·02% Pb
2·12% Zn
0·31oz Ag
Abandoned - no assays
Abandoned - no assays
No assay data
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM – 1000m + height a.m.s.l.
5 cm
Figure 7
R. CURTIS & ASSOCIATES
OCEANA - ZEEHAN - TASMANIA
EL 4/78 AMOCO MINERAL AUST. CO.
SECTION 3625N
MINERALIZATION
and GEOLOGY
Scale 1:2000
Author R.Curtis
Date
Plan No.



Jolly's Shaft
80-9
1400E
66
Abandoned - no assay data
ZT-80-5
D
5
no assay data
1200 m
1100 m
1000 m - SEA LEVEL
SEA LEVEL - 1000 m
900 m
2
Silty Dolomites
Dolomite / Calcilutite interbeds
Dolomite / Calcilutite / Calcareous
Dolomite / Calcilutites
Calcilutites / Dolomites
Slumped Calcilutites
Calcilutites / Dolomites
Tectonic Breccia
Dolomites / Calcilutites
Slump Breccia
Shaly Dolomite
Slumped calcilutites
Shaly Dolomite
Fossiliferous Slump Breccia
Slump Breccia
1400E
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM - 1000m + height a m s l
5 cm
Figure 8
R. CURTIS & ASSOCIATES
OCEANA - ZEEHAN - TASMANIA
EL 1/78 AMOCO MINERAL AUST CO.
SECTION 3600N
MINERALIZATION and GEOLOGY
Scale 1:2000
Author R Curtis
Date
Plan No.
060

934060

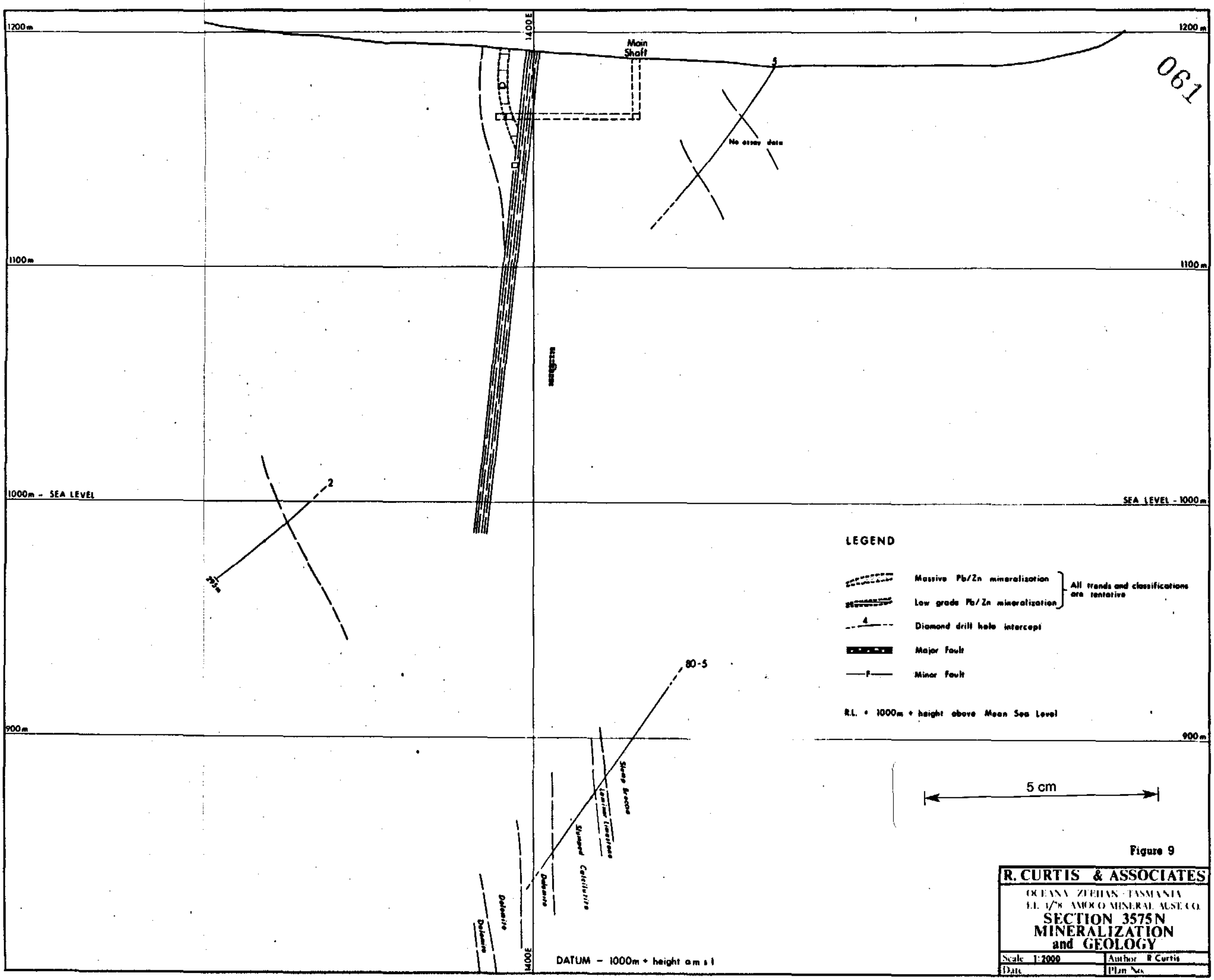


Figure 9

061

934061

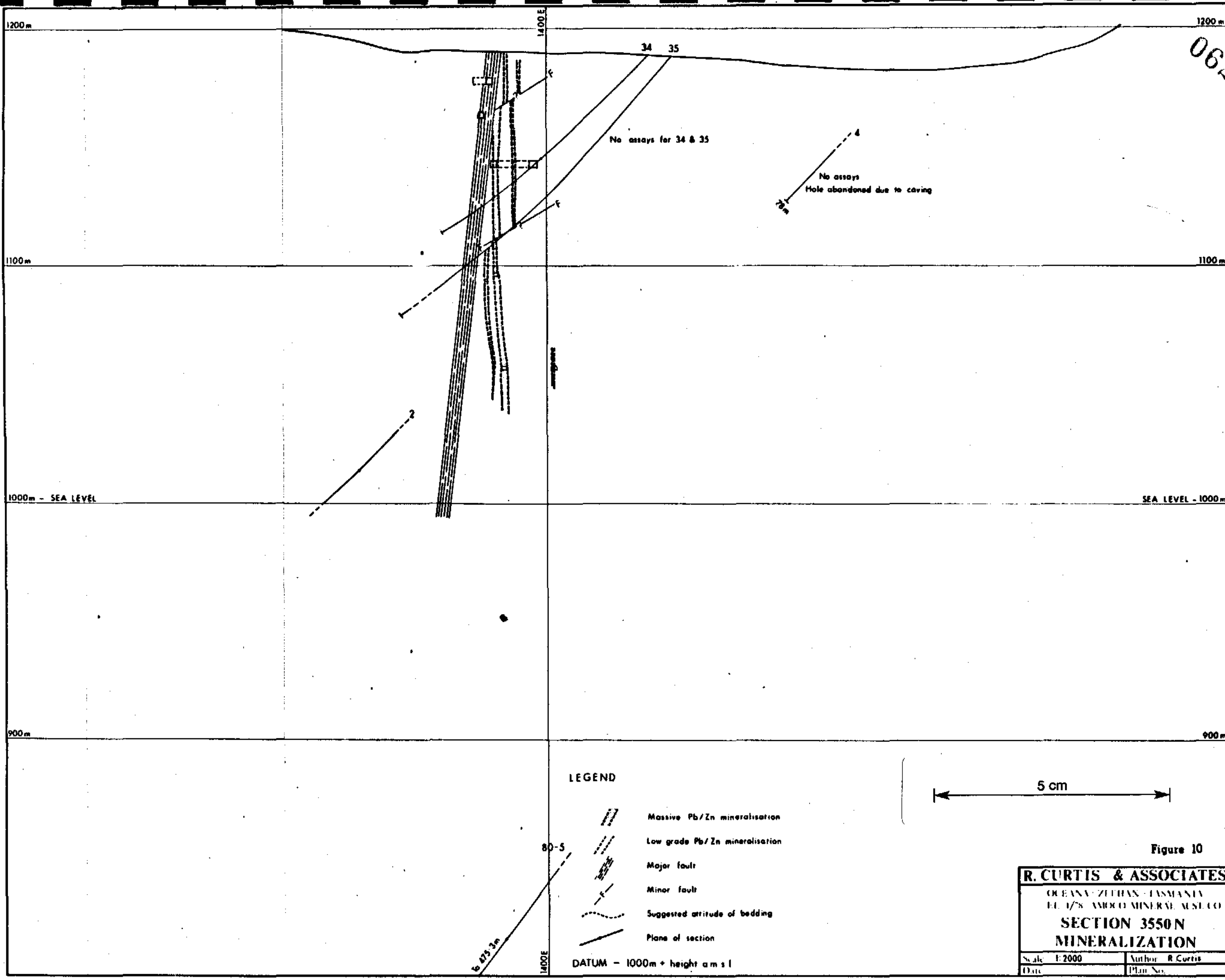


Figure 10

R. CURTIS & ASSOCIATES

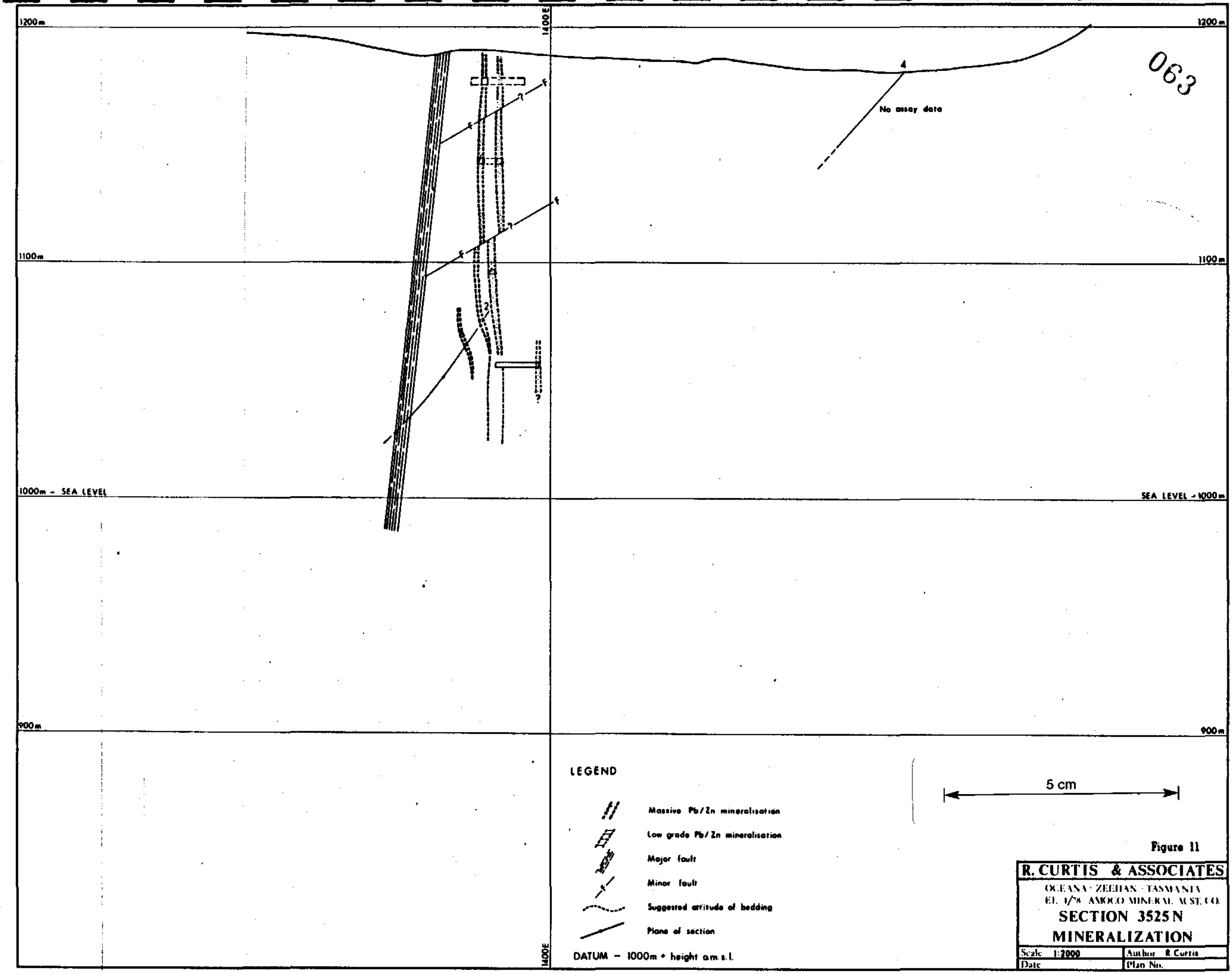
SECTION 3550 N MINERALIZATION

Scale 1:2000 | Author R Curtis

Date | Plan No.

062

93062



063
1200m
1400E
1200m
4
No assay data
1100m
1100m
1000m - SEA LEVEL
SEA LEVEL - 1000m
900m
900m
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM - 1000m + height a.m.s.l.
1400E
5 cm
Figure 11
R. CURTIS & ASSOCIATES
OCEANA · ZEEHAN · TASMANIA
EL 4/78 AMOCO MINERAL AUST. CO.
SECTION 3525 N
MINERALIZATION
Scale 1:2000
Author R. Curtis
Date
Plan No.

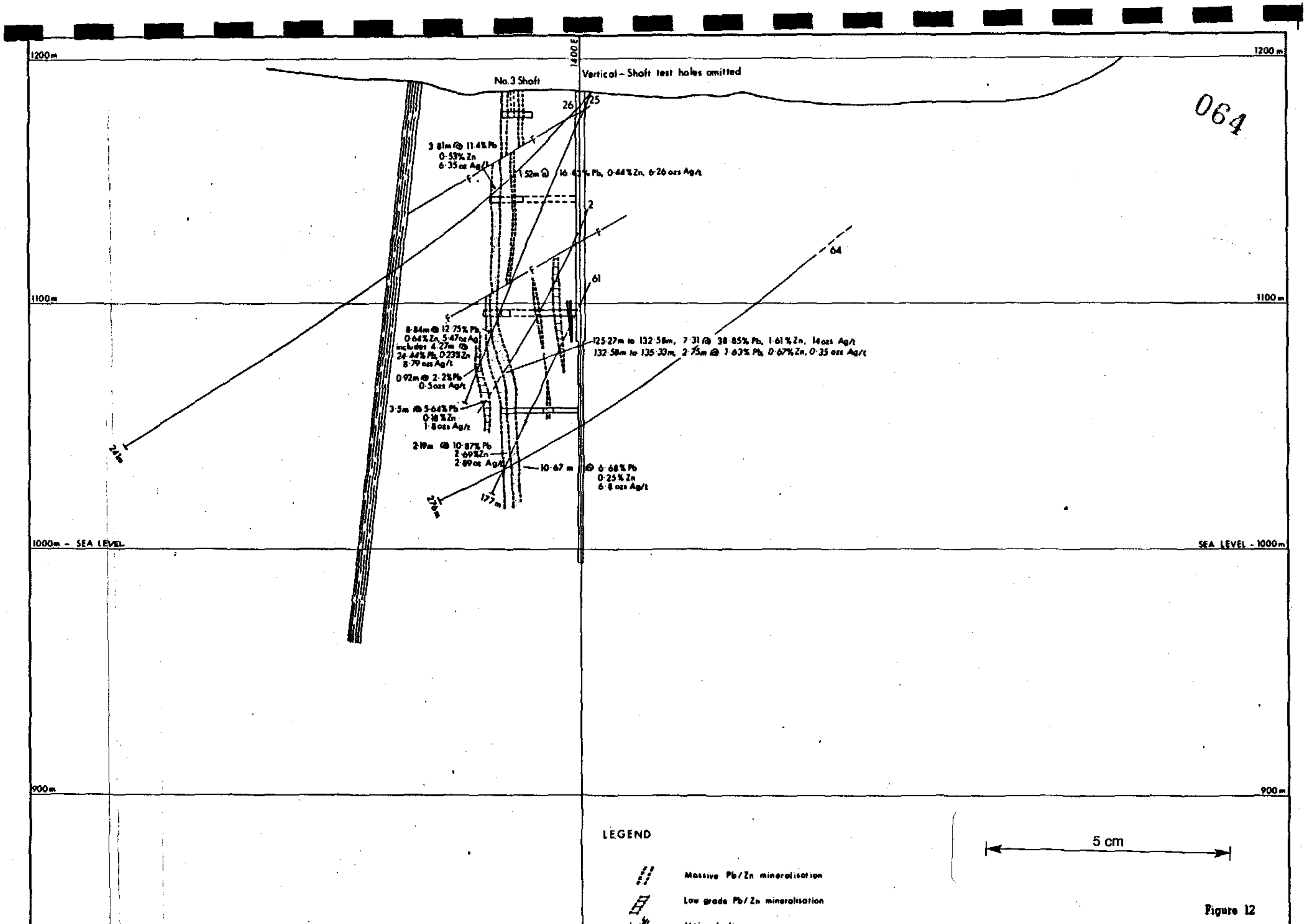


Figure 12

R. CURTIS & ASSOCIATES

OCEANA · ZEEHAN · TASMANIA

SECTION 3500N
MINERALISATION

Scale 1:2000	Author R.Curtis
Date	Plan No

9340064

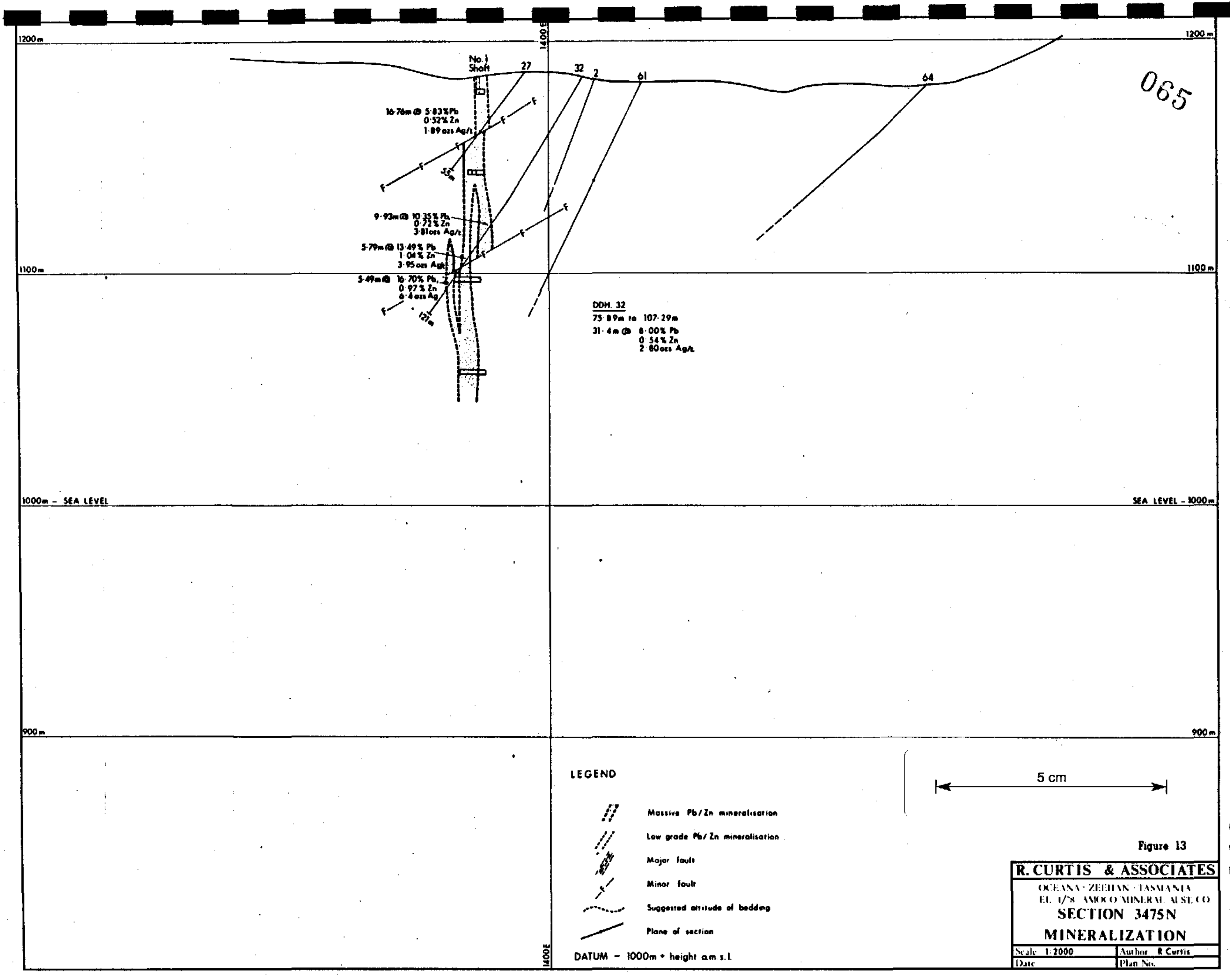


Figure 13

R. CURTIS & ASSOCIATES

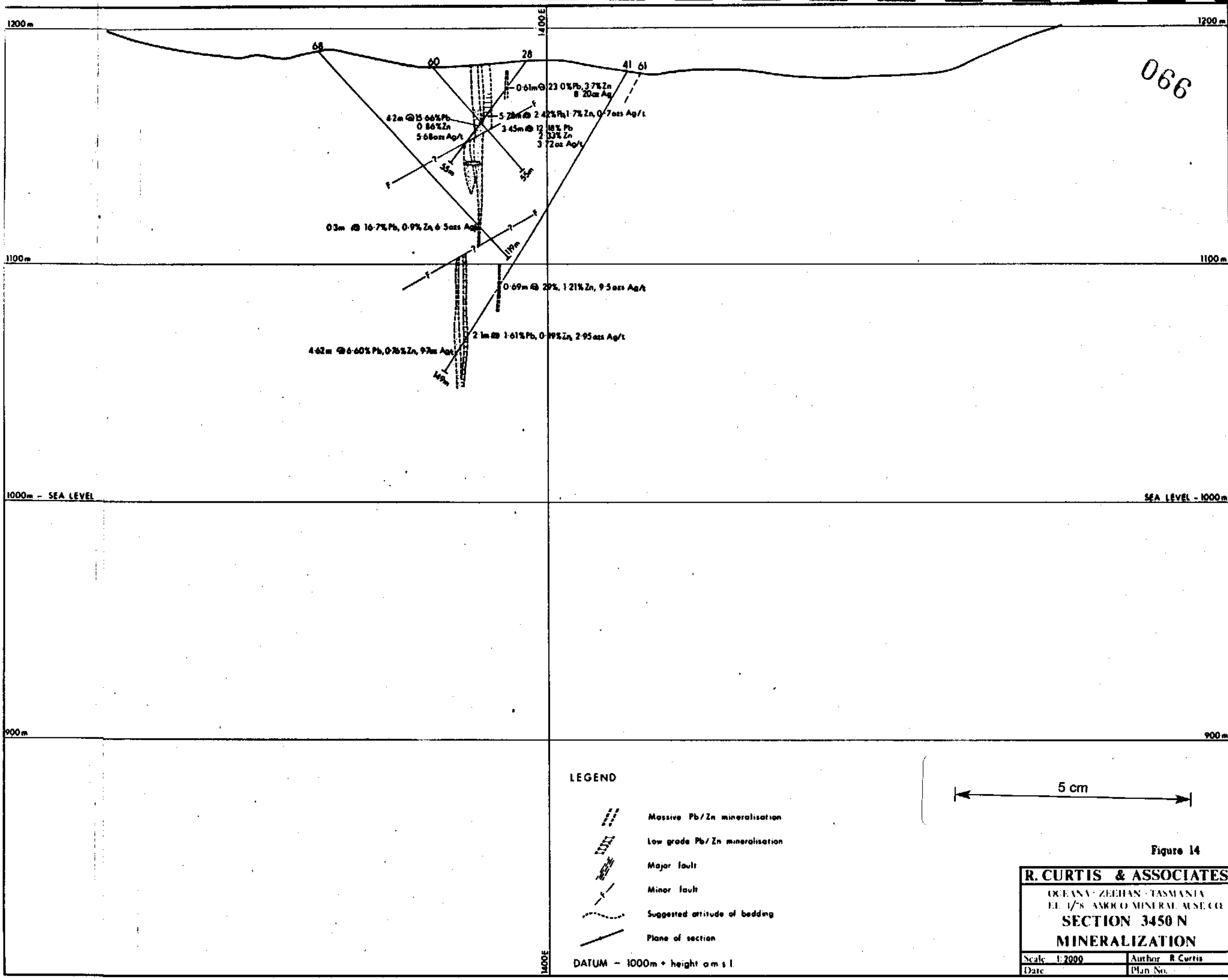
OCEANA - ZEEHAN - TASMANIA

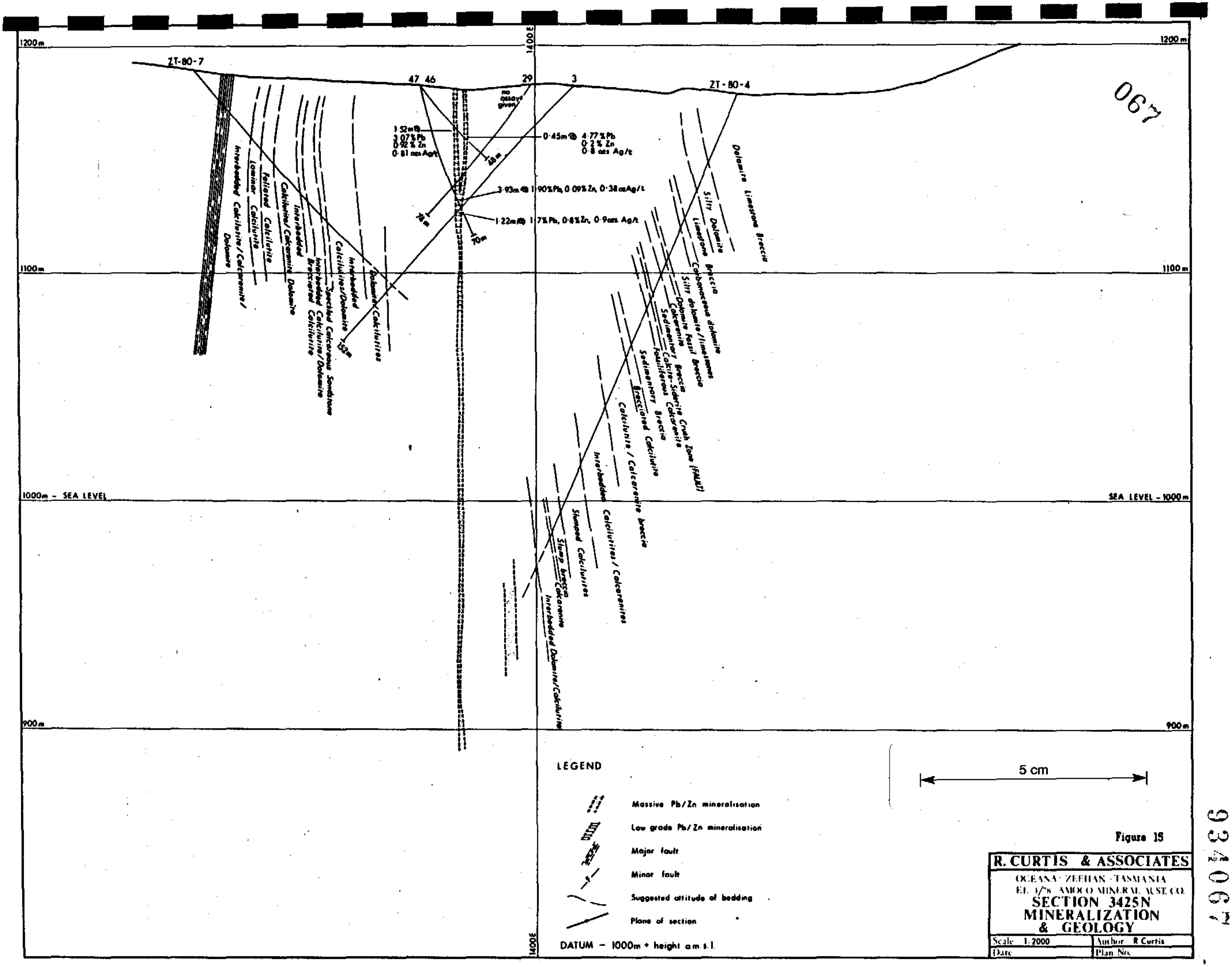
EL 1/78 AMOCO MINERAL AUST. CO.

SECTION 3475N

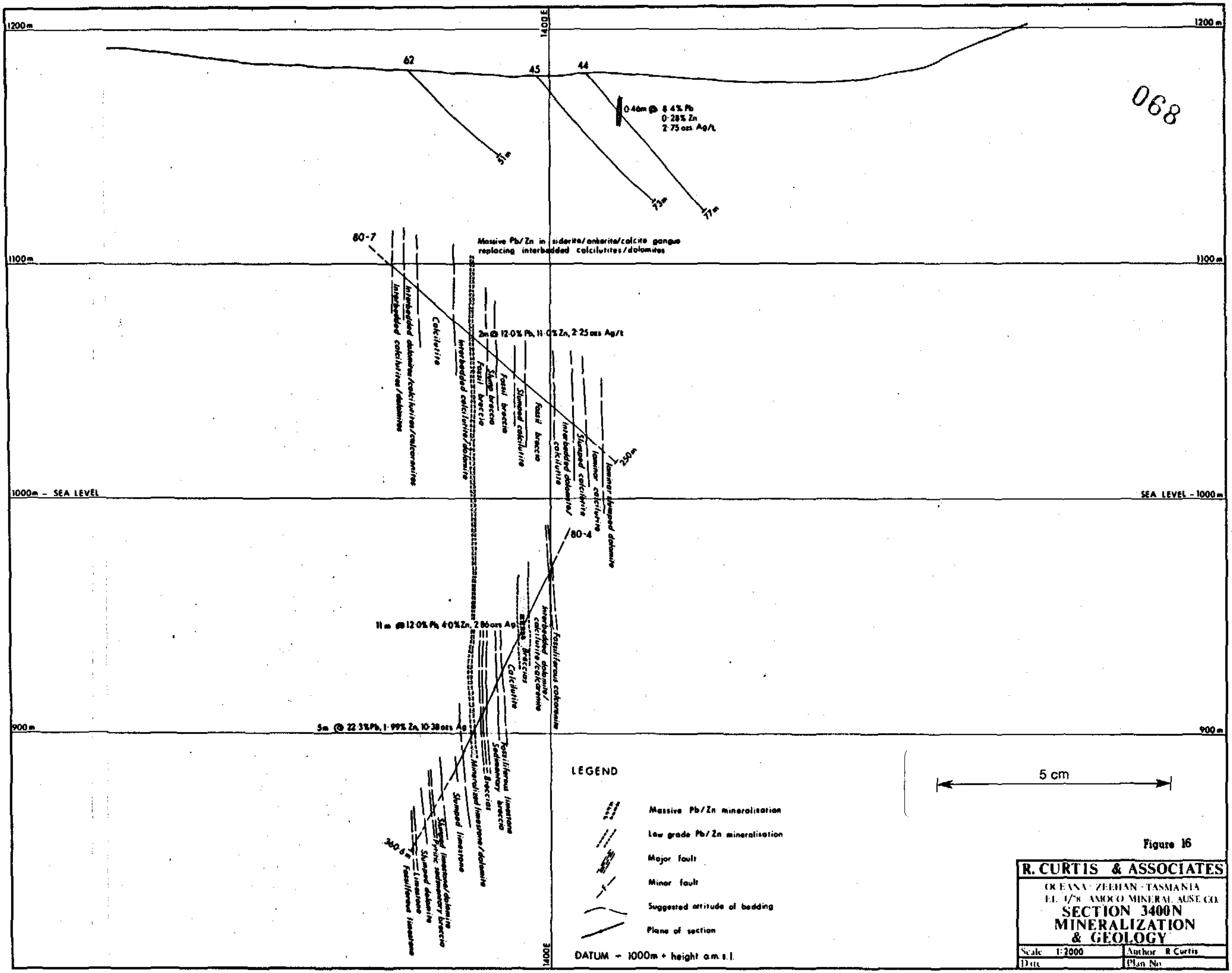
MINERALIZATION

Scale 1:2000	Author R Curtis
Date	Plan No.

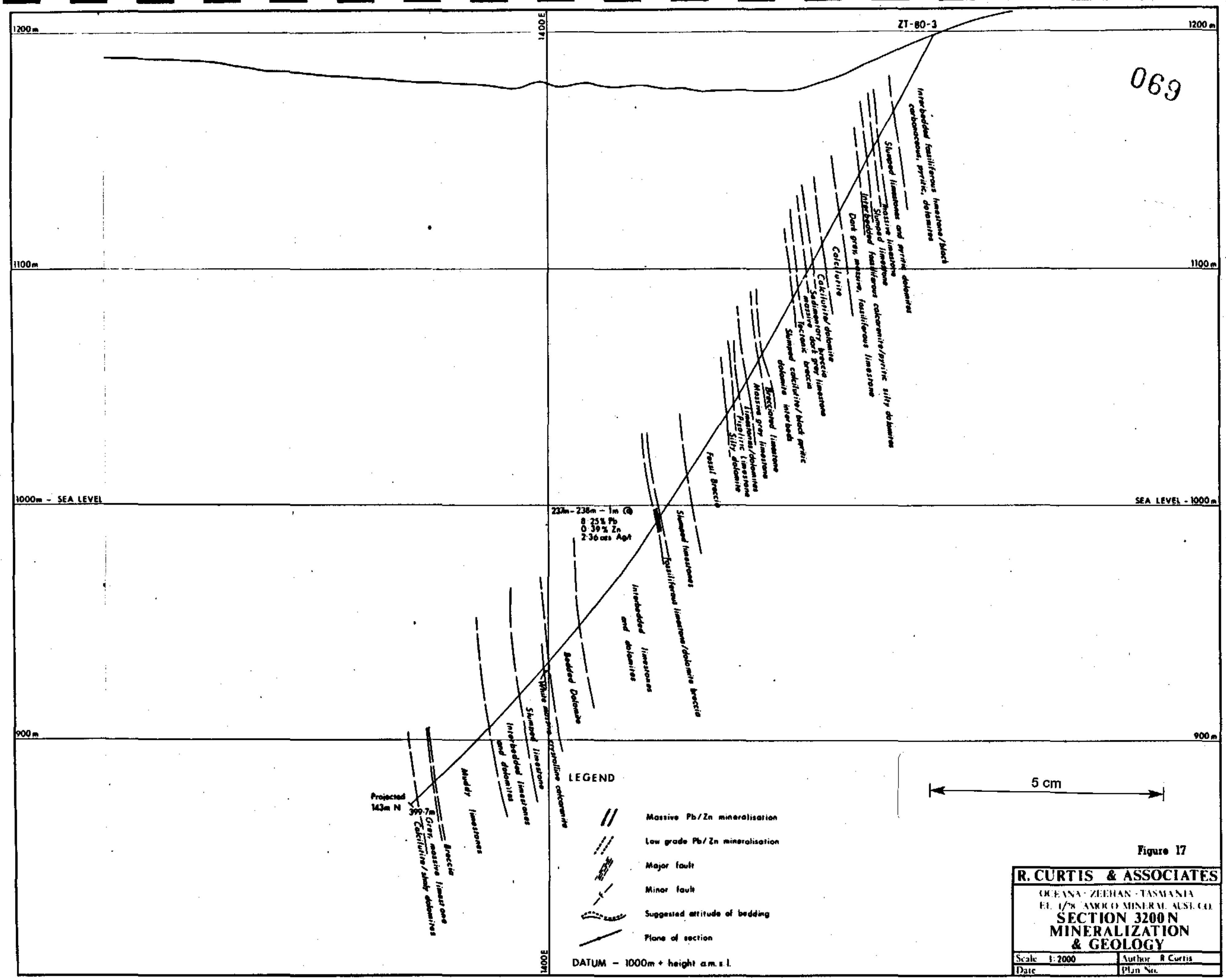

1200 m
1400 E
68
60
28
41
61
0·61m @ 23·0% Pb, 3·7% Zn
8·20oz Ag
4·2m @ 15·66% Pb
0·86% Zn
5·68ozs Ag/t
5·78m @ 2·42% Pb, 1·7% Zn, 0·7ozs Ag/t
3·45m @ 12·18% Pb
2·33% Zn
3·72oz Ag/t
55m
55m
0·3m @ 16·7% Pb, 0·9% Zn, 6·5ozs Ag/t
119m
1100 m
0·69m @ 29%, 1·21% Zn, 9·5ozs Ag/t
2·1m @ 1·61% Pb, 0·19% Zn, 2·95ozs Ag/t
4·62m @ 6·60% Pb, 0·76% Zn, 9·7ozs Ag/t
149m
1000m – SEA LEVEL
SEA LEVEL – 1000m
900 m
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM – 1000m + height a m s l.
5 cm
Figure 14
R. CURTIS & ASSOCIATES
OCEANA · ZEEHAN · TASMANIA
EL 1/78 AMOCO MINERAL AUST. CO.
SECTION 3450 N
MINERALIZATION
Scale 1:2000
Author R. Curtis
Date
Plan No.


1200m
1400E
ZT-80-7
47 46
29
3
ZT-80-4
067
no assays given
1·52m @ 3·07% Pb 0·92% Zn 0·81 ozs Ag/t
0·45m @ 4·77% Pb 0·2% Zn 0·8 ozs Ag/t
3·93m @ 1·90% Pb, 0·09% Zn, 0·38 ozs Ag/t
1·22m @ 1·7% Pb, 0·8% Zn, 0·9 ozs Ag/t
Interbedded Calcilutite/Calcarenite/Dolomite
Laminar Calcilutite
Foliated Calcilutite
Calcilutite/Calcarenite Dolomite
Interbedded Brecciated Calcilutite
Interbedded Calcilutite/Dolomite
Speckled Calcareous Sandstone
Calcilutites/Dolomite
Interbedded Dolomite/Calcilutites
Dolomite Limestone Breccia
Silty Dolomite
Limestone Breccia
Carbonaceous dolomite
Silty dolomite/limestones
Dolomite Fossil Breccia
Calcarenite
Sedimentary Breccia
Calcite-Siderite Crush Zone (FAULT)
Fossiliferous Calcarenite
Sedimentary Breccia
Brecciated Calcilutite
Calcilutite / Calcarenite breccia
Interbedded Calcilutites / Calcarenites
Slumped Calcilutites
Slump breccia
Calcarenite
Interbedded Dolomite/Calcilutite
1100m
1000m - SEA LEVEL
SEA LEVEL - 1000m
900m
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM - 1000m + height a.m.s.l.
5 cm
Figure 15
R. CURTIS & ASSOCIATES
OCEANA - ZEEHAN - TASMANIA
EL 1/78 AMOCO MINERAL AUST. CO.
SECTION 3425N
MINERALIZATION & GEOLOGY
Scale 1:2000
Author R Curtis
Date
Plan No.
93/067

068


1200m
1400E
62
45
44
0·46m @ 8·4% Pb
0·28% Zn
2·75 ozs Ag/t
51m
73m
77m
80-7
Massive Pb/Zn in siderite/ankerite/calcite gangue replacing interbedded calcilutites/dolomites
1100m
2m @ 12·0% Pb, 11·0% Zn, 2·25 ozs Ag/t
Interbedded calcilutites/dolomites
Interbedded dolomites/calcilutites/calcarenites
Calcilutite
Interbedded calcilutite/dolomite
Fossil breccia
Slump breccia
Slumped calcilutite
Interbedded dolomite/calcilutite
Slumped calcilutite
laminar calcilutite
laminar slumped dolomite
250m
1000m - SEA LEVEL
SEA LEVEL - 1000m
80-4
11m @ 12·0% Pb, 4·0% Zn, 2·86 ozs Ag
Breccias
Calcilutite
Interbedded dolomite/calcilutite/calcarenite
Fossiliferous calcarenite
900m
5m @ 22·3% Pb, 1·99% Zn, 10·38 ozs Ag
Fossiliferous limestone
Sedimentary breccia
Breccias
Mineralised limestone/dolomite
Slumped limestone
Slumped limestone/dolomite
Pyritic sedimentary breccia
Slumped dolomite
Limestone
Fossiliferous limestone
360·6m
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM = 1000m + height a.m.s.l.
5 cm
Figure 16
R. CURTIS & ASSOCIATES
OCEANA - ZEEHAN - TASMANIA
EL 1/78 AMOCO MINERAL AUST. CO.
SECTION 3400N
MINERALIZATION & GEOLOGY
Scale 1:2000
Author R Curtis
Date
Plan No.
1300E

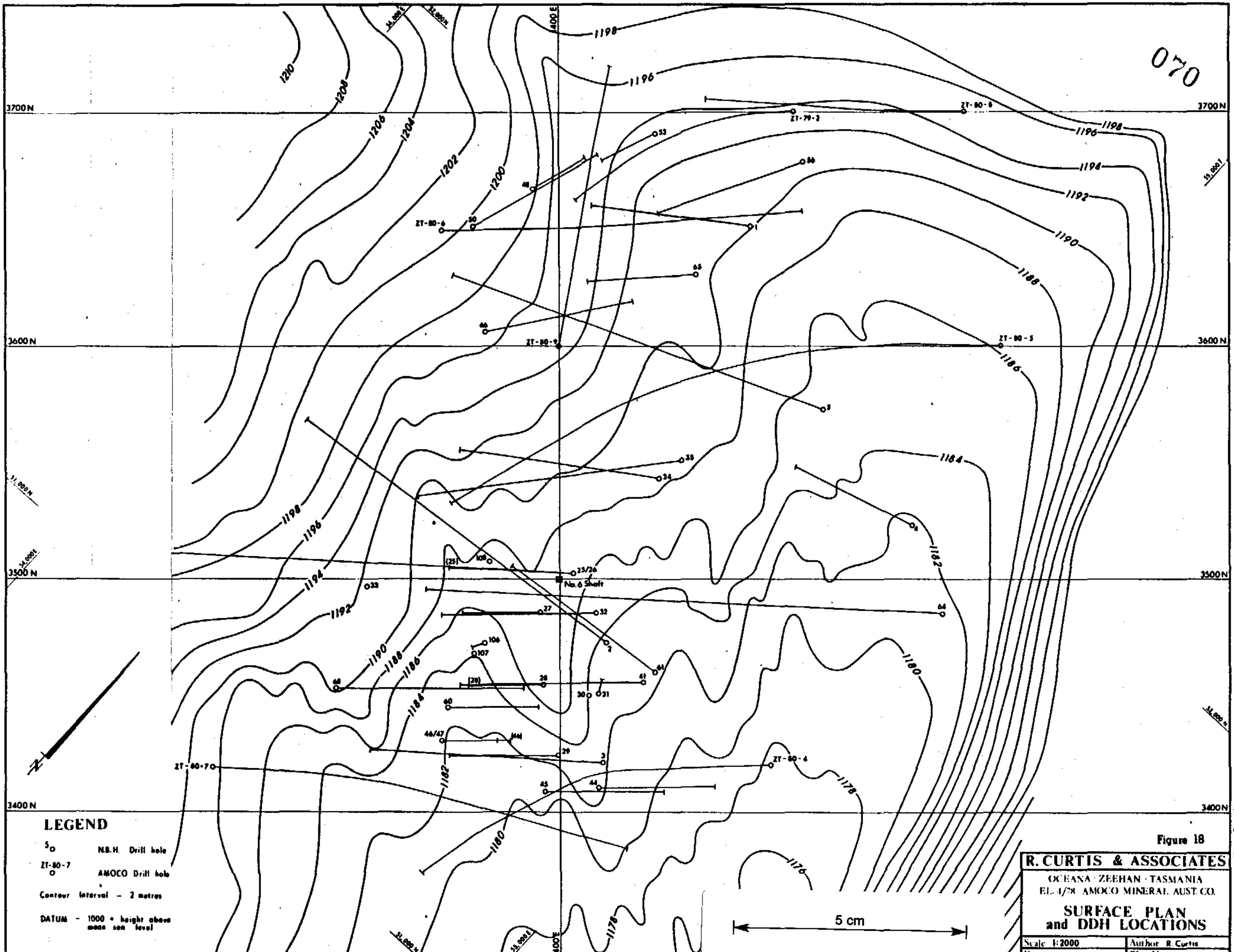
934068



ZT-80-3
1200 m
1100 m
1000 m - SEA LEVEL
SEA LEVEL - 1000 m
900 m
1400 E
069
237m - 238m - 1m @
8·25% Pb
0·39% Zn
2·36 ozs Ag/t
Projected
143m N
399·7m
Fossil Breccia
Stumped limestones
Fossiliferous limestone/dolomite breccia
Interbedded limestones and dolomites
Bedded Dolomite
Muddy limestones
Breccia
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralisation
Major fault
Minor fault
Suggested attitude of bedding
Plane of section
DATUM - 1000m + height a.m.s.l.
5 cm
R. CURTIS & ASSOCIATES
OCEANA - ZEEHAN - TASMANIA
E.L. 1/78 AMOCO MINERAL AUST. CO.
SECTION 3200 N
MINERALIZATION
& GEOLOGY
Scale 1:2000
Author R Curtis
Date
Plan No.
9340069

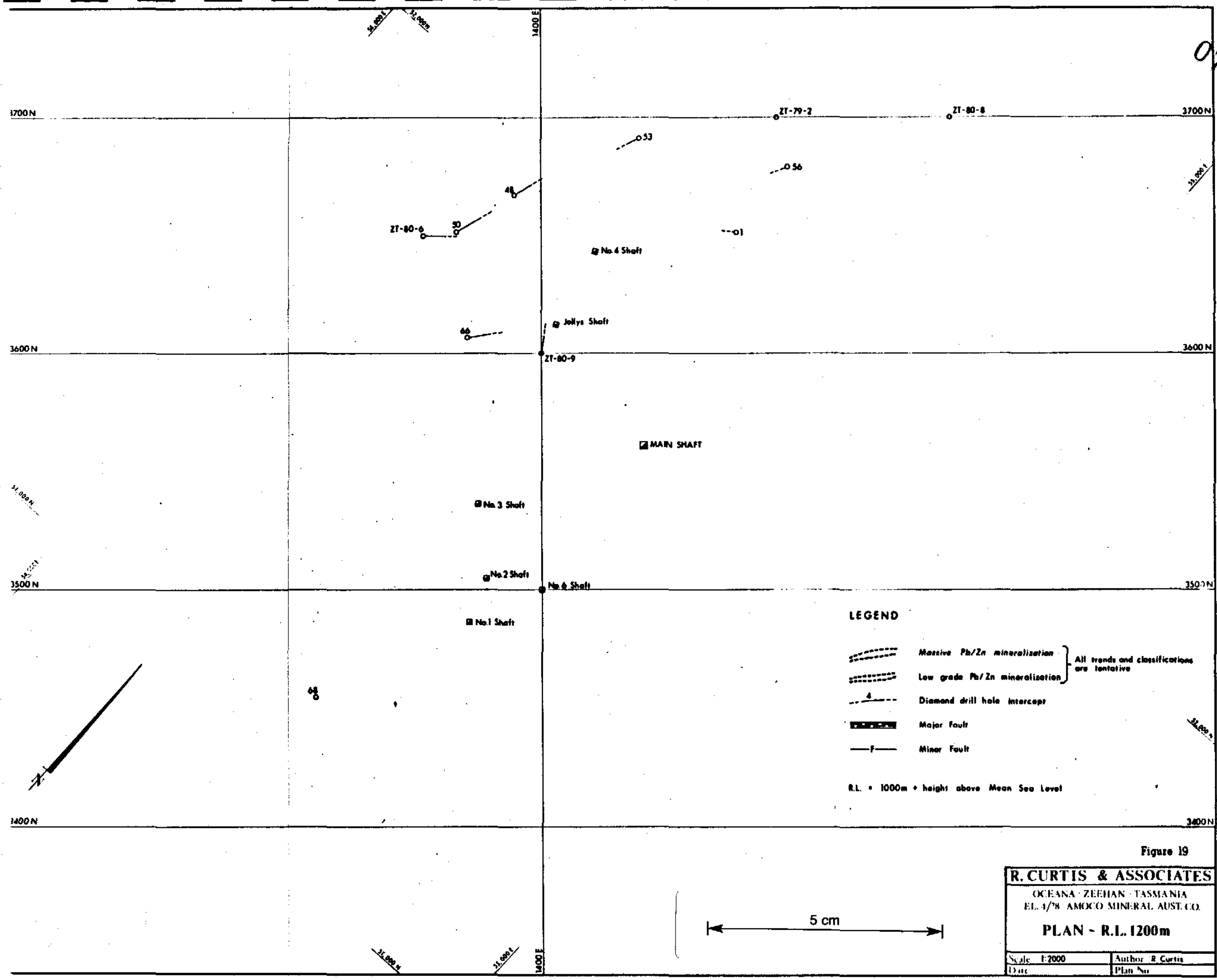
Figure 17

070



3700 N
3600 N
3500 N
3400 N
1400 E
No. 6 Shaft
LEGEND
N.B.H. Drill hole
ZT-80-7
AMOCO Drill hole
Contour interval - 2 metres
DATUM - 1000 + height above mean sea level
5 cm
Figure 18
R. CURTIS & ASSOCIATES
OCEANA · ZEEHAN · TASMANIA
EL 4/78 AMOCO MINERAL AUST. CO.
SURFACE PLAN
and DDH LOCATIONS
Scale 1:2000
Author R. Curtis
Date
Plan No

93070



1400 E
3700 N
3600 N
3500 N
3400 N
ZT-79-2
ZT-80-8
53
56
48
50
ZT-80-6
01
No. 4 Shaft
66
Jollys Shaft
ZT-80-9
MAIN SHAFT
No. 3 Shaft
No. 2 Shaft
No. 6 Shaft
No. 1 Shaft
68
LEGEND
Massive Pb/Zn mineralization
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
5 cm
R. CURTIS & ASSOCIATES
OCEANA · ZEEHAN · TASMANIA
EL 4/78 AMOCO MINERAL AUST. CO.
PLAN - R.L. 1200m
Scale 1:2000
Author R Curtis
Date
Plan No

Figure 19

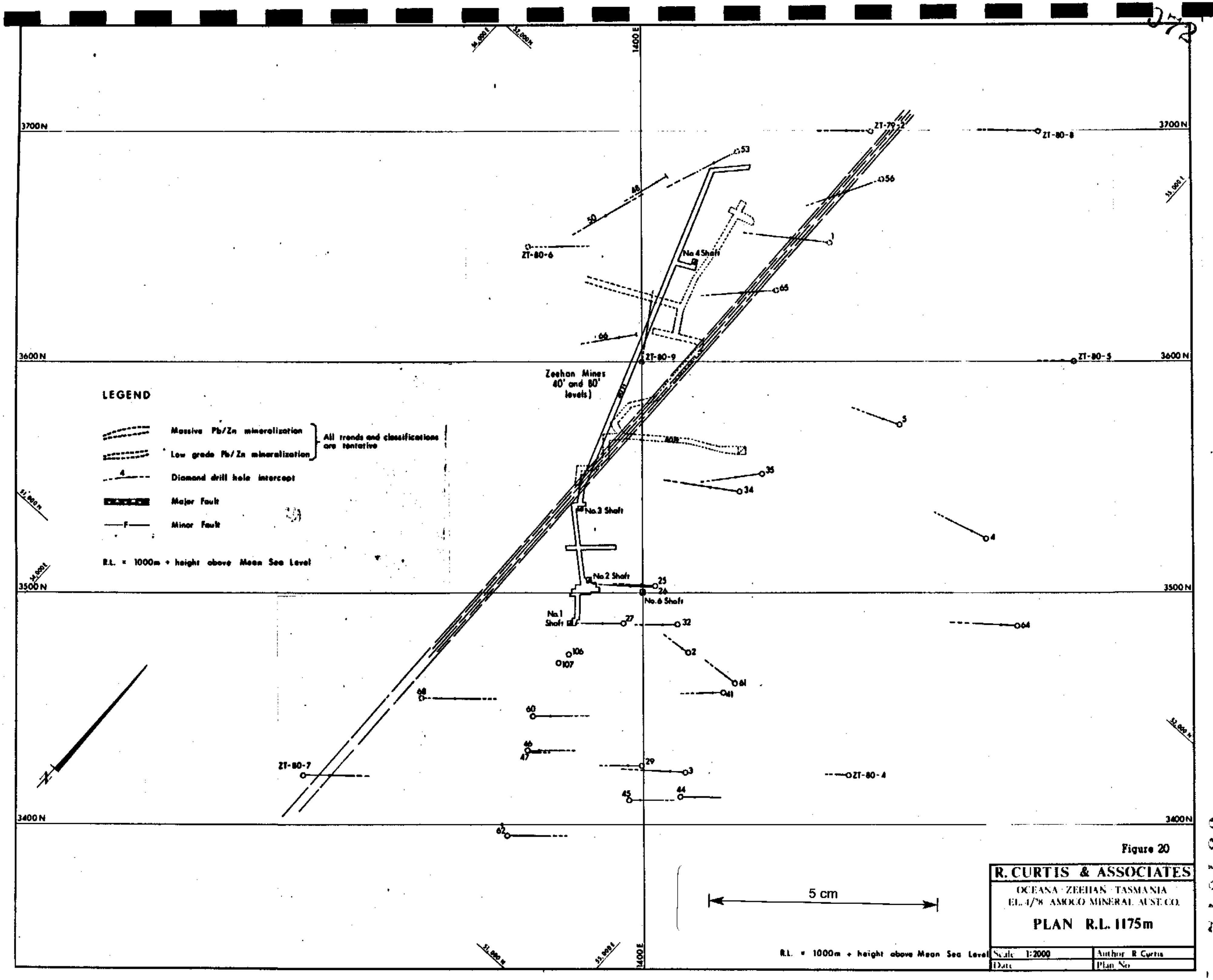
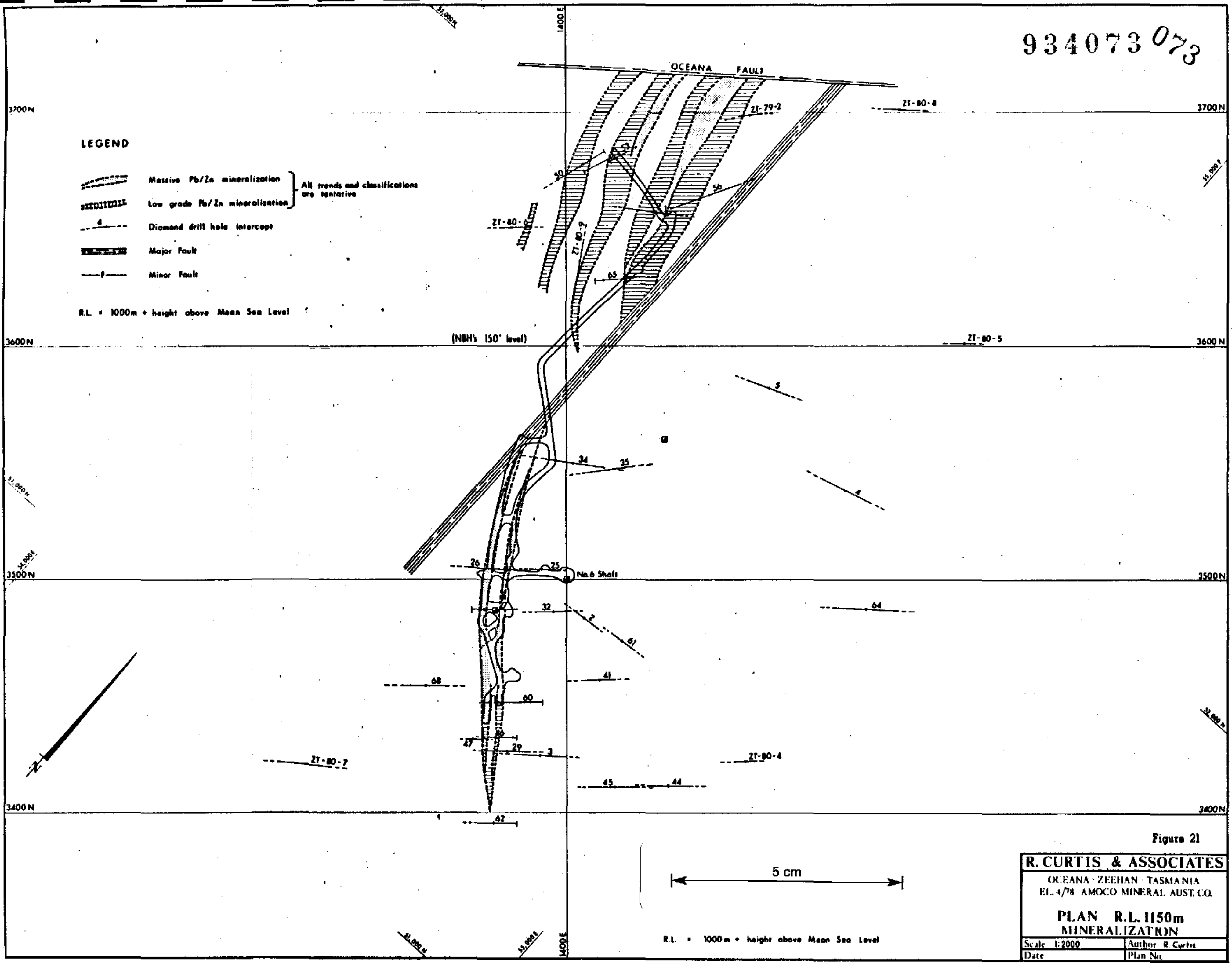


Figure 20

934072


934073 073
OCEANA FAULT
LEGEND
Massive Pb/Zn mineralization
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
(NBH's 150' level)
No.6 Shaft
ZT-80-8
ZT-79-2
ZT-80-6
ZT-80-9
ZT-80-5
ZT-80-7
ZT-80-4
3700N
3600N
3500N
3400N
1400E
5 cm
R.L. = 1000m + height above Mean Sea Level
Figure 21
R. CURTIS & ASSOCIATES
OCEANA · ZEEHAN · TASMANIA
EL 4/78 AMOCO MINERAL AUST. CO.
PLAN R.L. 1150m
MINERALIZATION
Scale 1:2000
Author R. Curtis
Date
Plan No.

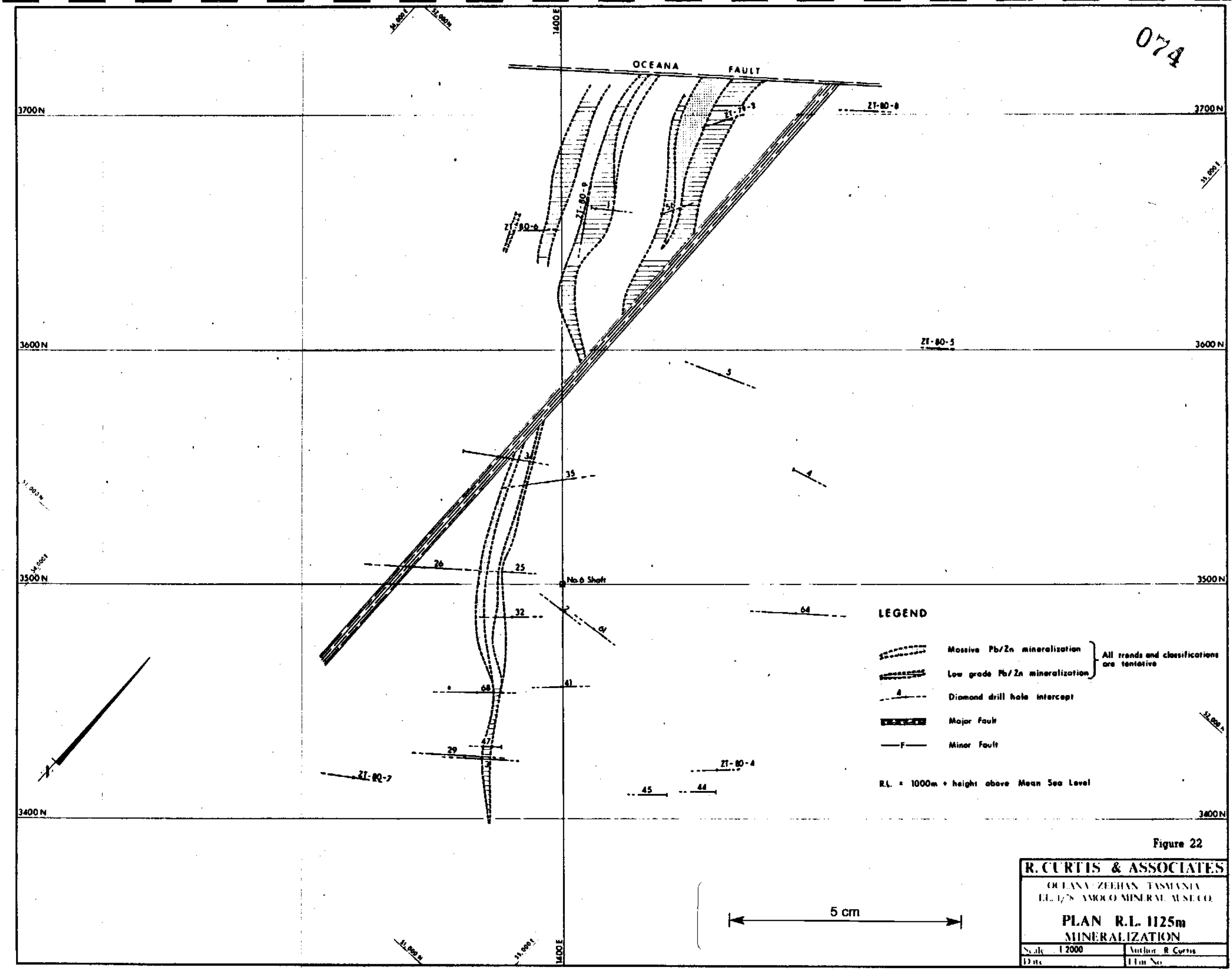

074
OCEANA FAULT
1400 E
3700 N
3600 N
3500 N
3400 N
ZT-80-8
ZT-80-5
ZT-80-6
ZT-80-9
ZT-80-4
ZT-80-7
No.6 Shaft
LEGEND
Massive Pb/Zn mineralization
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
5 cm
R. CURTIS & ASSOCIATES
PLAN R.L. 1125m
MINERALIZATION
Scale 1:2000
Author R. Curtis
93074

Figure 22

075

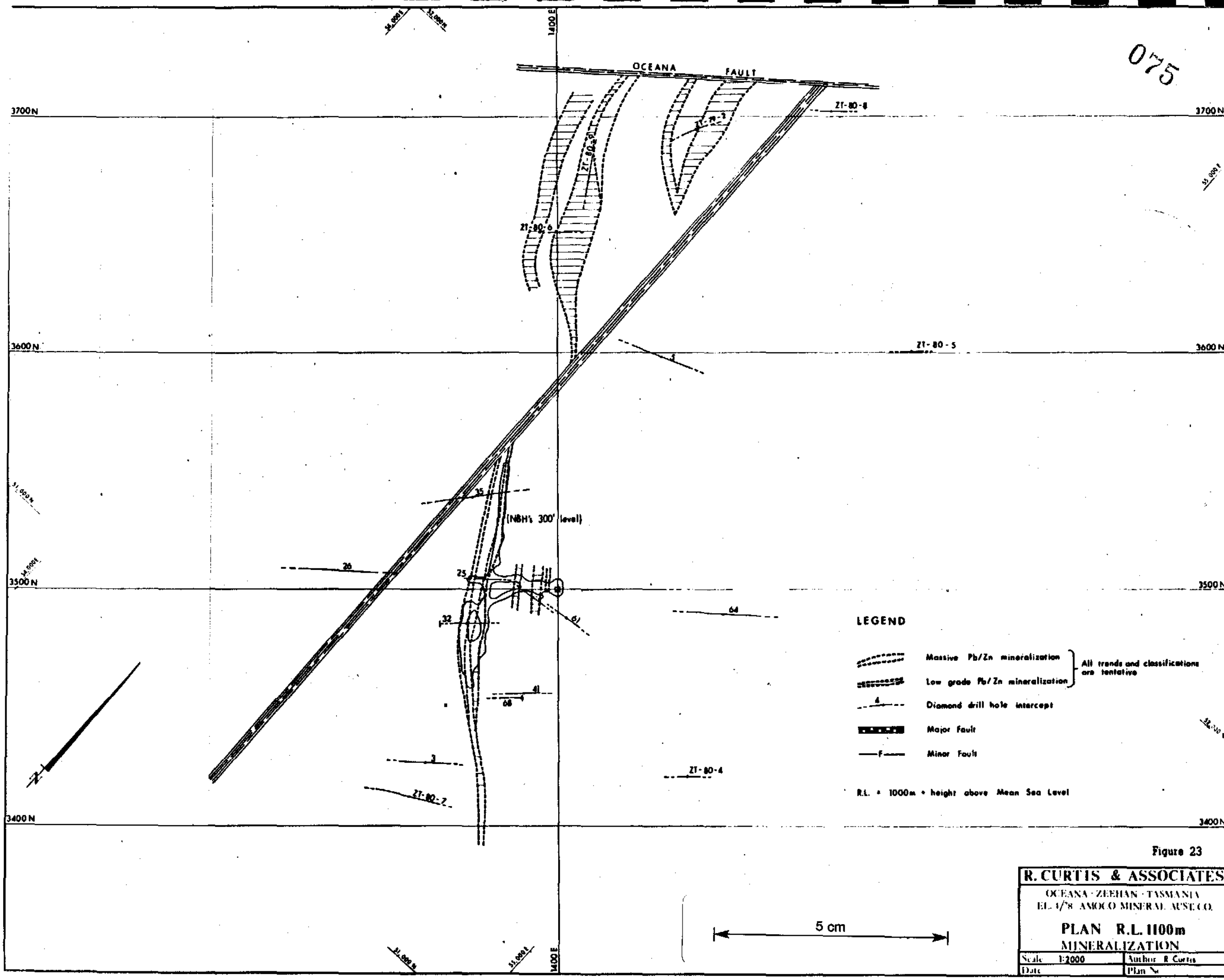
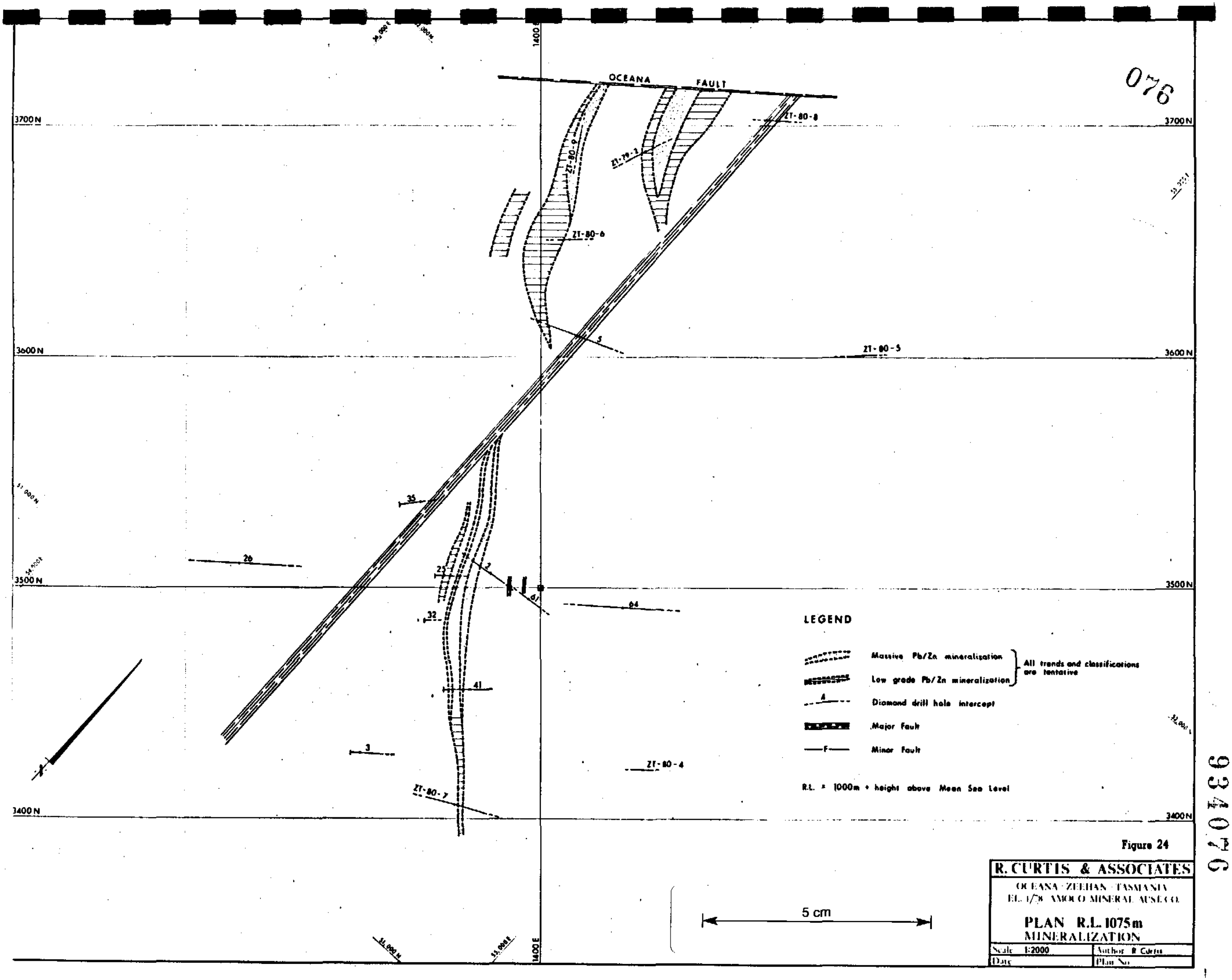


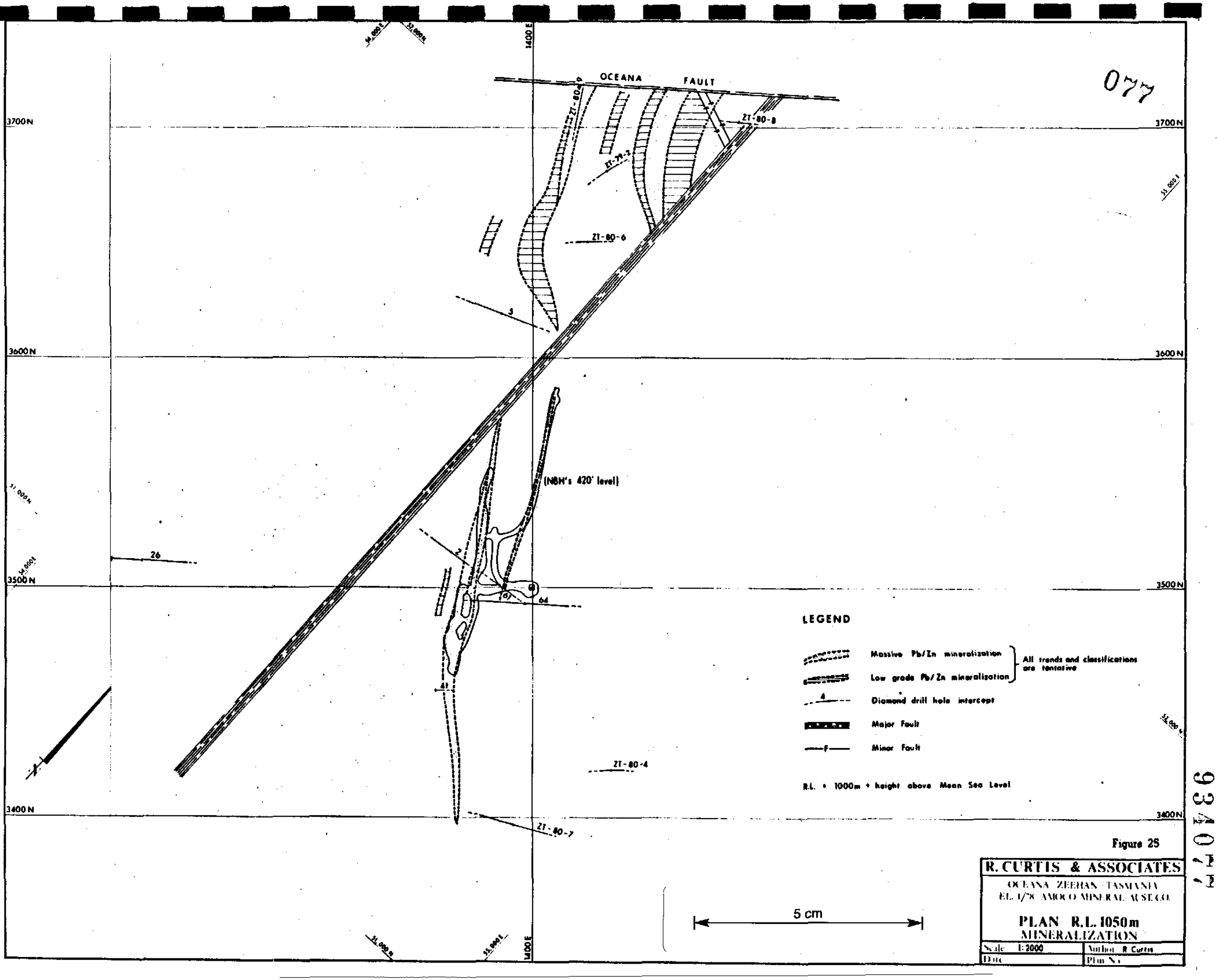
Figure 23

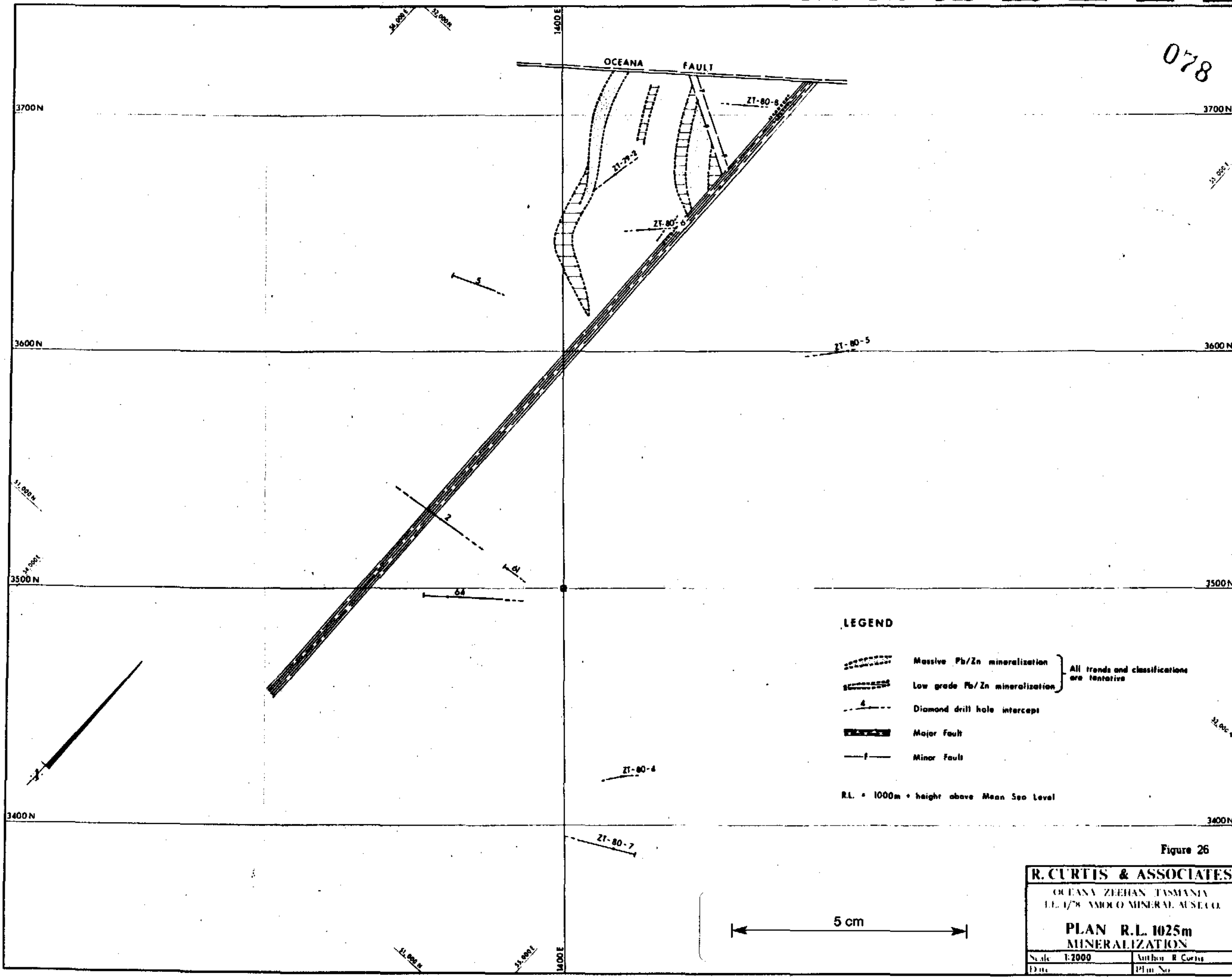
93075

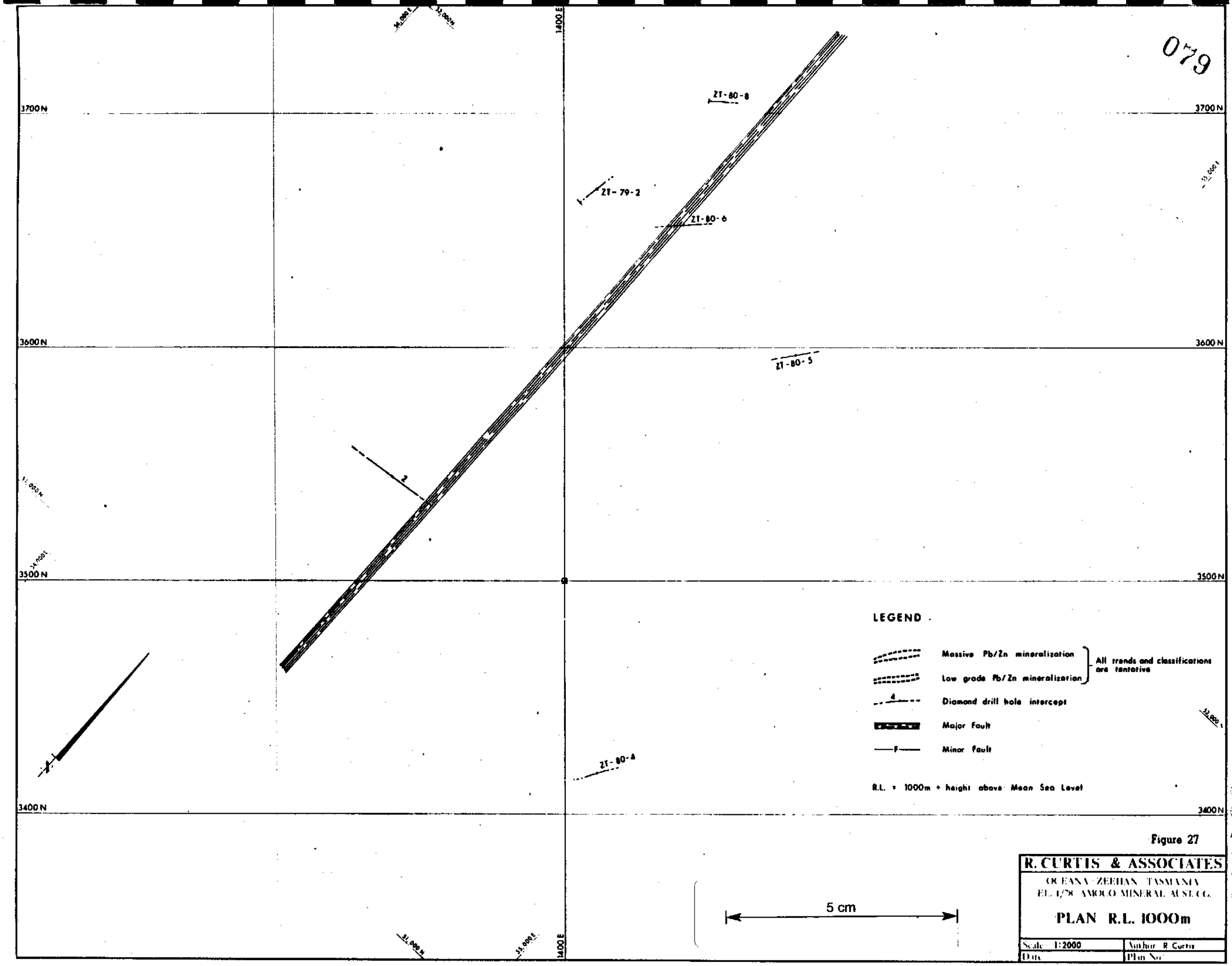


076
OCEANA FAULT
ZT-80-8
ZT-80-9
ZT-79-2
ZT-80-6
ZT-80-5
ZT-80-4
ZT-80-7
3700 N
3600 N
3500 N
3400 N
1400 E
35
26
25
2
61
64
32
41
3
5
LEGEND
Massive Pb/Zn mineralisation
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
5 cm
R. CURTIS & ASSOCIATES
OCEANA · ZEEHAN · TASMANIA
PLAN R.L. 1075m
MINERALIZATION
Scale 1:2000
Author R Curtis
Date
Plan No.
93076

Figure 24


077
OCEANA FAULT
3700N
3600N
3500N
3400N
1400E
ZT-80-9
ZT-79-2
ZT-80-8
ZT-80-6
ZT-80-4
ZT-80-7
5
2
26
41
64
(NBH's 420' level)
LEGEND
Massive Pb/Zn mineralization
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
5 cm
Figure 25
R. CURTIS & ASSOCIATES
OCEANA ZEEHAN TASMANIA
EL 1/78 AMOCO MINERAL AUST.CO.
PLAN R.L.1050m
MINERALIZATION
Scale 1:2000
Author R Curtis
Date
Plan No
93/047


078
OCEANA FAULT
1600 E
3700 N
3600 N
3500 N
3400 N
ZT-80-8
ZT-79-2
ZT-80-6
ZT-80-5
ZT-80-4
ZT-80-7
5
2
61
64
LEGEND
Massive Pb/Zn mineralization
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
5 cm
Figure 26
R. CURTIS & ASSOCIATES
PLAN R.L. 1025m
MINERALIZATION
Scale 1:2000
Author R Curtis
Date
Plan No



3700 N
3600 N
3500 N
3400 N
1400 E
ZT-80-8
ZT-79-2
ZT-80-6
ZT-80-5
ZT-80-4
LEGEND
Massive Pb/Zn mineralization
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
5 cm
R. CURTIS & ASSOCIATES
OCEANA - ZEEHAN TASMANIA
EL 1/78 AMOCO MINERAL AUST. CO.
PLAN R.L. 1000m
Scale 1:2000
Author R Curtis
Date
Plan No

Figure 27

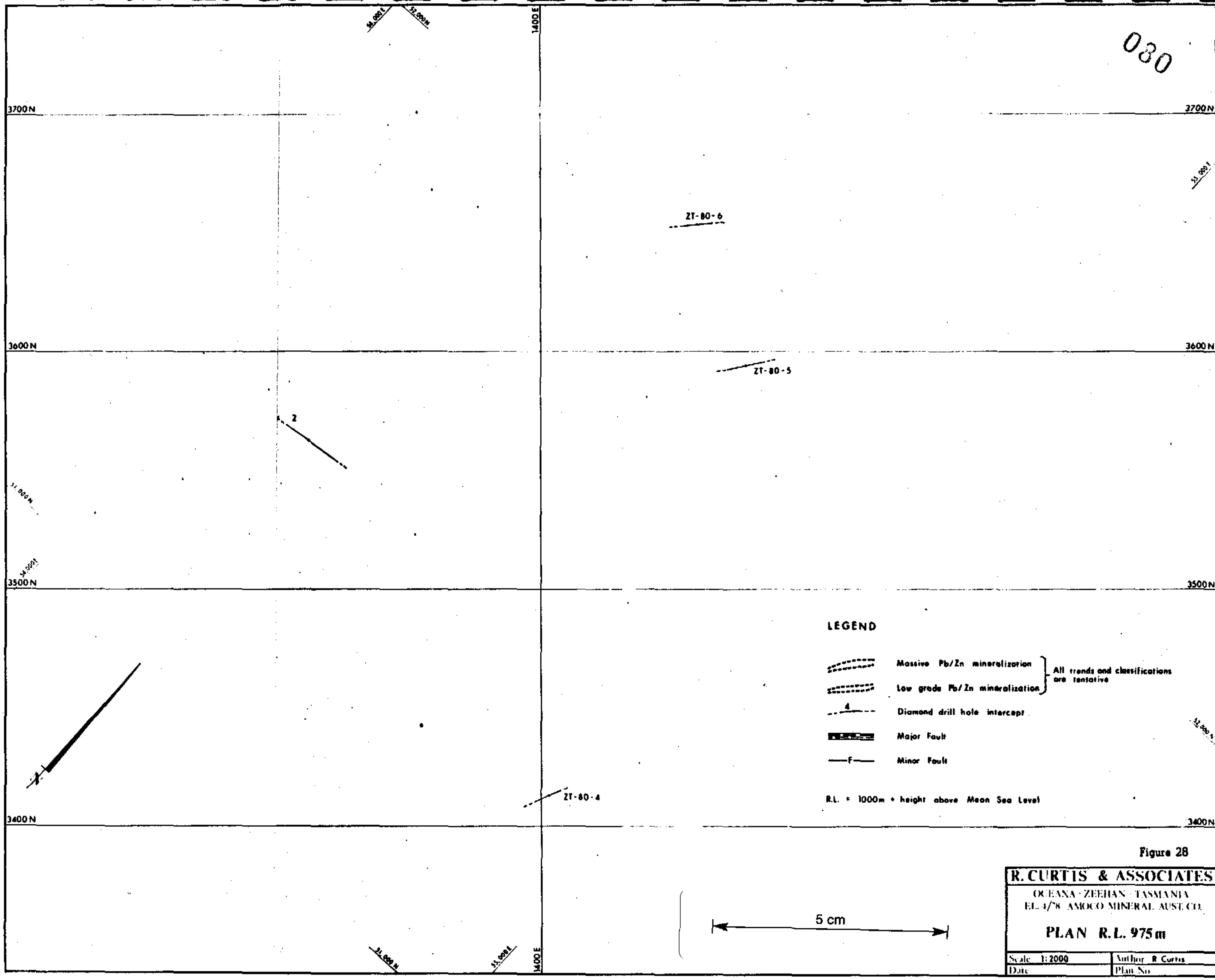
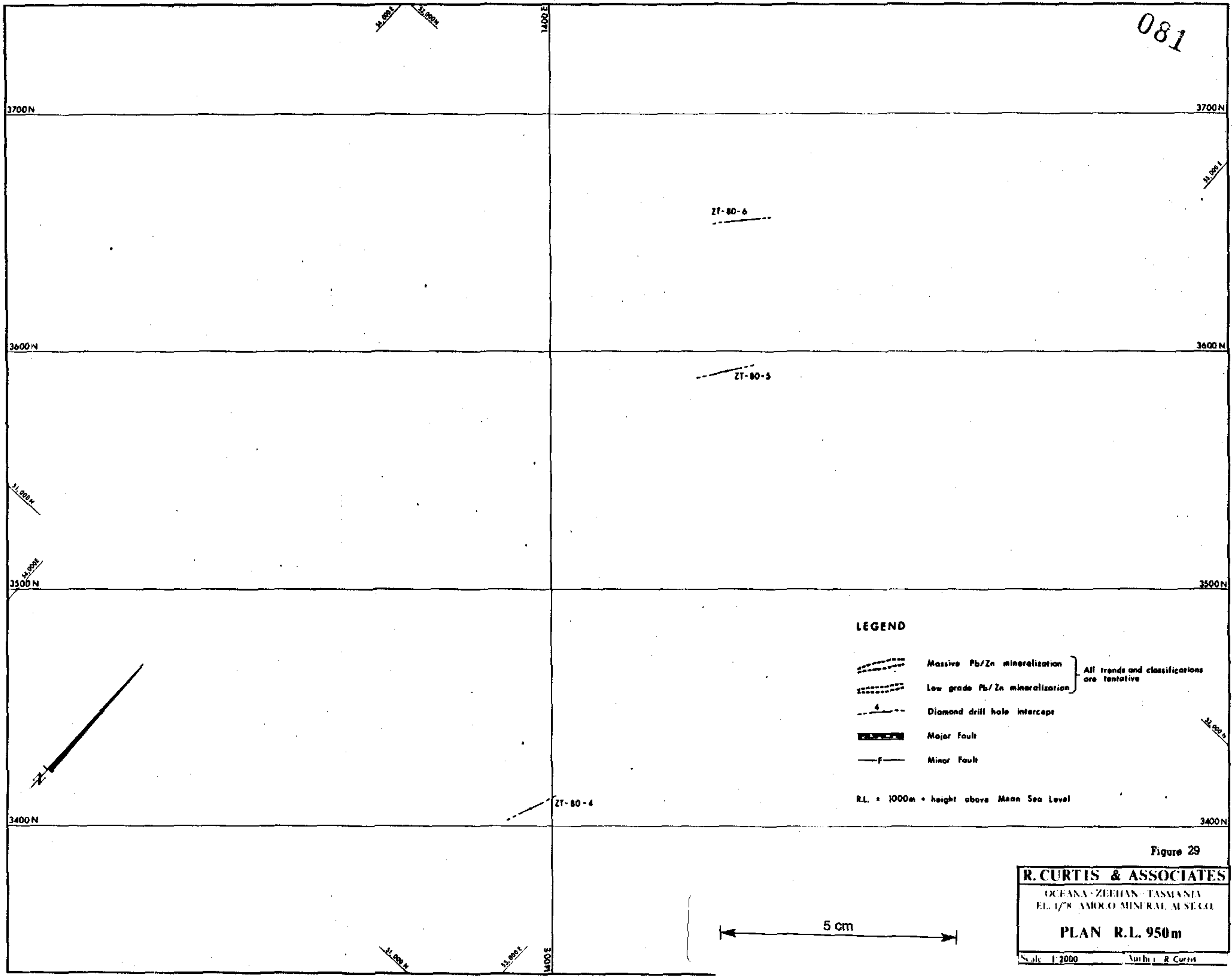
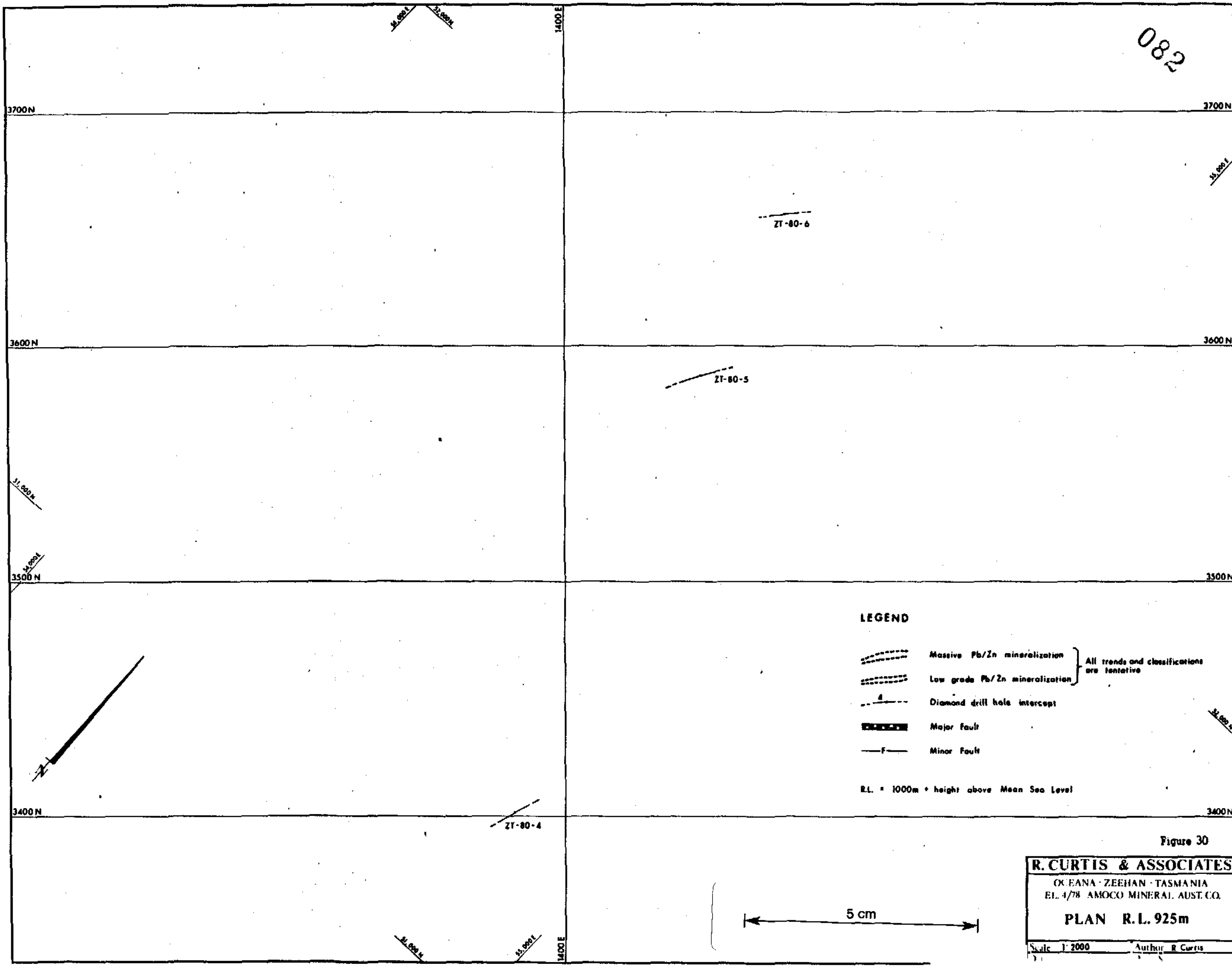


Figure 28

080976


3700 N
3600 N
3500 N
3400 N
1400 E
ZT-80-6
ZT-80-5
ZT-80-4
LEGEND
Massive Pb/Zn mineralization
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
5 cm
Figure 29
R. CURTIS & ASSOCIATES
OCEANA - ZEEHAN - TASMANIA
EL 1/78 AMOCO MINERAL AUST CO
PLAN R.L. 950m
Scale 1:2000
Author R Curtis


082
3700 N
3600 N
3500 N
3400 N
1400 E
ZT-80-6
ZT-80-5
ZT-80-4
LEGEND
Massive Pb/Zn mineralization
Low grade Pb/Zn mineralization
All trends and classifications are tentative
Diamond drill hole intercept
Major Fault
Minor Fault
R.L. = 1000m + height above Mean Sea Level
5 cm
Figure 30
R. CURTIS & ASSOCIATES
OCEANA · ZEEHAN · TASMANIA
EL 4/78 AMOCO MINERAL AUST. CO.
PLAN R.L. 925m
Scale 1:2000
Author R Curtis
9340082

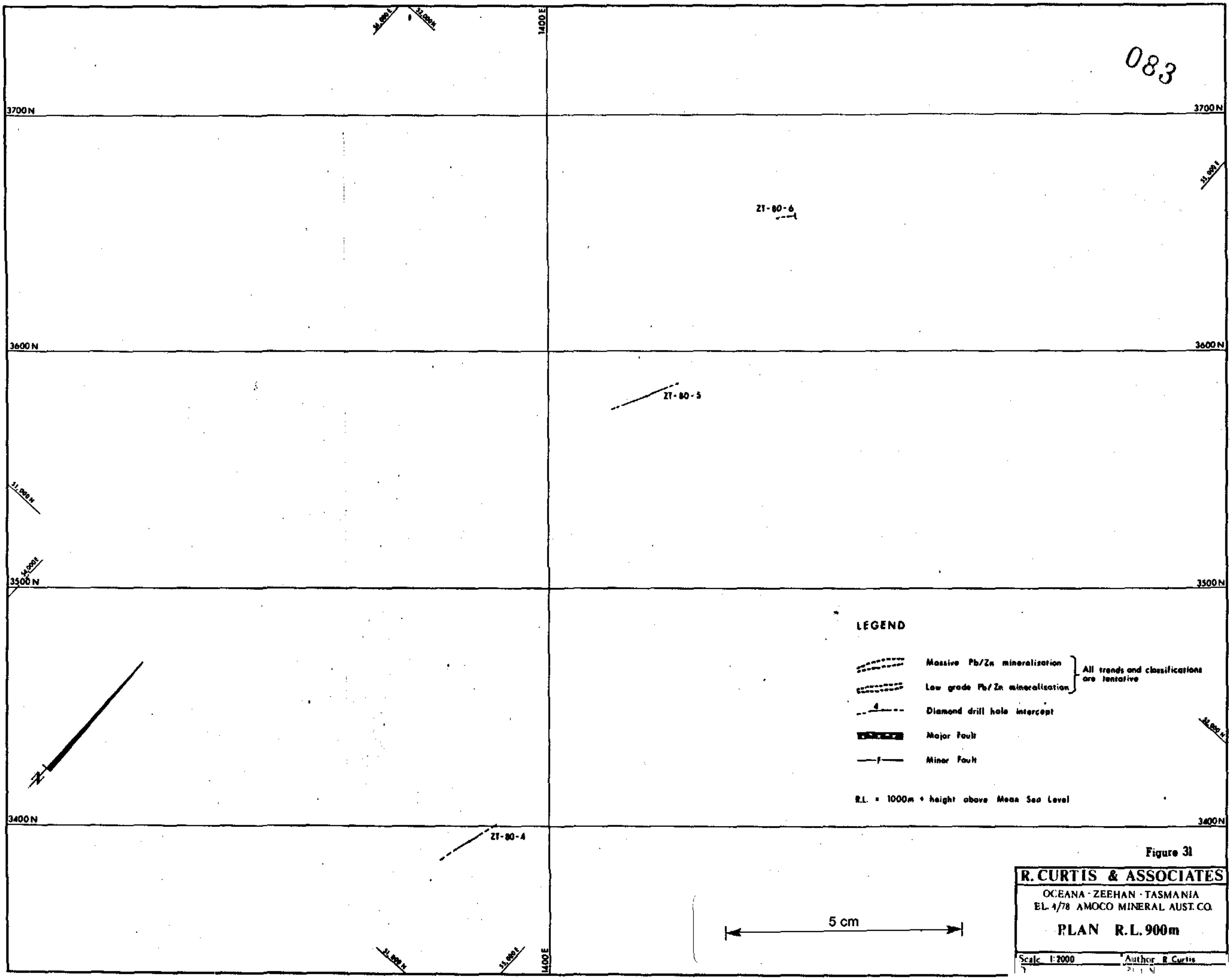


Figure 31

R. CURTIS & ASSOCIATES

OCEANA - ZEEHAN - TASMANIA
EL 4/78 AMOCO MINERAL AUST. CO.

PLAN R.L. 900m

Scale 1:2000 Author R. Curtis

93 083

The sections show the assays of the mineralized drill intersections, and from this data the extrapolated outlines of massive and low grade mineralization. The plans were constructed from the sections.

The original 40ft and 80ft levels and NBH's No. 1 (150ft), No.2 (300ft) and No. 3 (420ft) levels are plotted on both plans and sections, but no outlines of the 540ft and 640ft levels could be found. However, some idea of the extent of the workings on these levels can be gained from Blissett's (1962) description:

> "The main orebody was driven on for 115ft south and 130ft north in No. 5 (540ft) level. On No. 6 (640ft) level, the lode was intersected at 80ft in a cross cut from the shaft but is reported to be narrow and of relatively low grade."

NBH's drilling and mining programmes appear to have been carried out without the benefit of trained geological observation, and the geological descriptions accompanying the drill logs are basic. They cannot be used to correlate and extrapolate, so that the interpreted geological trends can be shown only on those sections containing Amoco's drill holes.

The outlines of the lode zone in the main mine area have been taken mostly from Jack (1961), except where data from NBH's drilling allowed more detailed representation. In the north however, the only available information, apart from the drilling, was an old plan which showed some assays towards the northern end of the No. 1 (150ft) level.

The eight diamond drill holes put down at Oceana by Amoco have proved, to a certain extent, the validity of the geochemical anomalism as a pointer to significant mineralization.

DDH ZT-79-2, an outstandingly successful hole, was drilled on a strong geochemical anomaly, and gave two massive sulphide intersections, the higher one of which represents a true width of 11 metres at 22.3% Pb, 11.7% Zn and 6.52ozs Ag/t. This is by far the widest zone of massive Pb/Zn mineralization recorded in the Zeehan Field.

Efforts to trace this mineralization south along strike with holes ZT-80-5 and ZT-80-6, and at greater depth with ZT-80-8, have been frustrated by faulting and dip inflexions. Diamond drill holes ZT-80-4 and ZT-80-7 show that the mine mineralization to the south is approximately 2m wide, while hole ZT-80-3 drilled to test three gradient array chargeability highs and a geochemical anomaly, cut a mineralized zone 1m wide which cannot be correlated with the mine lode without invoking faulting. This may be the case.

The final hole in the programme, ZT-80-9, was drilled to see if the mineralization in ZT-79-2 was associated with the Oceana Fault system. The hole cut mineralization which is now thought to correlate with the lower massive sulphide intersection in ZT-79-2, though this was not at first appreciated.

2.2 Mineralized Zones

For purposes of description the mineralized zones are divided into three sections, that area north of the mine workings, the mine itself, and the zone south of the mine.

2.2.1 North Zone

Close examination of the Oceana data suggests that although both the mine area and the north area are contained within one zone of mineralization, the massive sulphides in each are discrete bodies. The ore bodies in the mine virtually die out 55m north of the main cross-cut, and the north area massive sulphides are likewise much reduced to the south at the fault separating the two areas (Figure 21).

This fault (the Mine Fault), which is weakly mineralized, has been postulated from intersections in drill holes ZT-80-6 and ZT-80-8, and development records for the No. 1 (150ft) level.

The north area would appear to comprise three individual north north west-south south east trending zones of mineralization, two of which contain developments of massive Pb/Zn sulphides (Figure 21).

The easternmost zone has been intersected in DDH ZT-79-2 from 59m to 137m, by DDH 1 from 45m to 61m, by the northern end of the No. 1 (150ft) level, and in part by the old Oceana Mining Co.'s 80ft level.

In DDH 1 and the No. 1 level, assay values average around 5% Pb with insignificant zinc over a width of 20m, though what little information remains suggests massive galena occurred in the 80ft level. This data covers the mineralized zone over a depth from surface to 50m, and it is evident that by a depth from surface to 100m, at the ZT-79-2 intersection, the mineralized zone widens to some 26m and contains an 11m core of massive Pb/Zn sulphides.

Regrettably there is no further intersection of this mineralization below ZT-79-2 and the zone is thought to be cut off at around a depth from surface of 175m by a flat lying fault (Figure 3).

The intersections in ZT-79-2 are the widest known developments of massive Pb/Zn mineralization in the area, and to the north, must be cut off within 15m of the collar of the drill hole by the Oceana Fault. To the south of ZT-79-2, the massive sulphide zone attenuates and weakens rapidly so that at the No. 1 level the mineralization is a broad diffuse zone averaging 5% Pb (Figure 21).

The mineralized zones parallel the bedding, and between the Oceana Fault and the Mine Fault undergo a change of dip. At ZT-79-2 on 3700 N the mineralization dips steeply westerly, but 50m further south at the northern end of the No. 1 level, the dips are to the east. This dip reversal eventually results in the mineralized zone being cut out by the Mine Fault, although by this stage in the upper levels in particular, the mineralization is considerably weaker (Figures 3 & 6).

The central zone of mineralization is defined by drill holes ZT-79-2 from 204m to 218m, ZT-80-9 from 138m to 183m, ZT-80-6 from 112m to 134m, DDH's 1 and 53, and the Oceana Mining Co.'s 40ft Level and Southern end of the 80ft Level. Two further holes penetrate the zone; DDH's 5 and 66, but both these were abandoned with little recovery and no assaying.

This zone is similar to the eastern zone in that the mineralization weakens rapidly to the south and up-dip from the deep intersection in ZT-79-2, which represents a true width of 7m assaying 8.37% Pb, 2.95% Zn and 1.82ozs Ag/t. This intersection is at the 1000m reference level while that of ZT-80-9 is some 75m higher (Figure 5), but virtually on the same section.

While the ZT-80-9 intersection averages only 3.88% Pb, 1.19% Zn and 0.63ozs Ag/t, it is interesting to note that 7m of no recovery between 175m and 182m is flanked above by 3m of 9.8% Pb, and below by 1m of 44.0% Pb, 9.75% Zn and 8.03ozs Ag/t. Should the tenor of the missing core compare with the immediately adjacent recovered core, then the zone would be considerably up-graded.

However, the core and the orebody are semi-parallel which accounts for the long intersection, and it is calculated that the true width of the massive-type Pb/Zn mineralization here is some 3.5m.

Drill hole ZT-80-6 cuts this mineralization 50m to the south and at the 1100 reference level, where minor disseminated Pb/Zn mineralization occurs irregularly through a siderite/ankerite/dolomite breccia host rock. A true width of approximatley 15m is suggested by the dip of the beds and while over the full intersection from 112m to 134m the assay averages only 0.85% Pb and 0.63% Zn, the interval 126m to 134m, representing a true width of 5m, averages 1.21% Pb (Figure 6).

There is no record of the grades mined in the 40ft and 80ft levels, where, no doubt, the ore was secondarily enriched. DDH 3 records a 30m intersection of 4.49% Pb through the zone, while the log of DDH 1 mentioned only that the ground was mineralized and gossanous. Both holes, however were plagued by excessively poor recoveries.

This zone experiences the same dip reversals as the one to the east and as a consequence the surface to 24m mineralization cut in ZT-80-9 is part of the same zone cut between 138m and 183m (Figures 3 & 7).

The central zone trends into the Mine Fault between 3600 N and 3575 N.

The westerly zone is marked only by a small rise in the Pb/Zn values in a dolomite breccia in ZT-80-6 between 93m and 100m.

This however can be matched with mineralization cut in DDH 5 commented on as "low grade intersected" but for which no assaying was carried out, and also with the comment "little core recovered, lead mineralization" for the lower half of DDH 48 (Figure 5).

The ZT-80-6 intersection represents a true width of 6m averaging 0.42% Pb and 0.93% Zn.

There is one further mineralized intersection in a siderite/ankerite rock in ZT-80-6 between 69m and 71m, and this represents a true width of 1m assaying 1.87% Pb and 0.37% Zn. However, there is no further data which would allow this zone to be plotted outside the influence of ZT-80-6 (Figure 6).

2.2.2 The Mine

The Oceana Mine and the work carried out by NBH have been described and illustrated by Jack (1961) and no detailed accounts are given here. Reference can be made to the sections and plans (Figures 3 to 17 and 18 to 31), and to Jack (1961), whose account was summarized by Blissett (1962) thus:

> "Mineralization took place in Devonian times within a prominent shear zone which strikes NW and dips steeply to the NE. The ore occurs along two major shear planes and within tension fractures between them, and there has been some selective replacement of limestone. Where the mineralized fractures were of sufficiently high grade and close together, the ore bodies along the two main shears were mined as one stope. The ore has a maximum width of 60feet and is up to 350feet long, but workable ore was not more than 30 feet wide and 260 feet long."

The mineralization in the eastern shear is prominent from the surface to 105m depth, below which it is much reduced and often indeterminate. The western lens has been mined from above the No. 1 Level to below the No.5 Level, a depth of over 120m, and in consequence of Amoco's drilling is known to exist 300m below the surface some 50m south of the southernmost workings (Figure 16).

2.2.3 South Zone

South of the mine area the mine mineralization has been cut in drill holes ZT-80-4 and ZT-80-7 (Figure 16). In ZT-80-7 the close parallel zones of massive mineralization which was a feature of the mined area, have coalesced into one zone 1.5m wide, and this mineralization has been intersected 170m deeper on the 900m reference level by ZT-80-4. This is the deepest known intersection of the Oceana Mineralization and represents a true width of 2.5m averaging 22.3% Pb, 1.99% Zn and 10.38oz's Ag/t.

A further mineralized intersection higher up in ZT-80-4 represents a true width of 5m of massive sulphides (Figure 16), and this mineralization does not appear to be represented in ZT-80-7 which passes through equivalent stratigraphy 100m above. Though assaying of the extrapolated equivalents in ZT-80-7 may show a rise in the Pb/Zn values, it is not inconceivable that the lode zone in ZT-80-7 branches below the hole intersection to give the two lodes seen in ZT-80-4. However, separate lodes is the more likely explanation.

It is a matter of conjecture whether the 1m intersection in ZT-80-3 some 200m to the south on section 3200 N can be correlated with either of the two zones cut by ZT-80-4.

If it represents the mine mineralization then cross faulting is evident. However, it seems more likely that it is a discrete occurrence, and that this far south the structure containing the mine mineralization is either west of the end of ZT-80-3, or unmineralized in this area.

2.3 The Mineralized Veining

Walker (1951) briefly described the mineralization within the veining and the relationship of the veining to the host structure:

> "The cross-section of high grade ore, low grade ore and shear slip plane, now appear as a structurally related whole.
>
> The high grade ore related to the solid galena picking ore vein which provided ore for direct shipment, while the lower grade stringy galena ore relates to ore referred to by the old miners as milling ore.
>
> It is now clear that the earliest mineralized channels were replacements of cream ankerite in black limestone country rock, flecked with minor veinlets of calcite. The high grade vein clings consistently to the main slip shear. The low grade stringers are ores in subsidiary adjacent shearing and fracturing of the pre-existing gangue."

Both and Williams (1968), in their study of mineralized zoning in Zeehan, described in detail the mineralogy and paragenetic relationships of the constituents which make up the ores of the area. They established early, intermediate and late stages of mineralization, and listed suites of minerals which characterize each.

Galena, the major component of the Oceana ore belongs to the late stage, whilst the sphalerite and siderite gangue are intermediate stage products.

Because sphalerite and siderite can be shown to be each replacing the other in various ores, Both and Williams determined that they were deposited more or less contemporaneously. There is no doubt that: both are later than the pyrite, which figures predominantly in the western part of the Zeehan Field, and both are earlier than the Galena.

> "Pyrite, sphalerite and siderite are all extensively veined and partly replaced by galena; all three are frequently brecciated and the fractures have been healed by intergrowths of galena and late quartz. Extensively corroded residuals of early coarse-grained pyrite in galena are common. Galena often invades the cleavages of siderite to form networks with distinctive rhombohedral patterns......Veinlets of Galena transecting areas of sphalerite are common, and are usually accompanied by some degree of partial replacement .... Incipient replacement is often revealed by minute, discontinuous belbs of galena in the sphalerite grain boundaries,... as the replacement proceeds, these "coalesce" into continuous grain boundary penetrations, and ultimately only rounded residuals of sphalerite remain within a matrix of galena" (Both and Williams, 1968).

2.4 Structure of the Mineralized Zones

2.4.1 General

The structures containing the mineralization in the Zeehan Field were created by the Lower Devonian to late Middle Devonian Tabberabberan Orogeny, and Figure 32 illustrates the major fold and fault systems.

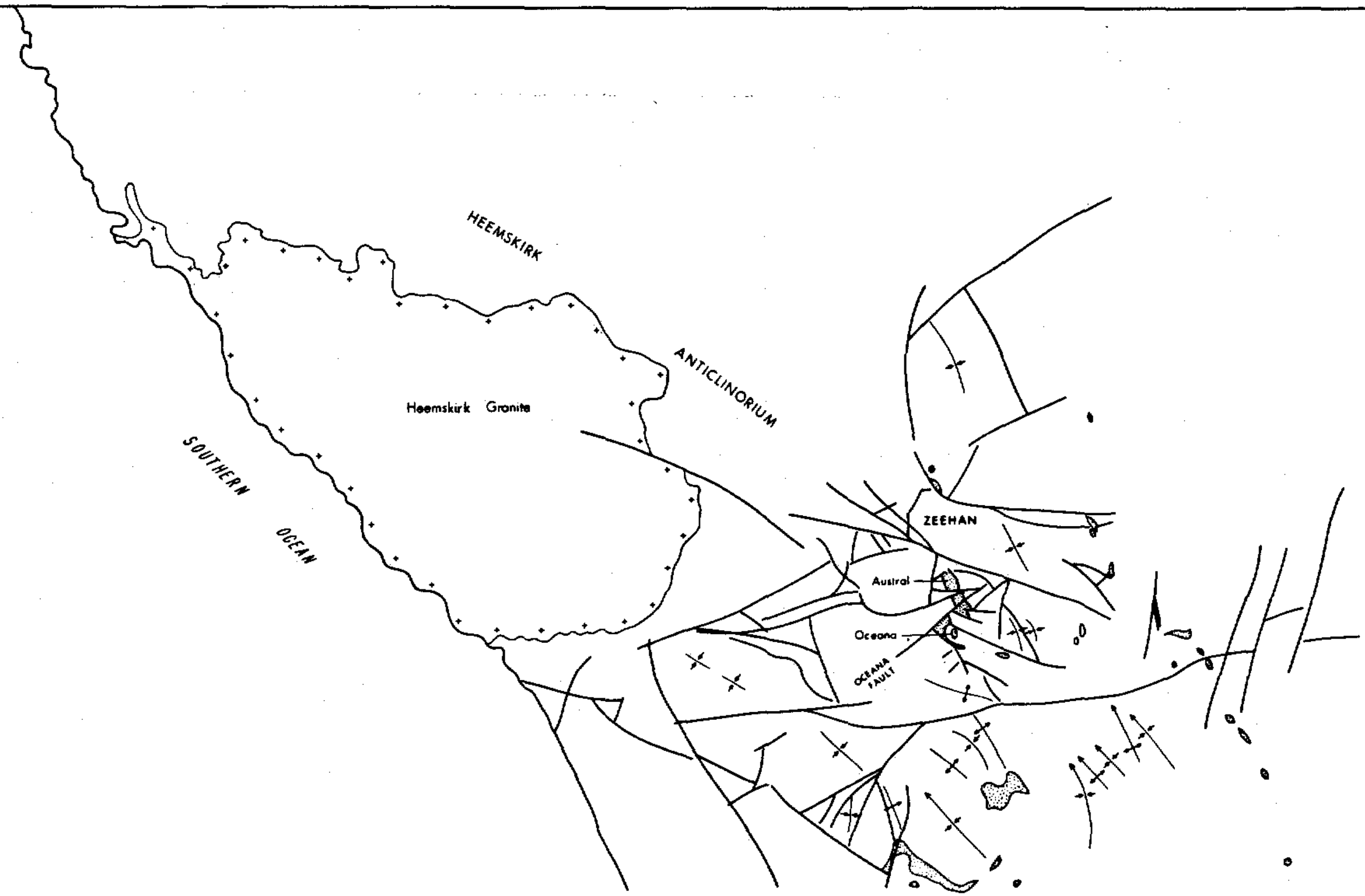


Figure 32

Fault

Gordon Limestone Outcrop

Folds

5 cm

R. CURTIS & ASSOCIATES	
Zeehan Quadrangle SIMPLIFIED STRUCTURAL GEOLOGY	
Scale 1:126,720	Author T.G.S.
Date	Plan No.

The Oceana and Austral properties are located on the southern part of the western limb of the Zeehan Syncline where the Ordovician formations are in fault contact with the Proterozoic, have steep dips, and are locally overturned.

The north west to north north west trending fold system has been cut by major west north west trending faults, the western termination of a complex zone of faulting which includes the Linda Valley and extends "from the Central Highlands almost to the Southern Ocean" (Solomon, 1962)

To the west of this cross-fault system is the Heemskirk Granite, a post-orogenic intrusion from which the mineralization in the Zeehan Field is generally regarded to have originated.

The Zeehan lodes are cut by numerous post-mineralization faults, probably related to Jurassic and Tertiary block faulting. While most of these faults strike north westerly or north easterly, researchers have suggested that:

> "Much of the complex disturbance of Proterozoic to Devonian rocks in the vicinity of Zeehan must be attributed to post Permian, possibly Tertiary, faulting which was partly controlled by Tabberabberan structures and zones of weakness" (Blissett, 1962).

The orebodies of the Zeehan Field are regarded as having originated by veining of fault fissure zones, with the mineralization being deposited either in open cavities in the fissures, or replacing zones of sheared and crushed rock.

Within the Gordon Limestone, the structurally created openings are frequently marked by seams of pug and/or rubble.

Waller (1904), who examined the field while most of the underground workings were accessible, notes that the lode formations usually have only one well defined wall, which represents the main zone of movement and results in the thickest zone of pug. The best mineralization is always found within the main channel.

Waller also comments that many of the smaller lodes do not appear to have formed in fault fissures, but are merely contained within cracks:

> "which have served as a channel for metal bearing solutions, and the metal has been deposited in the cracks, or as a replacement of the wallrock. These lodes are usually of very limited extent".

Both and Williams (1968) used detailed maps and reports by Waller (1903, 1904) to construct a map showing the distribution and orientation of the veins, and demonstrated how the veining is closely related to the faulting (Figure 33). This work clearly showed two major vein orientations, one set trending north north west and the other north to north east. They also noted that:

> "veins of the first set occur throughout the field, but those of the second set are most abundant in the Proterozoic and Cambrian rocks outcropping in the vicinity of the NNE-striking faults in the Argent Flat-Queen Hill area".

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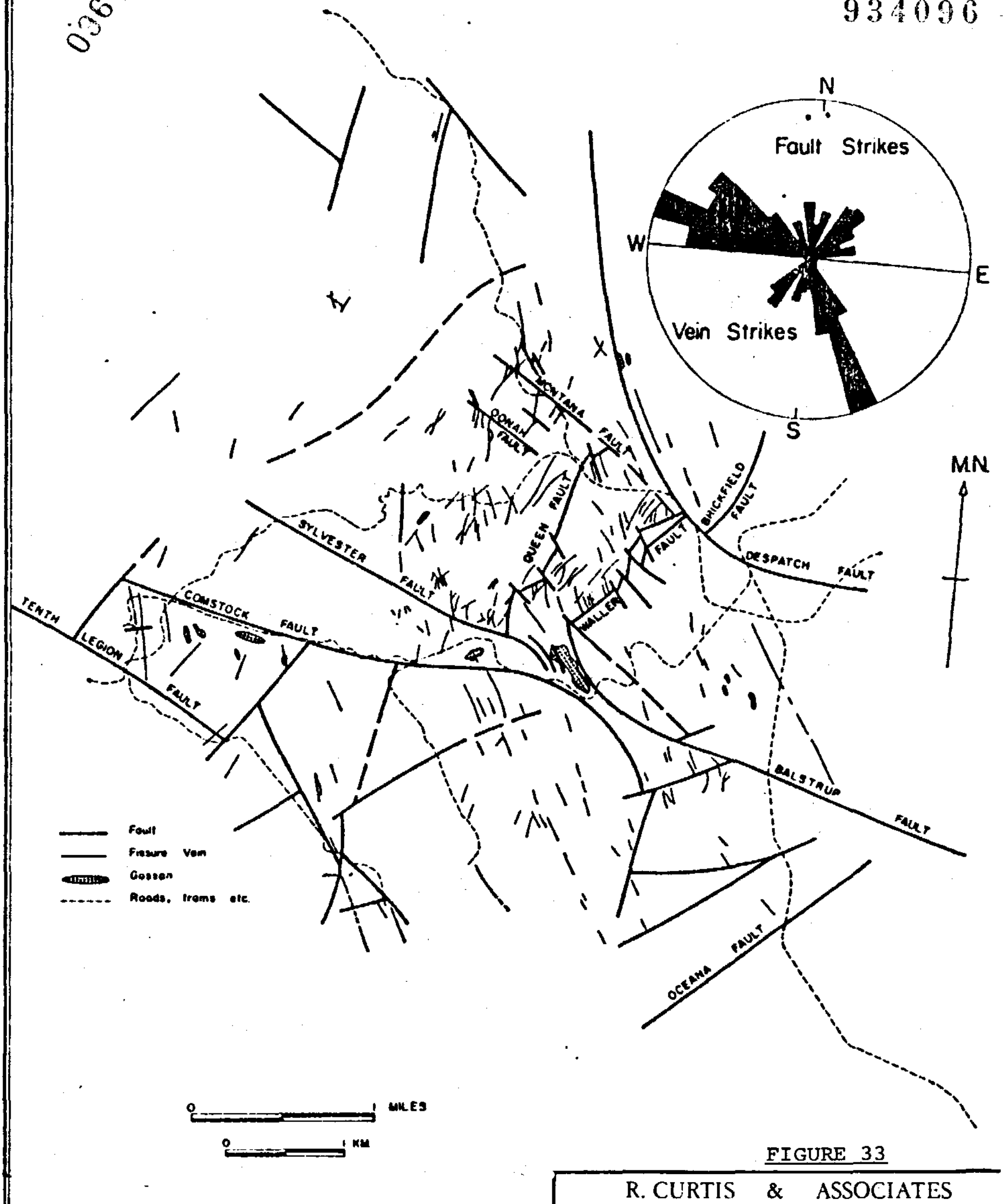

FIGURE 33

R. CURTIS & ASSOCIATES	
FAULT AND VEIN DISTRIBUTION ZEEHAN AREA	
Scale	Author BOTH(1968)

2.4.2 Oceana Area

During the period that NBH was developing the Oceana Mine, several ideas were put forward by the then manager of the operation, K. F. H. Walker, as to the structural attitude of the ore. He visualized the mineralization as a system of multiple and intermittent high grade lenses occurring over a width of up to 18m, separated by either barren or low grade disseminated ore.

Walker's suggested settings for this ore were:

(i) selectively replacing a favourable bed in the limestone series, or

(ii) replacement of such a favourable bed that had previously been thrown into a tight drag fold, with ore bulges at the nose, and tabular veins occupying the attenuated limbs.

However, Walker did not appear enthusiastic about either suggestion.

As the drilling and development work progressed, the structural setting of the mineralization became evident and by 1952 Walker had established that:

> "ore occurs in one or more strike shear planes of bedding. The drilling and opening up of the orebody has revealed that sideritic replacements of the limestone have occurred, probably in advance of lead emplacement, the ore occurring in these shear replacements less widely and frequently than the sideritic material itself".

Plotting of all the available diamond drill data on to sections and plans suggests that the massive Pb/Zn mineralization at the Oceana occupies a system of parallel bedding plane shears.

In the mine area it is well known that the shearing is dominated by two shears varying from 2m to 5m apart, the massive mineralization within the shears rarely exceeding 3m in thickness. The ground between the shears may, or may not show low grade disseminated Pb/Zn mineralization.

Both massive shear zone mineralization and intervening low grade disseminated mineralization together reach a maximum thickness of 11m near the main cross cut on the 1150m reference level (Figure 21).

South from the main cross cuts the shears appear to converge to form one minor zone of massive Pb/Zn mineralization approximately 1m to 1.5m wide (Figure 15).

Parallel zones of mineralization are common, in particular in the No. 2 Level (300ft) cross cut, and in the No. 3 Level (420ft), where one vein was driven on for a distance of 90m north from the shaft (Figure 25).
Amoco's DDH ZT-80-4 cut a 5m zone of massive Pb/Zn 18m east of the mine mineralization on section 3400 N at approximately the 950m reference level, and it is not known whether this is part of a bifurcation of the mine shear system or an independent zone, though the latter seems more probable (Figure 16).

No stoping was ever carried out on these parallel zones of mineralization.

Northwards, the mineralization in the mine shears weakens rapidly and has virtually disappeared on the major No. 1 Level (150ft) at 60m north of the main cross cut (Figure 21).

In plan, the trace of the mine mineralization, hence the strike shearing and the bedding, are slightly arcuate to the west. This gentle arching of the beds is thought to play a significant part in the choice of host by the mineralization, and will be discussed later.

To the north of the Mine Fault NBH's development work on the No. 1 Level (150ft) was extended beyond the zone of mine mineralization in the hope of intersecting downward extensions of the ore mined in the 40ft and 80ft Levels. However, for reasons discussed later, the problems of correlation between the No. 1 Level and the old Oceana Mining Co.'s 40ft and 80ft Levels were never resolved by NBH:

> "The orientation of the 80ft Level development driving was very largely inconsistent with that of the 40ft Level, and both have been inconsistent with the trend of the ore in the south end of the mine which we have tested in some detail".
>
> In the meantime the north end of the 150ft Level has revealed an even bedding trend which departs from the trends of the 80ft Level at angles which range from 35° to 60°. Our more recent ideas of structure derived from south end development are that the ore channel or structure may follow bedding trends and drag folds consistently.
>
> Whatever may be the true nature of the ore structural control, it is reasonable now to suppose that the 80ft Level has in its first leg north followed entrained galena in a fault plane, and is totally unrelated to the ore channel which remains undiscovered on that level" (Walker, 1952).

This fault plane, suggested by Walker as the course for part of the 80ft level, is the Mine Fault, and the mineralization within this fault zone has been intersected at depth by ZT-80-8 and ZT-80-6. However, the ore channel was discovered on the 80ft Level, since a cross cut westerly from the fault to Foleys Shaft (figures 20 & 21) intersected at a high level the southern tip of the mineralization in the northern end of the No. 1 (150ft) Level. In this area the beds and mineralization dip east but immediately to the north undergo a reversal to form the westerly dipping mineralization intersected between 96m and 122m in ZT-79-2.

The effects of this dip reversal were never appreciated during the development of the No. 1 level in the north, and neither was the fact that the 40ft and 80ft Levels' trends were inconsistent because they followed discrete mineralized zones.

The 40ft Level follows the zone cut by intersections in ZT-80-9 and the lower part of ZT-79-2. DDH ZT-80-9 was collared in the mineralization which dips east at the collar, and the hole leaves the mineralization by the west wall. At depth however, the hole re-enters the now westerly dipping zone through the same west wall.

2.5 Conclusions

The mineralization in the Zeehan Field is generally regarded as hydrothermal in origin, related to the intrusion of the Heemskirk Granite at the end of the Tabberabberan Orogeny. The zonal pattern of mineralization around the granite has been the subject of a number of papers dating from studies by Twelvetrees (1901-1910) to those of Both and Williams (1968).

All regard the granite, or a late differentiate, as the origin of the mineralization, which occurs in fissure veins, in rocks ranging in age from late Proterozoic to early Devonian.

While it is not within the terms of reference of this report to discuss in detail the origin of the mineralization, it is suggested that there is an alternative to a hydrothermal origin for the Pb/Zn mineralization which merits attention, and has important implications in the search for Mississippi Valley type mineralization.

The most recent interpretation of the mineralogical zoning in the Zeehan Field is by Both and Williams (1968). This is illustrated in Figure 34, and although they stress the paragenetic overlap of the minerals within the zones, it is noteworthy that the sideritic zone approximately covers the Palaeozoic sediments, while the pyritic and intermediate zones are mostly in the Proterozoic sediments. The only significant incursion of the sideritic zone into the Proterozoic rocks is in the north, along the Despatch and related faults.

It is suggested that the tin, wolframite, bismuthinite, and possibly part of the pyrite mineralization originated from the Heemskirk Granite hydrothermal solutions, while most of the pyrite, and the lead and zinc originated from connate brines entrapped within the Zeehan basinal sediments. If this is correct, the zonal arrangement of the mineralization is of composite origin, resulting from a primary distribution of the mineralization, and a concentrating effect due mainly to structure, the increase in temperature attendant on the Heemskirk Granite intrusion, and the passage of hydrothermal solutions through the rocks.

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ZONING OF GANGUE MINERALOGY

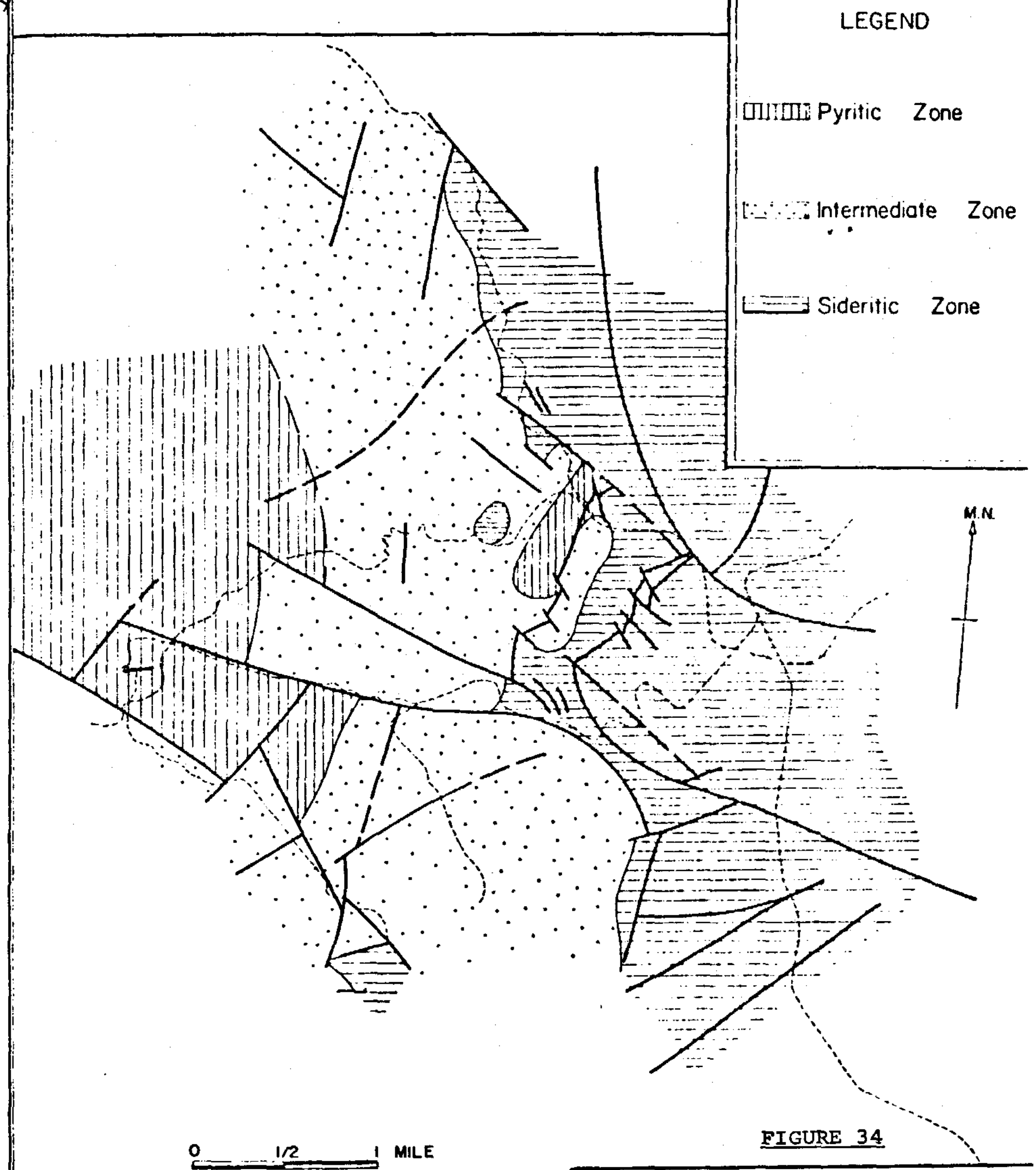

FIGURE 34

R. CURTIS & ASSOCIATES

AREAL DISTRIBUTION OF ZONING IN THE ZEEHAN ORES

5 cm

There is evidence to suggest that the Zeehan Area is the western termination of a major west north west to north west fracture system which trends through the Linda Valley, and the Heemskirk Granite may well have risen along this lineament. Mineralization occurs along this structure at Linda, and at Bubs Hill, where the disseminated Pb/Zn is stratabound (see 1:250,000 Series, Queenstown).

It is thought that this fault system reflects a basement structure and that during the deposition of the Palaeozoic sediments, those sediments adjacent to the lineament may well have been receiving metals by ascending solutions from magnetic sources.

To briefly recap, at the Oceana it is evident from mining and drilling records that massive Pb/Zn mineralization occurs in bedding plane faults and shears. The Oceana Mine was developed in two semi-parallel shears 2m to 5m apart over a strike length of 160m.

In the northern zone, three north north westerly trending zones of mineralization have been recognized at approximately 20m separations. In the two easternmost zones massive Pb/Zn mineralization has been intersected, one of which is the widest intersection of its kind so far encountered in the Zeehan Field. The massive Pb/Zn in this zone is surrounded by an envelope of disseminated low grade, zinc-rich mineralization.

The plans of the mineralization show an arcuate pattern which indicates that the beds and host structures are gently folded about vertical, or near vertical axes.

The attitude of the bedding, plotted from the diamond drill data, suggests that the Gordon Limestone in the northern area is overtuned, with a near vertical west dipping recumbent limb.

On Section 3700 N the dip changes back to east at a depth of approximately 200m (Figure 4), while 100m to the south the flexure is at approximately 75m. This suggests the axial plunge of this structure, which appears to be a gentle drag fold, is approximately 50° northerly.

The structural picture is further complicated by a local dip reversal within the westerly dipping overturned limb which causes the southern end of the north zone mineralization to dip east and to be cut out against the Mine Fault.

It appears therefore that there has been more than adequate structural preparation for the mineralizing solutions. Bedding plane shearing resulting from the major folding which created the overturned western limb of the Zeehan Syncline in this area, has undergone gentle secondary folding about near vertical axes and also gentle drag folding about northerly plunging axes.

Parallel shearing near the nose of the major overturning has resulted in the several discrete zones of mineralization in the northern area.

The Mine Fault contains minor mineralization and it is difficult to be certain whether this mineralization results from penetration of the fault zone itself by mineralizing solutions, or whether it derives from the mineralized beds being cut by the fault.

The Mine Fault was followed in part by the 80ft Level and "slugs of galena" were found in "soft lode" which suggests a derivation from the mineralized beds being cut. However, ZT-80-6 cut 2.0% Zn in ankerite-breccias thought to represent the fault in this area, and likewise ZT-80-8 in clays derived from ankerite/siderite breccias.

This would indicate that the fault existed during the mineralizing phase and this is probably the more acceptable answer.

Whichever it may be, the fault does not appear to be important as a host to mineralization.

The Mine orebody is cut by numerous small displacement faults, and Walker (1953) describes flat, west dipping faults which cause minor top block to the east displacement of the ore. It is apparent however that NBH was never in danger of losing the orebody through faulting.

2.6 Recommendations

Of the exploration techniques used over the Oceana, only the geochemical surveys appear to have produced a significant guide to the mineralization. NBH commenced the exploration in the late 1940's with high hopes for the gravity anomalies defined by the BMR (Figure 35). The idea that the mineralization would give a gravity signature was strengthened when early drilling confirmed the existence of mineralization in the north zone and under the old workings, since both areas gave gravity anomalies.

The gravity anomalies in the South Oceana area were thoroughly tested by 434m of diamond drilling in eight holes, all of which were recorded as having nil mineralization. A further 240m of drilling in three holes, to test a supposed orebody, also recorded nil mineralization.

NBH attributed the anomalism to large quantities of siderite and to density differences between massive and highly porous limestones. The logs of the drill holes however only rarely refer to siderite.

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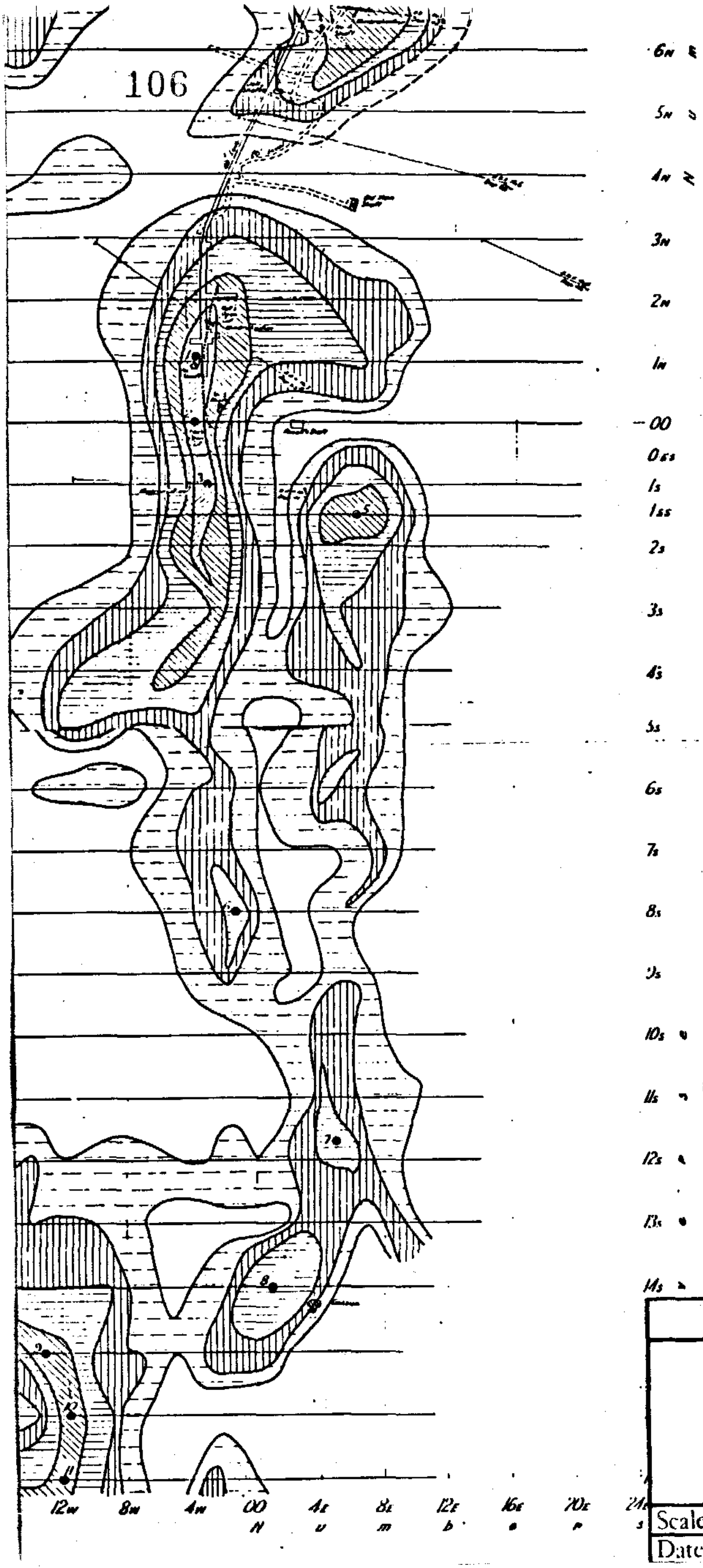

SCALE 0 100 200 300 feet

5 cm

FIGURE 35

R. CURTIS & ASSOCIATES	
ZEEHAN GEOPHYSICAL SURVEY OCEANA AREA	
Scale	Author BMR
Date	Plan No.

It is evident that gravity anomalism cannot be used as the sole parameter for follow up exploration, and all explorers in the area agree that electrical and electromagnetic geophysical methods do not give significant responses.

The degree of geochemical anomalism in an Oceana-type setting gives little indication of the worth of the target because of extreme and rapid variation in width and tenor of mineralization, both along strike and with depth.

Had the mine area been non-outcropping and remained undiscovered, one could not confidently predict that initial reconnaissance geochemical surveys would have established an anomaly, since the spacing could straddle the narrow mineralized zone.

It is reasonable to assume however that some indication would be given, and the patterns established by Amoco's surveys suggest that one, or two point, linear anomalies, represent outcrops of the minor zones cut in the drilling. These minor zones may develop at depth into significant orebodies, but there is no way of establishing this by surface exploration.

The outstanding geochemical response defined by Amoco in the north zone covers the area in which three mineralized structures outcrop, and had there been no indication of past prospecting or mining activity, the area would certainly have been established as a prime target as a result of the geochemical work.

The spread of geochemical anomalism in the north zone is thought to be due to mineralization in parallel shears in the overturned western limb of the Zeehan Syncline, and the widest and highest grade mineralization is known to occur at depth in the zone where the dip of the beds changes from west to east.

The above suggests that mineralization of significant width and depth will only be found where there has been adequate structural preparation. The north zone of the Oceana provides a precedent, and with due appreciation of the difficulties involved in exploring the Zeehan area, like structures should be searched for and thoroughly examined.

It is recommended that:

(i) A revision be made of the fault pattern in the Oceana-Austral area, initially by expert photogeological analysis and follow up ground check. Of utmost importance is the search for the possible faulted continuation of the north zone orebodies on the north side of the Oceana Fault, and the course of this fault should be determined as accurately as possible.

(ii) The limestone in the Austral Valley immediately north of the Oceana Fault should be tested by closely spaced auger geochemistry, and any anomalism clearly defined.

(iii) Since the north zone mineralized area at Oceana provided a gravity anomaly, the area covered by auger geochemistry in (ii) should also be gravity surveyed.

(iv) There is little doubt that the Gordon Limestone areas provide a minimal amount of surface information and it is assumed that all surface data has already been plotted.

In order to detect any broad structural changes, the exposed adjacent Moina and Crotty Formations should be traversed in the hope that structural changes in them may also be reflected in the Gordon Limestone.

The most sought after structural irregularities should be significant changes in strike, and westerly dipping beds.

While changes in strike can be plotted, there will be little, if any, information to suggest at what depth the overturned westerly dipping limb assumes a normal easterly dip, and it is this zone of change which is the main target.

Change in strike, westerly dip and broad geochemical anomalism may be regarded as the best possible combination of parameters in establishing a diamond drill target.

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R. CURTIS & ASSOCIATES

APPENDIX

Note on the Austral Prospect

The following is a short note only, since most of what has been concluded and recommended for the Oceana applies directly to the Austral areas.

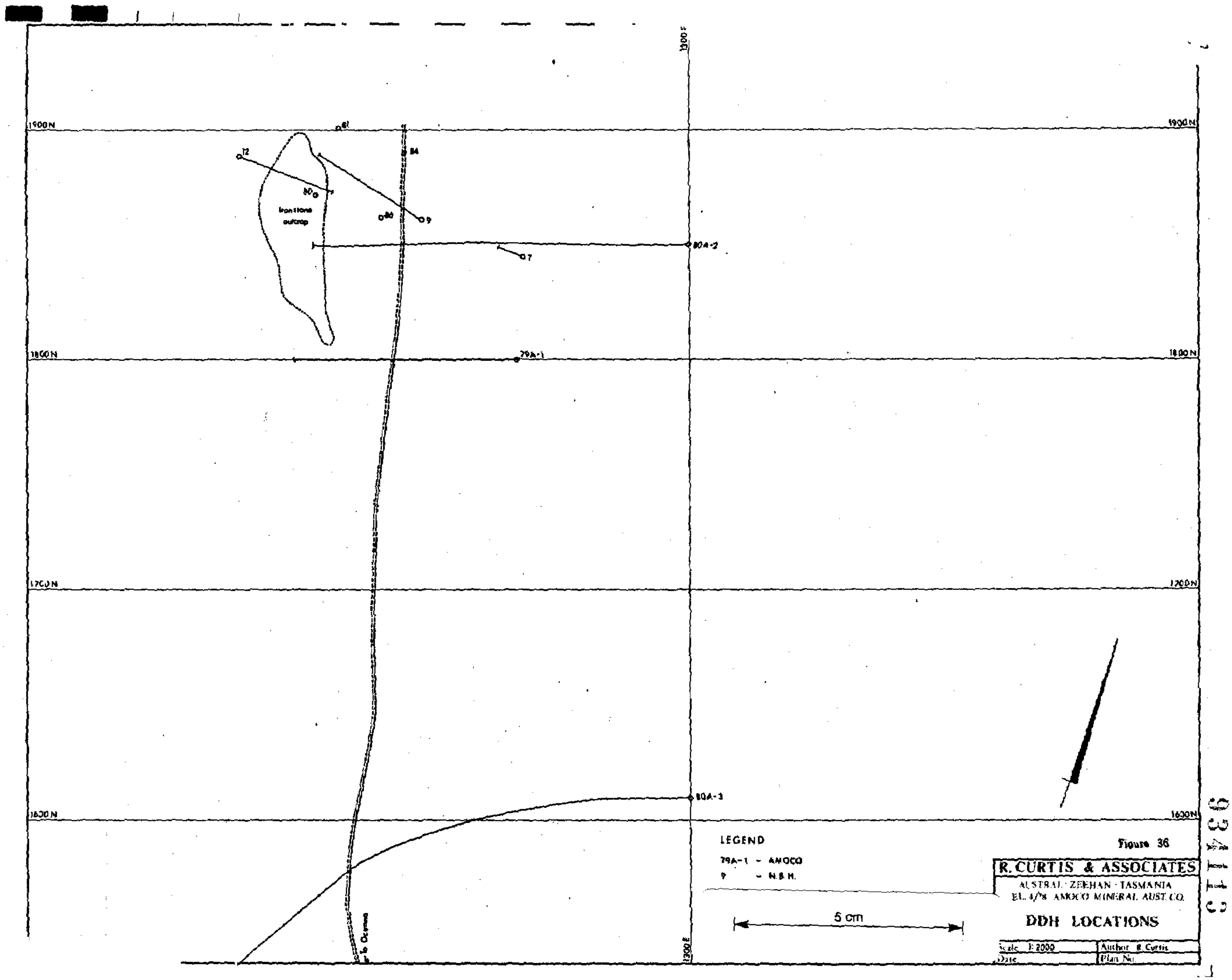
Amoco's follow up work has concentrated on mineralization in a system of bedding plane shears which occupy the contact zone between the Gordon Limestone and the Moina Formation.

Ironstone outcrops resulting from supergene enrichment along the shear zones have long attracted the attention of prospectors, and some mining for flux was carried out in the area.

NBH put down seven diamond drill holes in the area, the locations of which are shown in Figure 36. These locations have been plotted from vague diagrams on the log sheets and must be regarded as very approximate. No mineralization was recorded in DDH's 7 and 12 and the loss of core in DDH 9 was so severe that the results could only be used by NBH as an indication that mineralization did exist. Consequently four more holes were drilled.

Most of NBH's and Amoco's drilling is illustrated on one section, Figure 37, and although there are projections up to 50m it can be seen that there is good correlation between the mineralized intersections. Regrettably the later drill holes by NBH were vertical, and since the shears are near vertical, the intersections represent only minor true widths of mineralization.

The mineralization has been proved to occur in this contact zone for 400m south along strike, by a number of early adits and by Amoco's costeans.


1900 N
1900 N
1300 E
81
72
84
80
86
9
Ironstone outcrop
80A-2
7
1800 N
79A-1
1800 N
1700 N
1700 N
80A-3
1600 N
1600 N
To Oceana
1300 E
LEGEND
79A-1 - AMOCO
9 - N.B.H.
5 cm
Figure 36
R. CURTIS & ASSOCIATES
AUSTRAL · ZEEHAN · TASMANIA
EL 4/78 AMOCO MINERAL AUST. CO.
DDH LOCATIONS
Scale 1:2000
Author R. Curtis
Date
Plan No.

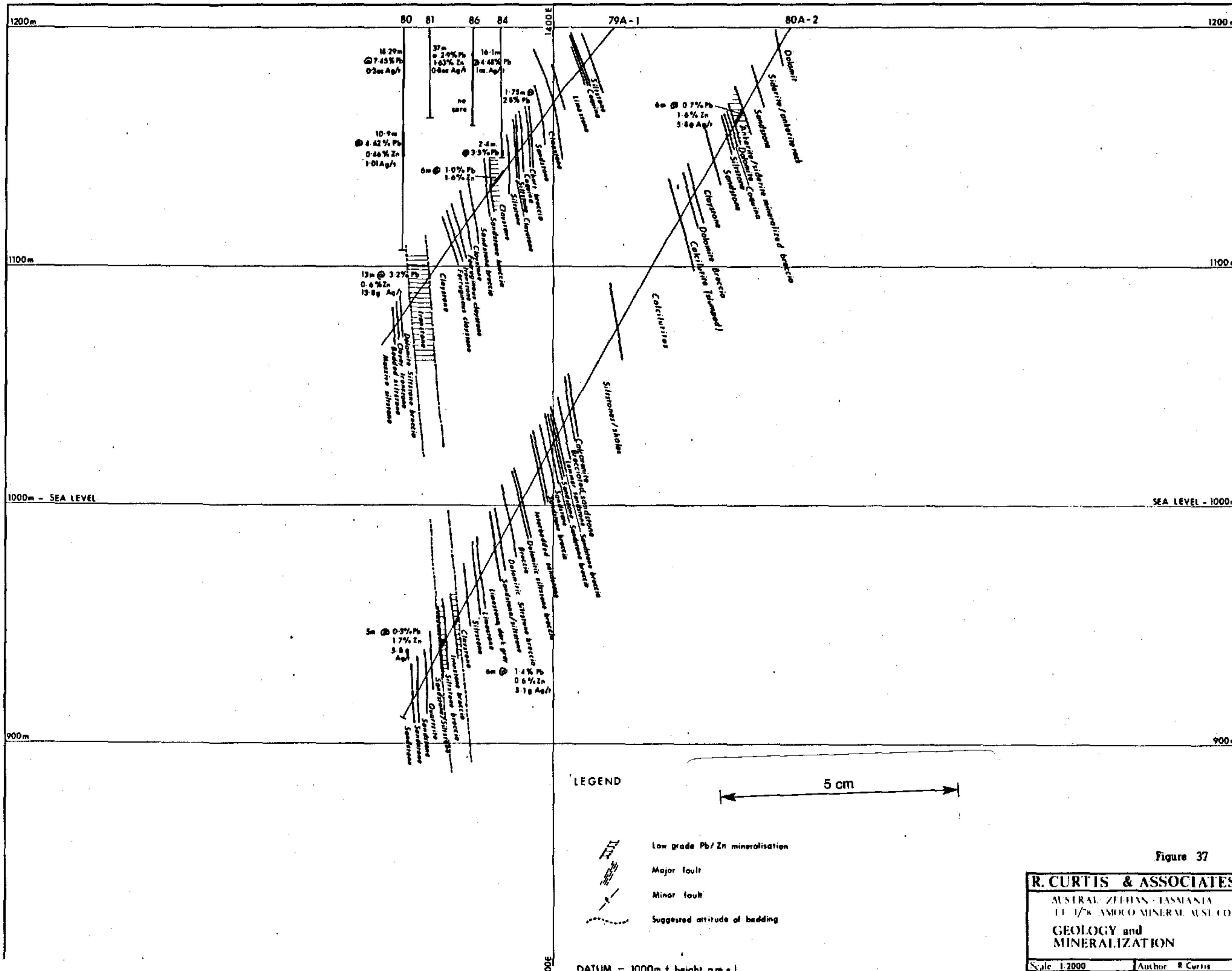


Figure 37

93-114

Evidence suggests that the best near-outcrop mineralization in this area is that occupied by the ironstones and drilled by NBH and Amoco. The presence of ironstones suggests zones of high porosity and permeability which are normally created by faulting and brecciation, and since the better grade mineralization is known to occur in the most disturbed part of the structure, it is not surprising that NBH intersected the higher grade mineralization in the vertical holes.

Amoco's three diamond drill holes indicate that the mineralization becomes low grade rapidly with depth over the 300m strike length between ZT-80A-2 and ZT-80A-3.

According to the known DDH and costean data, and the conclusions generated by the study of the Oceana, the contact zone between the Gordon Limestone and the Moina Formation in the Austral Valley would not be a favourable host for a massive Pb/Zn orebody of significant dimensions. The outcrop of conglomerate is straight, well defined and does not suggest any folding about a vertical axis. The steep easterly dip suggests that the present day level is below the zone of overturning and dip inflexion from west to east, if indeed the limb was overturned in the first place. Also DDH ZT-80A-3 indicates there is no irregularity of dip to suggest structural complexities within reasonable reach of diamond drilling.

Mapping by P.Jones at the Oceana indicates that the North Zone massive Pb/Zn mineralization would outcrop some 100m east of the conglomerate beds at the base of the Gordon Limestone. There is no evidence to suggest that the thickness of the succession between the conglomerate and the major mineralized shears at the Oceana would remain constant on the north side of the Oceana Fault.

However there is Pb/Zn geochemical anomalism at approximately this distance east of the conglomerate in the Austral Valley, immediately north of the Oceana Fault, and notwithstanding the lack of structural detail, this zone should be further investigated (see Austral Lead and Zinc Bedrock Geochemistry 1:2,500 Sheets).

Other than follow up work on the geochemically anomalous zones, no specific recommendations can be made for the Austral Valley. The amonalism mentioned above, the zone enclosing Costeans I and J, and the zone immediately east of the collar of ZT-80A-2 appear worthy of further attention.

The area covered by rock chip samples Numbers 36233-36 and 36245 is also of interest in that the continuation of the Oceana structures may be represented in this wedge of Gordon Limestone.

Presence and degree of mineralization and attitude of the beds over these geochemically favourable zones, could be established initially by a series of short diamond drill holes.

Using the Oceana area as a model, the Oceana Fault may be said to cut across the broad north north west to south south east trending structures at locations where secondary folding within these Tabberabberan trends are most complex.

It is already known that the better mineralization is associated with these secondary folds at the Oceana, and possibly this is also true of the Austral.

If therefore the cross faults have taken advantage of these structural weaknesses, then they provide a useful starting point for exploration.

APPENDIX 2

COSTEANS A TO K - AUSTRAL PROSPECT

W

Cu	Pb	Zn	Ag
6	16	2	<1
4	16	<2	<1
<2	8	2	<1
2	12	2	<1
No sample taken			
10	16	6	<1
14	28	4	<1
4	32	<2	<1
4	44	<2	<1
<2	20	<2	<1
8	20	2	<1
290	130	50	1
85	110	50	<1
50	55	12	<1
70	60	26	<1
44	65	<2	<1
20	40	2	<1
46	55	2	<1
100	60	4	<1
16	70	4	<1
50	220	6	1
8	95	6	7
8	55	6	2
4	20	4	4
2	16	4	1
20	65	48	2
370	1450	290	7
150	1350	145	3
90	1250	610	1
75	1050	1550	<1
6	115	690	<1
10	140	200	<1
6	75	70	<1
6	24	100	<1
6	[illegible]	[illegible]	<1
4	40	460	<1
32	50	500	<1
10	36	410	<1
14	50	440	<1

Geology

Interval | **Lithology**

- Rhythmically interbedded siltstones, shales, sandstones, very micaceous
- Grey green shales, minor pink fine sandstone interbeds. Bedding 315°/83E
- 1130 E — Well bedded, grey to brown micaceous tubicolar siltstones, minor sandstones. Bedding 325°/86W
- Grey interbedded shales and sandstones. Bedding 315°/Vertical
- Olive grey interbedded micaceous siltstones, sandstones and shales. (minor tubicolar)
- White to honey brown massive to wkly bedded conglomerate, minor quartzose - hematitic sandstones
- 1140 E —
- Black mottled gravelly clay
- Interbedded fawn/brown siltstones and sandstones
- Fawn laminar micaceous siltstone. Bedding 155°/85E
- Chocolate brown manganiferous sandstone
- Grey to fawn foliated micaceous clayey siltstone
- Micaceous grey to brown clayey, gravelly siltstones
- Fault breccia zone
- Grey fawn foliated silty claystone
- 1150 E — Brown siltstone
- Manganiferous chocolate brown siltstone
- Dark brown laminar siltstone. Bedding 145°/54W
- Light brown massive siltstone
- Ferriginous, manganiferous, qtzose mottled brown/white/grey sandy clayey siltstone
- Black/brown resinous lignite bands cross cutting light brown micaceous siltstones
- Brown and mottled brown orange micaceous clayey siltstone
- 1160 E —
- Fawn laminar silty clays
- Black manganese rich fault pugh
- Gritty micaceous honey brown siltstone within conglomerate unit. Bedding 352°/62W
- White to fawn quartzose porous hematitic stained conglomerate
- Fawn to dark brown clayey siltstones
- Breccia within mottled olive grey micaceous clays
- Laminar fawn grey clays (shale)
- Honey brown clayey gritty sands
- 1170 E — Interbedded mottled grey cream brown silty, gritty clays
- Brown silty grit
- Light brown micaceous clays mottled
- Fawn clay, massive
- Gritty sandy clay
- Beige grey talcy massive clay
- Gritty sandy clay
- Beige grey talcy massive clay
- Fine grained white/cream sandstone
- Grey to fawn bleached micaceous talcy siltstone
- Fawn fissile, contorted silty shale
- 1180 E — Light grey laminar shaley clays
- Interbedded clayey brown siltstones and fine sandstones
- 1190 E —
- Mottled grey claystone
- Mottled grey/black clayey siltstone
- Olive grey massive claystone
- Black/chocolate brown massive clays, minor pyrite nodules
- Laminar silver grey (brecciated ?) dolomite
- Mottled brown grey and orange cw dolomite
- Chocolate brown silty cw dolomite
- Black brown cw dolomite breccia, Angular fragments, hematite stained minor qtz. component
- 1200 E — Grey slumped dolomite
- Dolomite breccia, dark brown/grey, fragments from 2mm to 3cm, angular
- Dolomite cw dark grey, 5-7% pyrite as fine disseminations
- Dolomitic chocolate brown pyritic sandstone, brecciated
- Grey/beige laminar, finely bedded calcareous shale. Bedding 75°W
- Brown coarse grained clayey sandstone
- Grey beige laminar calcareous shale
- Olive/chocolate brown massive dolomitic claystone
- Calcarenite, massive fresh grey crystalline
- Calcareous shale, fresh, fissile, light grey
- 1210 E — Calcarenite/calclutite, fresh, massive grey crystalline
- Calclutite, fresh grey massive, minor calcite veining
- Calcareous shale, light grey, fissile, calcite veined. Bedding 80°W
- Silty dolomite, black, foliated, massive, hard, minor calcite veining. Bedding 80W to vertical

E

See Geologic map for symbol reference

1265 N
Scale 1:200

5 cm

AUSTRAL PROSPECT
COSTEAN A

934118

W

Cu	Pb	Zn	Ag
2	780	4	<1
80	1950	2	<1
85	5100	26	<1
170	4200	28	1
290	750	8	4
75	1150	12	2
36	2100	44	2
24	2400	22	3
14	670	8	3
80	2800	970	9
36	1400	2400	3
26	1050	2150	1
26	920	2300	2
50	550	3600	1
40	460	3800	1

Geology

Interval: 1150E – 1160E – 1170E – 1180E

Lithology

- Conglomerate / sandy white quartzose gravel
- Grey brown gravelly sand.
- Interbedded beige silty claystones and brown clayey gravels. bedding 160/77 W
- Laminar to thickly bedded interbedded shales, claystones, and sandstones, minor siltstones
- Sandstone, brown hematitic, well sorted, porous bedding 150/72 E
- Light brown siltstone
- Siltstone, olive grey beige
- Sandstone, orange/brown silty in part.
- Siltstone, dark olive grey bedding 145/46°E
- Siltstone, brown.
- Sandstone, brown, manganiferous & gritty.
- Siltstone, grey beige & laminar
- Claystone, ochre, yellow/brown. bedding 230°/40°S
- Breccia, manganese cemented angular tectonic breccia.
- Interbedded brecciated choc brown sandstones and black beige fissile siltstones.
- Siltstone, yellow/fawn, soft sediment slumped. Bedding 145/85°E
- Shaley Siltstone, light olive grey, laminar Bedding 151/84E
- Shales, dolomitic, silty, laminar, pyritic grey olive, bedding 356/76°E
- Siltstone breccia, olive dark grey, slumped & dolomitic, pyritic, trace galena.
- Breccia olive grey yellow & mottled.
- Dolomite grey black silty. pyritic Trace galena/sphalerite.
- Dolomite black, carbonaceous, pyritic shaley & brecciated. Trace galena/sphalerite.
- Siltstone, grey, laminar dolomitic. Bedding 170/56W
- Siltstone, d grey, pyritic, massive & dolomitic.
- Dolomite Breccia, black to dark grey, pyritic, calcite vughed, Trace galena/pyrite
- Interbedded Dolomitic Shales and siltstones, brecciated, carbonaceous, pyritic. massive to laminar.

E

1415 N
Scale 1:200

5 cm

See Geologic map for symbol reference

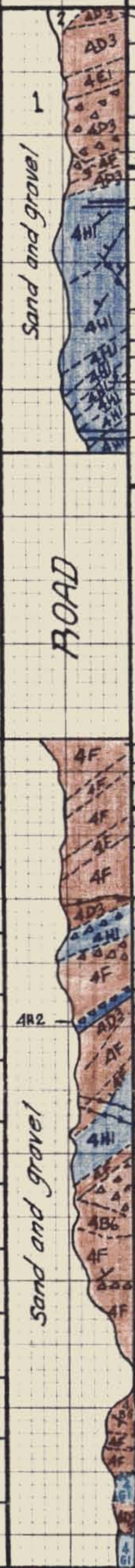
AUSTRAL PROSPECT

COSTEAN B

W

Cu	Pb	Zn	Ag
90	310	1050	6
60	1350	810	3
48	2.75%	8250	18
22	6400	4200	3
26	1.60%	5700	3
16	1.85%	4200	<1
26	3750	40	3
9	2440	64	2
40	2.19%	40	1
6	2440	12	<1
24	280	8	2
28	520	6	1
42	1360	2600	<1
32	2600	1020	<1
18	1000	540	<1
9	168	24	<1
<4	28	6	<1
10	240	60	<1
16	136	440	<1
9	104	600	<1

Geology



Interval | Lithology

1155E
- Siltstone, dolomitic, black/brown
- Siltstone, dark brown sandy, shaley + laminar in part.
- Shale, dolomitic, laminar contorted grey. bedding 70°W.
- Siltstone Breccia, massive fractured, black brown, lignitic veined manganiferous.
- Olive grey clayey Breccia. underneath fault crush zone. very carbonaceous.

1160E
- Siltstone, light brown sandy.
- Dolomite, olive grey, pyritic brecciated, (laminar in part) contamed brown/grey siltstoney interbeds. joints carbonaceous 115°/vert. 148°/43W
- Dolomite, grey clayey, laminar, pyritic containing thin cream silty interbeds 44°W & 28°W. Cut by lignitic vein.
- Dolomite, olive/brown/grey, silty, brecciated.
- Dolomite, steel grey, laminar, clayey.
- Dolomite, cream, silty clayey slumped. bedding 45°W.
- Dolomite, carbonaceous, gritty, dark grey pyritic. (laminar)
- Dolomite, grey massive, silty.
- Dolomite, silty carbonaceous & grey pyritic + well bedded. Jointing 100°/vertical.

1170E

AUSTRAL ROAD.

- Claystone, fawn brown massive silty clays.
- Claystone, dark grey olive laminar mottled orange yellow. Bedding 120°/54°W
- Claystone, laminar + massive light grey sticky clays, minor cream silt interbeds bedding 105°/53W.

1180E
- Claystone, Brown to cream orange mottled, massive sticky clays. Bedding 135/40°W.
- Claystone, fawn to white, laminar, silty, gravelly taley! clays.
- Siltstone, laminar, siliceous, fawn to cream bedding 102/65W
- Claystone, manganese stained cream/white sticky. overlying ferruginous crush zone.
- Dolomite, olive grey brown, clayey slumped dolomite. laminar, minor folding?
- Dark olive grey to cream/white claystones, massive to very laminar bedding 46-49°W
- Dolomite Breccia. cut by joint 55°W
- Siltstone, bedded massive, siliceous siltstones + minor fine grained Sandstones + clays.
- Claystone, olive dark grey to grey massive + laminar clays.
- Claystone, brown grey massive fat clay.
- Dolomite, dark grey to black silty, massive. Cut by calcite veins.

1190E
- Claystone, grey brown massive silty clays, minor lenticular clasts parallel to bedding 57°W
- Dark grey to olive brown lignitic fine sandstone/siltstone Breccia, black wet massive.
- Sandstone, dark brown, massive, porous, wet.
- CLAYSTONE, Interbedded dark grey to brown, silty, minor thin sandstone interbeds dipping 54°W
- FAULT CRUSH ZONE
- Claystone, grey/fawn wet sticky gritty massive to weakly laminar.
- Sandstone, massive, porous, wet, black silty & clayey fine grained. S= smelling. bedding 66°E

1200E
- Claystone, laminar orange/olive grey sticky clays bedding 86°E.
- Claystone; grey to black, blocky massive
- Interbedded calcarenite/calcilutite, sparry, very fresh grey + dark grey, very fossiliferous.
- Shaley dolosiltstones, grey, very laminar.
- Interbedded calcilutites, shaley calcilutites and calcarenites.

E

See Geologic map for symbol references

1455 N
Scale 1:200

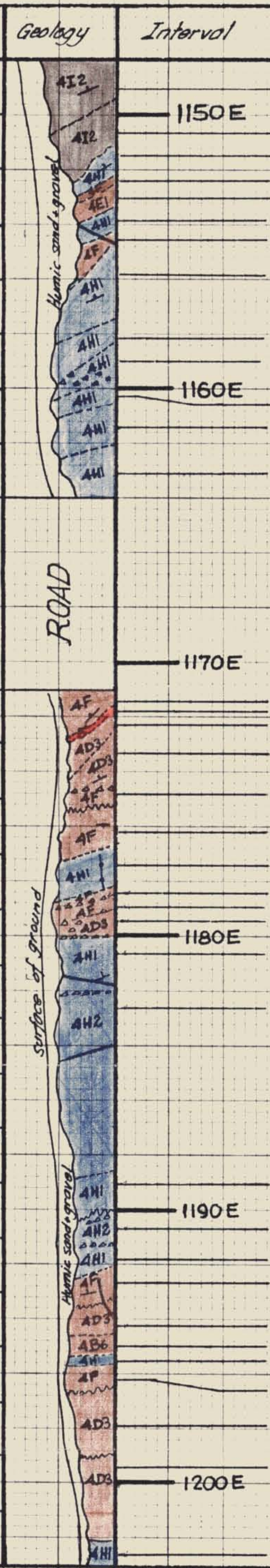
5 cm

AUSTRAL PROSPECT
COSTEAN C

Cu	Pb	Zn	Ag
<4	232	8	1
5	1040	8	<1
96	1680	40	25
560	2600	1000	30
52	1000	1560	1
24	3120	560	2
13	1080	1720	2
20	2·61%	1·60%	15
96	19·4%	290	8
60	2600	240	12
280	2080	32	63
36	1·99%	160	3
56	1·81%	780	1
16	8200	920	<1
14	4800	2520	<1
18	376	620	<1
16	2960	1640	<1
12	880	340	1
8	1080	1000	<1
6	88	24	<1
18	204	18	<1
24	200	20	<1
28	780	1560	2
15	256	280	<1

W

Geology | Interval



Lithology

Conglomerate, white, well rounded peddles with brown interbeds of silty grits bedding 131/69 W.
Conglomerate scree!
Dolomite, silty, laminar chocolate brown, bedding 64° W.
Claystone, interbedded, laminar silty carbonaceous clays. bedding 58° W.
Shale, black to brown interbedded lignitic shales with minor carbonaceous siltstones. Bedding 64° W
Dolomite, dark grey, laminar, silty, Bedding 115/62° W. Cut by carbonaceous joint 140/65E.
Claystone, interbedded grey, brown, orange, olive silty clays + clayey siltstones.
Dolomite, dark brown black carbonaceous & silty. Bedding 105°/66 W.

Dolomite, laminar olive grey brown micaceous? & silty.
Dolomite, dark olive grey massive silty dolomite, minor qtz fragments. Bedding 105/50 W
FAULT CRUSH ZONE - lot of water. very fractured.
Dolomite, olive grey, silty.
Dolomite, dark grey, black, massive & silty. very fractured.
Dolomite olive grey massive & silty.

Claystone, Interbedded mottled yellow grey brown gritty sticky clays, laminar, bedding 135°/45 W
Ironstone, orange yellow very ferruginous.
Siltstone, yellow white cream, laminar sticky clayey silts.
Siltstone, white clayey, bedding 40° W. minor laminar mottled orange/yellow clays.
FAULT ZONE
claystone, mottled orange yellow cream clays, ferruginous ironstone towards fault zone.
claystone, fawn to cream laminar, silty, Bedding 095/88° E
Dolomite, interbedded massive + laminar, slumped, pyritic, carbonaceous silty dolomite Bedding 71° W.
claystone, choc brown thickly laminar ferruginous clays. surrounding fault zone.
claystone, cream grey thickly laminar clays.
Breccia, mottled brown olive grey brecciated clayey siltstone??
FAULT ZONE.
Dolomite, black carbonaceous, pyritic laminar to thickly bedded silty dolomite bedding 110/69 W., 096/75 W
CRUSH ZONE
Dolomite Breccia, black olive grey, slumped, pyritic, slumped grey brown silty fragments, Joint 74° W.

Dolomite, dark brown, thickly laminar silty & sandy.
Breccia, very carbonaceous, chocolate brown extensively fractured. silty dolomite?
FAULT ZONE
Dolomite, dark grey laminar silty.
Claystone, fawn, laminar silty bedding 81° W. cut by ironstone joint dipping 18° E.
Siltstone, fawn brown weathered clayey siltstone.
Sandstone, coarse grey well sorted friable sandstone.
Dolomite, black carbonaceous + clayey. Bedding 110/87 W.
Claystone, mottled grey white massive fat clay. grades laterally into grey brown clays.
Siltstone, dark brown clayey siltstone
Siltstones, interbedded with qtzose friable + silicified sandstones.
Dolomite, black, silty, massive.

E

See Geologic map for symbol reference

1490 N
Scale 1:200

5 cm

AUSTRAL PROSPECT
COSTEAN D

W

Cu	Pb	Zn	Ag
980	1440	224	14
36	680	52	2
28	600	800	<1
40	296	300	<1
20	208	1320	<1
15	4.20%	1.12%	9
24	312	880	<1
18	3080	460	8
10	880	48	36
6	460	32	11
160	5400	216	19
80	840	580	2
44	1800	1280	2
24	1840	1680	1
20	2240	6800	<1
12	720	2280	<1
6	72	40	<1
5	152	72	<1

Geology

Interval / Lithology

- Siltstone, clayey, cream to light brown
- Silty Dolomite, laminar olive grey. bedding 119°/30° W
- Sandstone, fine grained silty light brown, massive textureless.
- Carbonaceous Fault Zone & surrounding crush zone.
- Dolomite, black brecciated silty carbonaceous dolomite.
- Dolomite, grey brown, silty, mottled, laminar, bedding 51° W
- Dolomite, black, brecciated silty carbonaceous dolomite.
- Siltstone, brown grey massive to thickly bedded siltstone, black, bedding 109°/79W.
- 1150E
- Dolomite. interbedded slumped black silty clayey carbonaceous dolomites with thin olive grey siltstones bedding 106/57W
- Dolomite, pughy grey clays, increasingly, fractured eastward with less silty component. Bedding 41°W
- FAULT ZONE - pyritic. minor galena. pyrite nodules.
- Dolomite, massive brown olive, dense, pyrite veined silty.
- Claystone, bleached cream, mottled, silty clays.
- 1160E
- ROAD
- Claystone, bleached cream brown massive.
- Claystone, laminar ferruginous brown/choc silty. bedding 095/27W.
- 1170E
- Claystone orange brown laminar 121°/61E bedding
- Claystone, laminar, yellow brown silty claystone
- Claystone folded light orange brown, laminar well bedded silty, minor ferruginous beds bedding 118/75E
- Claystone, well bedded pale grey silty minor thin carbonaceous beds. Bedding 113/65E
- Dolomite. black to dark grey, massive textureless silty, minor silty interbeds bedding 122/65E
- Dolomite breccia, mottled orange grey brown massive silty minor qtz, trace sphalerite.
- Dolomite, olive grey, laminar, silty, bedding 090/45W minor galena/sphalerite vein.
- FAULT ZONE 125/59W. ferruginous, carbonaceous, qtz filled crush zone.
- Breccia, mottled light & mid grey massive clay breccia.
- Dolomite, interbedded brown black carbonaceous siltstones + dolomites. bedding 121/86E.
- Siltstone, mottled orange brown grey clayey sandy siltstone. bedding 79°W.
- 1180E
- Dolomite, very pyritic, slumped, olive grey brown massive. silty
- Dolomite, thickly bedded dense, grey. brown olive silty. bedding 136/46W minor qtz vein.
- Claystone, grey. dolomitic silty clays.
- Siltstone, laminar, quartzose, horizontally bedded
- Interbedded coquina, silicified sandstones and cream white quartzose sand. bedding 055/23°S.
- Siltstone, sandy brown clayey. crushed siltstone.
- Siltstone. choc brown carbonaceous sandy. bedding 140/75E.

E

See Geologic Map for symbol reference

1518 N
Scale 1:200

5 cm

AUSTRAL PROSPECT
COSTEAN E

W

Cu	Pb	Zn	Ag
440	620	1280	15
28	460	2400	1
152	8.70%	9600	102
44	2.28%	1.36%	25
24	7600	7600	2
20	1.61%	9400	1
14	2.03%	840	12
13	2520	1200	1
20	420	2720	<1
22	440	880	1
16	232	2400	<1
18	432	4200	<1
18	500	1760	1
24	1000	1440	2
18	1280	80	1
6	176	88	<1

Geology

Interval — Lithology

- Sandstone, fawn brown silty, massive to weakly bedded. bedding 48° W. Sequence cut by fault. 10°E
- Dolomite, black carbonaceous silty.
- Siltstone, fawn, crushed ochre yellow, clayey. bedding 144°/55° W
- FAULT.
- Dolomite, black, massive to weakly bedded carbonaceous silty, minor quartz + siderite augen, bedding 170/49° W becoming pughy and fracturing prominent eastward.
- claystone, white + black clays Interbedded with granular galena + sphalerite mineralization. ≃ 15% Pb/Zn
- 1150E
- Dolomite, laminar, silty, slumped, black with pyrite beds prominent, silty grey interbeds, bedding 155°/58° W. and 142/55 W.
- Dolomite Breccia, massive brown black olive mottled, silty, lignitic, minor qtz + sandstone fragments. Zone becomes very fractured eastward.
- FAULT..... Black carbonaceous fault zone minor galena / sphalerite mineralization
- Siltstone, chocolate olive brown sandy, well jointed, massive, textureless.
- 1160E
- Dolomite, ferruginous, massive, concoidal fractured brown olive and silty.
- claystone, grey to black wet pughy clay. minor quartz augen.
- Dolomite Breccia, olive brown massive carbonaceous.
- FAULT....... with surrounding crush zone. disseminated very minor galena.
- 1170E
- Sandstone, bedded coarse brown sands and minor clays.
- Dolomite, olive brown mottled, very carbonaceous massive to laminar silty, intense fracturing west towards fault. bedding 49° W.
- FAULT......... Very carbonaceous.
- claystone, olive grey mottled, silty. overlain by carbonaceous layer.
- Dolomite, grey, olive, brown, clayey jointed silty dolomite ironstoney near fault.
- Sandstone, friable chocolate. brown. bedding 85° E
- Dolomite, olive grey, brecciated, weakly laminar silty calcite veined, weakly carbonaceous dolomite.
- Sandstone, friable chocolate brown sand.
- Siltstones, grey brown clayey, fine sandy, coarsely bedded.
- claystone, laminar light grey fawn sticky clays bedding 142°/55° W.
- claystone, dark grey black, bedded silty. clays.
- Claystone, folded, laminar, light grey fawn sticky clays, bedding 125°/60° W.
- Claystone dark grey black sticky clay.
- 1180E
- Dolomite, brown, carbonaceous silty bedded.
- FAULT
- Claystone, light grey to cream laminar brecciated mottled sticky clays bedding 15° N.
- Dolomite dark grey silty.
- Claystone, brecciated light grey cream mottled clay.
- Dolomite Breccia, fine sandy grey brown
- Dolomite, chocolate brown silty.

E

See Geologic map for symbol reference

1550 N
Scale 1: 200

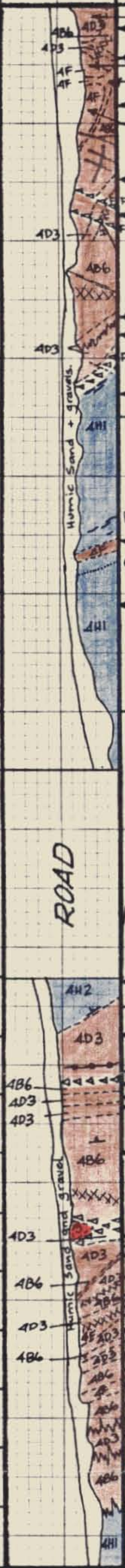
5 cm

AUSTRAL PROSPECT
COSTEAN F

W

Cu	Pb	Zn	Ag
152	400	17	1
284	180	14	2
160	860	104	1
396	700	1640	5
24	480	420	1
56	396	3520	1
150	830	2800	5
24	165	1500	<1
26	220	1950	<1
50	1.70%	1.45%	14
24	710	330	<1
24	1700	3200	34
75	1.98%	3200	34
28	5800	5900	5
28	1.00%	3300	8
18	760	1000	<1
10	520	300	<1
20	620	3200	<1
14	770	2000	<1
10	250	50	<1
115	1250	34	<1
34	520	44	<1
26	970	50	<1

Geology



interval | **Lithology**

- Siltstone. ferruginous dark brown.
- Sandstone, interbedded fawn coloured fine grained ssts and siltstones.
- Siltstone, drag folded thinly bedded micaceous. Cut by crush zone.
- Claystone, light grey to grey pughy clay.
- Claystone, white silty clays. overlying carbonaceous filled joint plane. bedding 10°W.
- Sandstone, medium to fine grained brown micaceous sandstones. Jointed attitudes 160/61E.

1130E

- Claystone, grey, silty, sticky, laminar clays. bedding 194/30°W.
- Siltstone, dark grey black clayey siltstone overlying extensive crush + fracture zone.
- FAULT / FAULT — Sandstone, cream yellow gravelly sandstone. lot of quartz fragments. Manganese on joint surfaces. fracture zone further to east.
- Siltstone, dark brown sandy brecciated weakly ferruginous. bedding 27°W
- Siltstone fawn, sand fractured slickensided sandy siltstone.
- FAULT....... Black pughy clay within fault zone, minor cw calcite within zone.
- Dolomite, massive. blocky silty, weakly slickensided near fault zone. Fault zone overlies bedded fine grained pyrite

1140E

- Py. Bedded fine grained pyrite, bedding 60° W.
- Claystone, light grey cream silty fat sticky dolomitic clays. bedding 152°/57W. very lensoidal.
- Gn, St. Galena sphalerite vein 2 cm in width, attitude 67° W.
- Dolomite, massive pyritic, sticky, wet, dolomite clays, minor quartz augen.

1150E

ROAD

- Dolomite Breccia, massive to laminar, dark grey dolomitic clay breccia, bedding 54°W. Rock pyritic.

1160

- Siltstones, weakly bedded grey to brown lignitic dolomitic slumpy siltstones. Containing carbonaceous vein.
- FAULT. Sandstone, cw coarse grained friable brown.
- Siltstone, olive grey clayey.
- Siltstone, interbedded grey/cream - grey dolomitic siltstones.
- Sandstone, interbedded grey, cream, brown coarse grained sandstones with slumped siltstone interbeds (westerly dip)
- FAULT ZONE... overlain by ironstone.
- Siltstone, olive grey mottled laminar lignitic siltstone. bedding 115°/70W
- Siltstone, interbedded laminar siltstones, dolomitic siltstones and clayey siltstones.
- Sandstone, chocolate brown, coarse grained.
- Siltstone. interbedded grey brown siltstones and sandstones, overlying crush zone of attitude 59°W.
- Sandstone. grey olive brown med grained sst.

1170E

- Siltstone, dark grey carbonaceous siltstone, bedding 096/60W. overlying extensive fracture zone.
- Claystone, laminar, grey cream black dolomitic clays.
- Siltstone, dolomitic laminar grey cream.
- Sandstone, cream brown coarse grained. bedding 64° W
- Siltstone, black grey interbedded with yellow grey medium grained sandstones.
- Sandstone, yellow grey medium grained, well sorted, very friable.
- Claystone, dark grey dolomitic clays.
- Sandstones, silty, dark grey to brown.
- Siltstones, light grey cream clayey.
- Sandstone, pelletal, well sorted, med/coarse grained grey porous sst, minor clayey interbeds.
- Dolomite, dark grey black, very laminar, silty, minor sst interbeds.

E

See Geologic map for symbol reference

1575 N
Scale 1:200

5 cm

AUSTRAL PROSPECT
COSTEAN G

934125

Cu	Pb	Zn	Ag
26	1750	1·15%	3
155	7·85%	17·50%	53
16	290	2400	<1
20	160	2400	<1
16	9400	1·2%	<1
44	3500	560	13
40	4900	640	3
125	3·40%	1500	19
105	5·65%	2900	20
110	5·70%	2100	23
55	3·05%	2700	20
42	3·65%	3200	17
12	2·00%	4600	7

Geology

interval / **Lithology**

1100E

- Py
- Dolomite, grey black, silty massive to laminar, minor fine grained pyrite beds. bedding 60° W.
- Gn Sl ...... Semi massive lead/zinc mineralization, coarse grame gn/sl crystels within black & white pughy clays. ≈ 25% Pb/Zn
- Dolomite, chocolate brown massive silty, slickensided? dolomitic clays.
- Py
- Dolomite, clayey, dark grey to black sticky wet massive to weakly laminar, minor thin white/cream silty interbeds. minor pyrite beds and calcite veining. Bedding 70° W.
- Siltstone, dolomitic cream white bed, bedding 64° W.
- Py – Dolomite, black silty pyritic partly carbonaceous.
- Siltstone, dolomitic, laminar cream, grey clayey siltstone interbeds. bedding 51° W.
- Py
- Dolomite, interbedded silty black laminar dolomite and yellow cream laminar clayey interbeds. bedding 73° W.
- FAULT ZONE extensive crush zone with olive grey yellow, ferruginous, hard silty dolomite.

1120E

- Shale yellow ferruginous slickensided shale.
- Dolomite, mottled black olive grey ferruginous gritty silty. Zone badly fractured.
- Dolomite, silty, black brown carbonaceous breeciated. Lying in close proximity to fault zone. Fault attitude 78° W.
- Siltstone, ochre brown cream, grey, laminar siltstone.
- Siltstone, laminar cream grey. bedding 64° W. overlying material altered by cross vein lignitic.
- Siltstone, brown, cream, grey, very laminar, bedding 69° W
- Silty Dolomite olive grey black.
- Siltstone, altered brown grey, manganese stained. bedding 69° W.
- Ironstone, yellow orange, manganese stained porous, fractured clayey ironstone.
- Ironstone more manganiferous than ferruginous
- Ironstone, massive goerthite fractured, porous black, brown. harder relict thin bed dipping 85° E.
- Ironstone, orange brown clayey wet mottled ferruginous + soft.
- Claystone, pink yellow brecciated.
- Ironstone, orange brown ferruginous.

1130E

- Claystone, Pink + yellow sticky ferruginous clays surrounding ironstone core.
- Ironstone, concretionary, hard massive dark brown
- Siltstones, altered ferruginous orange yellow.
- Sandstone, altered black white clayey sandstone.
- Claystone, ferruginous, gritty brown ochre yellow mottled manganese stained clays. Ferruginous fracture prominent
- Siltstone, ferruginous yellow/white clayey
- Dolomite, silty, light grey laminar.

see Geology map for symbol references

1660 N

Scale 1: 200

5 cm

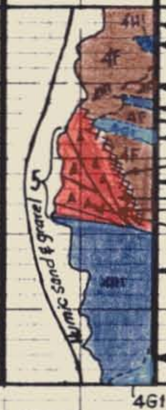
AUSTRAL PROSPECT

COSTEAN H

934126

Cu	Pb	Zn	Ag
36	1.22%	1.65%	14
20	1950	750	4
85	4.80%	1.95%	75
18	4100	5000	11
6	750	2100	<1

Geology



Interval	Lithology
1310 E	claystone, ferruginous yellow orange clays. interbedded with d grey + black silty clays.
	Dolomite, black shaley dolomite interbed less weathered.
	claystone, grey sticky.
	Dolomite, silty black
	claystone, grey sticky.
	Calcilutite, calcite veined silty.
	Fault zone, crushed slickensided. grey dolomitic shale
	claystone, grey sticky very wet clays.
	Siderite Breccia, olive grey mottled Pb mineralized altered, fractured sideritic breccia.
	Breccia mottled brown grey cream breccia.
	Siderite Breccia, altered white cream siderite quartz mineralized breccia.
	Dolomite, dark grey black, silty sticky wet massive swelling dolomitic clays.
	calcilutite, grey, calcite veined, minor arenaceous interbeds.
1300 E	

1050 N

Scale 1:200 (Looking North)

5 cm

See Geologic map for symbol reference

AUSTRAL PROSPECT

COSTEAN I

934127

W

Cu	Pb	Zn	Ag
14	65	12	3
14	60	18	2
38	200	36	10
55	230	115	16
55	2600	400	3
4	105	10	< 1
< 2	60	12	< 1

Geology

Interval: 1280 E – 1290 E

Lithology

- Sandstone, coarse grained brown.
- Siltstone, dolomitic, chocolate brown laminar bedding 52° W.
- Siltstone, grey cream, sticky, clayey massive
- Siltstone, dolomitic, dark brown black fractured massive to thickly bedded, carbonaceous.
- Siltstone Breccia, mottled grey cream brown yellow, highly fractured intensely chevron folded clayey siltstone breccia
- 1280 E
- FAULT BRECCIA mottled grey yellow brown, sandy + silty fault breccia, minor quartz fragments, weakly ferruginous.
- Shaley Dolomite, dark grey very fractured overlain by yellow Siltstone and also brown brecciated sandstones.
- claystone, black pughy clay.
- Siltstone, mottled yellow orange brown, brecciated clayey siltstone. bedding 130/ 32 SW.
- claystone, dolomitic, laminar, black / cream, sticky wet, minor fresh fragments of calcite veined calclutites.
- siltstone, ferruginous brown olive clayey siltstone.
- Claystone, black, sticky wet.
- Shales, dolomitic mottled ferruginous orange yellow grey very fractured. overlying X cutting ferruginous crush zone. bedding 60° W
- Shales, silty grey very laminar, with minor ferruginous zones (due to pyrite?). bedding 131° / 75 E
- Siltstone, black, dolomitic. joint set in rock 21°/65° SE.
- Siltstone, sheley brown, underlying orange yellow brown ferruginous fracture zone.
- 1290 E

E

See Geologic map for symbol reference

1100 N

Scale 1:200

5 cm

AUSTRAL POSPECT

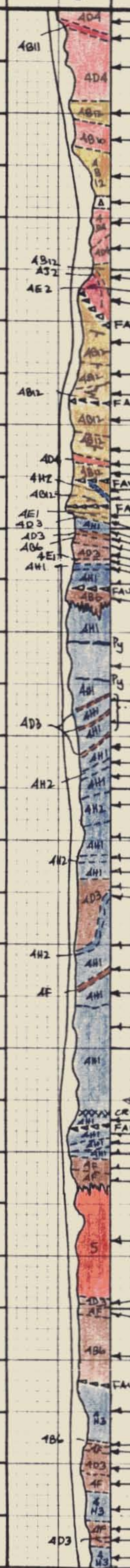
COSTEAN J

934128

W

Cu	Pb	Zn	Ag
<2	60	12	<1
14	145	12	<1
10	44	10	<1
180	1800	46	3
290	650	26	13
910	1250	50	6
1450	1250	60	103
145	1.22%	6800	6
240	1.50%	1.40%	8
38	810	9100	<1
22	175	3600	<1
20	155	3800	<1
16	125	7900	<1
20	210	4100	<1
22	340	2500	<1
130	8.40%	1.10%	37
30	3100	1.0%	5
18	2500	1.0%	3
26	2200	6.0%	7
18	6400	48%	<1
22	8200	1.70%	<1
18	7400	1.05%	4
125	6.0%	5600	15
90	5.65%	3600	7
110	5.4%	2200	19
14	1.38%	900	4
10	7000	1000	3
18	2800	2600	14
16	2100	3500	7
46	1800	1750	2

Geology



Interval / Lithology

1110E
- Siltstone, micaceous fawn brown interbedded with reddish silicified fine grained sandstones. bedding 130/73E.
- Sandstone, pink, coarse grained silicified, porous. bedding 120°/85E
- Siltstone, micaceous fawn brown, interbedded with reddish silicified fine grained sst.
- Sandstone, brown to light grey micaceous porous silty sst. bedding 126°/89E
- Sandstone, tubicolar brown, medium grained sst. Tubules comprised of silicified white quartz grains.
- Sandstone, brown micaceous silty sst, bedding 125°/86°E.
- Sandstone, ferruginous, quartz veined, brown sst extensively crushed - FAULT ZONE?
- Siltstone, massive, brown micaceous sandy siltstone, minor laminar interbeds, bedding 52°W.
- Siltstone, laminar micaceous brown gritty sltn. Bedding 82°W.

1120E
- Sandstone, mottled dark grey dolomitic sst.
- Shale, interbedded fawn to ochre brown shales, sandstones and siltstones.
- Sandstone, quartzose, gritty contorted. Bedding 360/63° SE.
- Sandstone, interbedded coarse and fine sandstones, blocky, crushed, minor siderite. bedding 180°/78E
- Sandstone, coarse grained, white, wet, foliated, minor karkhi clayey siltstones. bedding 84°E.
- Sandstone, olive, dark grey, dolomitic changing upwards into a brecciated brown coarse grained sst.
- Sandstone, mottled, olive brown, hard, blocky silty fine grained sandstone.
- Sandstone, laminar, yellow, grey, fine grained, porous friable silty sandstone, bedding 145°/81°E.
- Siltstone, black dolomitic clayey siltstone very laminar, wet, minor lensoidal interbedded sst fragments.
- Sandstone, laminar yellow grey fine, porous silty sst, bedding 85°E.
- Sandstone, coarse grained pyritic grey sst.
- Dolomite Breccia, pyritic bedding 204/76SE overlain by coarse grained ssts, pyritic sltns and minor shales, bedding 165/65E
- Shale, interbedded with slickensided grey laminar siltstones.

1130E
- Siltstone, grey sandy.
- Dolomite, silty pyritic, laminar, black, minor qtz?
- Siltstone, dolomitic laminar grey, bedding 175/70E
- Sandstone, fine grained, massive black, silty qtz augened
- Siltstone, dolomitic, laminar, black, grey cream?, bedding 88°W.
- Shaley Dolomite, laminar, light grey.
- Silty Dolomite, laminar, black grey cream.
- Dolomite, slumped, light grey pyritic, silty. bedding 54°W.
- Sandstone, coarse grained, massive, black, gritty, quartzose.
- Dolomite, dark grey to black massive, textureless, hard dense, pyritic as disseminations and veinlets.
- Siltstone interbeds within dolomite, thin beds < 5cm width, very laminar, bedding 55-65° W.
- Breccia, sedimentary pyritic breccia, breccia fragments up to 5cm in width cemented in dolarenite matrix. bedding 67°W
- Dolomite, silty, massive black, quartz veinleted. bedding 79°W.

1140E
- Breccia, sedimentary angular to sub rounded gritty breccia, mineralized with galena as fine disseminations, pyritic
- Dolomite, dark grey silty. minor calcite veining.
- Breccia, sedimentary? black brown, dolarenite breccia.
- Dolomite, dark grey silty massive, + textureless.
- Siltstones, laminar light grey to grey dolomitic, minor calcite veining.
- Breccia, sedimentary dark brown grey pyritic breccia.
- Dolomite, dark grey coarsely bedded, silty
- Claystone light grey cream sticky, laminar clays. bedding 67°W.
- Dolomite silty, laminar dark grey, grading laterally into altered olive dense silty dolomite eastwards.
- Dolomite, mottled olive, green, brown grey, hard altered, dense, silty dolomite, extensively veined, vughy, faulted??

1150E
- Dolomite, dark grey slumped silty dolomite.
- Dolomite, beige yellow brecciated silty.
- Dolomite, black silty.
- Dolomite, grey cream, yellow orange laminar, silty dolomite.
- Claystone ferruginous, orange, brown, yellow sticky silty. bedding 85E
- Claystone, laminar, black, sticky wet, brecciated eastward.
- Ironstone Breccia, orange, black, cream, ferruginous and manganiferous, pisolitic & massive sandstone/ironstone breccia
- Siltstone? very laminar, orange, wet clayey silts. bedding 095/81°E.

1160E
- Claystone, black sticky wet clays.
- Sandstone, mottled grey/white vughy, calcite veined, coarse to fine grained silty sandstones. Minor druzy qtz augen.
- Silica Dolomite, honeycombed, very porous, silicified silica dolomite, honey brown. with minor siltstone interbeds.
- Sandstone, ferruginous orange yellow coarse grained.
- Claystone, chocolate brown sticky
- Siltstone, sandy white grey. with numerous interbeds of coarse grained porous friable cream sandstone (westwards)
- Claystone, ochre dark brown very sticky wet clays.
- Silica Dolomite, ferruginous mottled, hard, leached + porous, silica dolomite, minor interbeds of siltstone.
- Claystone, ochre brown.
- Siltstone, white sandy siltstone interbeds?
- Silica Dolomite, with siltstone interbeds

1170E

E

1736 N
Scale 1:200

5 cm

See Geologic map for symbol reference

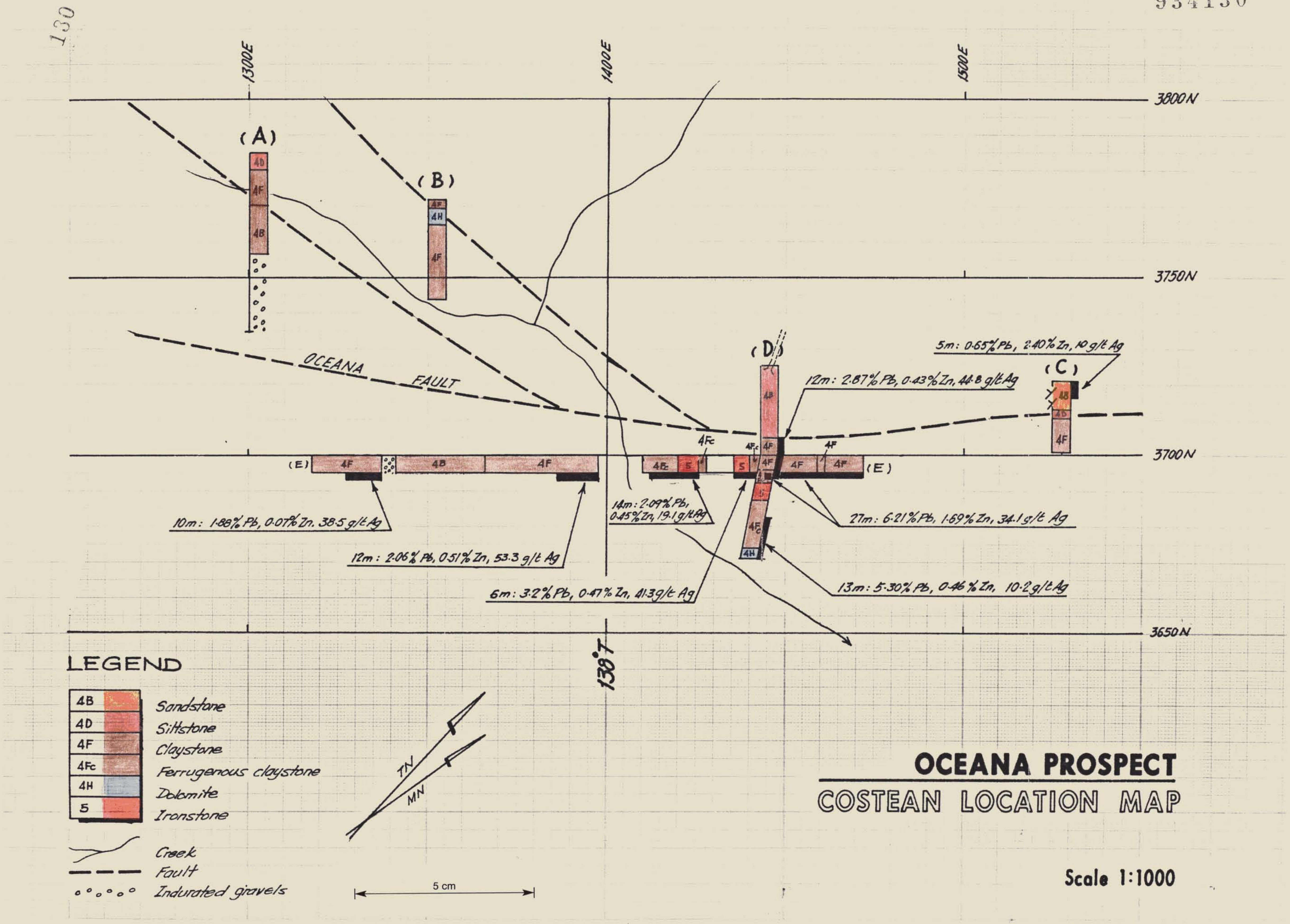
AUSTRAL PROSPECT

COSTEAN K

APPENDIX 3

COSTEANS A TO E - OCEANA PROSPECT

934130



OCEANA PROSPECT

COSTEAN LOCATION MAP

Scale 1:1000

NW

Cu	Pb	Zn	Ag	Geology	Interval	Lithology
150	3200	200	1	Gravel / boulder overburden; 4D4, 4D+, 4D4	3785N – 3780N	Pale grey siltstone, clayey in places, some bedding. dip near vertical Yellow clayey siltstone Pale grey siltstone, clayey in places, some bedding with near vertical dip to N.W.
290	5900	3500	2	Gravel / boulder overburden; 4F, 4I3	3780N – 3775N	Siltstone as above silty grey clay Quartzite conglomerate, bedding dipping vertically N.W.
				RIVER	3775N – 3772N	
350	2700	2100	3	Overburden; 4F, 4B6	3772N – 3767N	FAULT ?? Silty clay Vertically outcropping sandstone, fawny-grey in color
280	8500	800	3	Overburden; 4B6	3767N – 3762N	Sandstone as above, near vertical to steeply dipping N.W.
200	3100	910	3	4B6	3762N – 3757N	Sandstone as above Indurated gravels
WATERACE				Gravels - indurated	3757N – 3745N	
130	3100	145	1	(gravels)	3745N – 3740N	Indurated gravels, unable to dig through
910	3500	450	6	(gravels)	3740N – 3735N	Indurated gravels as above

SE

See Geologic map for symbol reference

1300 E
Scale 1:200

5 cm

OCEANA PROSPECT
COSTEAN A

934132

NW

Cu	Pb	Zn	Ag	Geology	Interval	Lithology
46	1000	3700	1	4F 4F	3772N 3767N	Grey clay Brown/yellow mottled clay
130	4200	5500	1	4F 4F	3762N	Grey/fawn dolomitic clay, in some places sand Mottled yellow/brown wet clay
80	2300	3100	1	overburden 4F	3757N	Mottled yellow/brown/orange clay
40	1500	3800	<1	Gravel/ 4F	3752N	Mottled yellow/brown clay containing small pods of ferrugenous material
22	1100	1950	4	4F 4F	3747N	Mottled yellow/brown clays with minor ferrugenous patches Marroon hematitic patches of clay
90	2100	1800	9	4F 4F 4F	3744N	Mottled grey/fawn/brown clay Yellow/brown/orange clay Metallic grey clay containing relict pyrite

SE

1350 E (Looking West)

Scale 1:200

5 cm

See Geologic map for symbol reference

OCEANA PROSPECT

COSTEAN B

NW

Cu	Pb	Zn	Ag	Interval	Lithology
70	6500	2.40%	10	3722N 3717N	Sandstone, grey with bedding. (Dip 45° N.W.) Sandstone, weathered to a clayey sandstone
80	1200	2100	3	FAULT 3712N	Sandstone as above Siltstone Indurated gravels
20	460	3100	1	3707N	Collaspe zone due to fault on 3712N Metallic grey clays with no visible bedding
60	900	880	1	3702N	Metallic grey clays as above

Geology:

SE

1525E (Looking West)
Scale 1: 200

5 cm

See Geologic map for symbol reference

OCEANA PROSPECT

COSTEAN C

NW

Cu	Pb	Zn	Ag	Geology	Interval	Lithology 934134
30	1000	190	1	$4B_{10}$	3726N 3721N	Adit Entrance Light grey sandstone Moina sandstone
40	720	36	2	$4B_{10}$	3716N	Moina sandstone
180	1800	175	12	$4B_{10}$	3711N	Moina sandstone
30	1000	290	1	$4B_{10}$	3706N	Moina sandstone, weathered predominantly to a sandy grit
180	2.95%	5000	60	$4B_{10}$ 4F Gravel overburden	3701N	Moina sandstone, steeply dipping N.W. clays and grits, silty and sandy, light to metallic grey in color
310	3.10%	3500	14	4F	3696N	Yellow/grey silty clay
330	2.10%	4500	84	4F	3694N	Ferrugenous clays
105	9500	3600	36	4F	3692N	Ferrugenous clay with occassional black clayey pods
165	9500	5100	55	4F 5	3690N	Ferrugenous clay with minor black clay Ironstone outcropping, massive with no visible bedding attitude
90	6000	5000	38	4F 5	3688N	Ferrugenous clays Ironstone as above
55	7600	3600	24	4F	3686N	Ferrugenous clays as above
46	8500	4300	26	4F	3684N	Ferrugenous clay zone
80	3.40%	5300	9	4F	3682N	Ferrugenous clays as above
90	6.80%	6600	9	4F	3680N	Ferrugenous clay zone
85	6.10%	6200	9	4F	3678N	Ferrugenous yellow/brown clays
55	2.7%	5300	9	4F	3676N	Yellow/brown ferrugenous clays
55	6.20%	2600	12	4F 4F/H1 Gravel overburden	3671N	Ferrugenous clays as above Gravels in black clays (probably dolomite), end of ferrugenous zone, end of costean due to river

SE

See Geologic map for symbol reference

1445 E
Scale 1: 200

5 cm

OCEANA PROSPECT

COSTEAN D

NE

Cu	Pb	Zn	Ag	Geology	Interval	Description
					1472 E	
850	16.8%	6.40%	37	Gravel overburden; Sloopy grey; 4F		Grey metallic clay; Yellow/grey clay, visibly mineralised
					1467 E	
360	5.95%	9400	28	silty grit; 4F		Grey, olive, tan clay
					1462 E	
85	1.75%	5200	5	4F; 4F; 4B6; 4F		Olive clay; Mottled grey, olive clay; Outcropping grey sandstone ? (≃75°E); Mottled grey, olive grey
					1457E	
36	1.65%	2300	4	silty grit; 4F		Metallic grey clay
					1452 E	
290	5.25%	3100	82	4F		Mottled grey clays
					1447E	
410	5.30%	5200	70	4F	1445E	Mottled grey clays grading into ferrugenous clays
						COSTEAN D
					1442E	
195	3.10%	5300	36	Gravel overburden; 4F	1440E	Black and yellow ferrugenous clays
190	4.60%	5300	28	4F; 5	1438E	Ironstone outcrop flanked bu hard ferrugenous clays, and some metallic clays
135	1.90%	3400	60	4F; 5	1436E	Ironstone overlain by yellow-brown ferrugenous clay
75	8200	3400	37	4F	1434E	Metallic grey + ferrugenous clay
75	4700	1700	42	4F	1432E	Mottled grey, yellow, brown clays with minor ferrugenous areas
42	4800	2200	27	4F	1430E	Mottled grey-yellow clay
50	6200	2100	70	4F	1428E	Yellow-grey mottled clays, visible bedding ≃70°E
44	5700	2400	8	4F	1426E	Ferrugenous clay zone
125	3.25%	4300	44	4F; 5	1424E	Ironstone, hard and overlain by ferrugenous clay with bedding ≃75°E
30	9500	3100	14	4F; 5	1422E	Ironstone, overlain by ferrugenous clay. No visible dips
80	3.50%	4500	16	4F; 5	1420E	Ironstone overlain by folded yellow brown ferrugenous clays (4F)
90	2.65%	4600	14	4F	1418E	Ferrugenous clay with westward dipping limb @ ≃40°
110	1.51%	3800	6	4F	1416E	Ferrugenous zone, no visible bedding
48	1.70%	5200	37	4F; 4F	1414E	Yellow/tan clays; Metallic grey clays
32	1.10%	6200	3	4F; F	1412E	Ferrugenous clays; F Fault ?
65	7600	5800	8	4F	1410E	Yellow brown, ferrugenous clays
				RIVER		
				BASELINE 1400E	1398E	
14	8300	1.45%	10	overburden; 4F	1396E	Silty mottled grey clay
40	2.55%	5600	100	4F; 4F; 4F	1391E	Silty mottled grey clay; Mottled tan/grey clay; Silty mottled grey clay
42	2.05%	800	24	4F	1386E	Mottled tan/grey clays; Boulders
						ROAD
					1381E	
14	6500	3100	2	4F		Interbedded silty clays in gravel, minor organic matter also
					1377E	
24	2020	4400	4	overburden; 4F		Brown silty clay with interbedded sand seams, unit overlain by carbonaceous material in a dark brown silty clay
					1372E	
14	3000	4100	3	4F		Interbedded sand seams within silty clay; clay is brown Bedding along sand seams (fawn-light brown) ≃60°E
					1367E	
14	600	20	2	4F; 4B6		Interbedded dark and light brown, silty and sandy clay overlain by carbonaceous material
					1362E	
8	190	10	<1	4B6		Dark brown silty sand with fossils (leaf + Spider)
					1357E	
6	110	6	<1	4B6		Brown silty sand, with leaf fossils and carbonaceous material
					1352E	
6	210	10	1	4B6		Brown silty sand, overlain by root material in sandy matrix
					1347E	
8	6600	160	14	Gravel boulders; 4B6		Brown silty sand
					1342E	
22	7200	860	12	4B6		Sand sample taken, brown and silty; Indurated gravels
					1337E	
24	2.20%	1200	22	4F; 4F		Dark brown clays, visible bedding at clay/gravel interface ≃65°E gravels indurated in places
					1332 E	
18	1.55%	210	55	4F		Mottled kahki/brown clays - bedding 75°E
					1327E	
32	8300	800	32	Gravel overburden; 4F		Mottled yellow/grey clay. coarse glacials underlain by a fine pebble horizon.
					1322E	
90	9300	1700	20	4F; 4F; 4F		Grey and interbedded metallic grey clay. Bedding interface ≃78°E overburden well cemented fluvioglacial gravels.
					1317E	

SW

3700 N
Scale 1:200

5 cm

See Geologic map for symbol reference

OCEANA PROSPECT

COSTEAN E

APPENDIX 4

DOWNHOLE PEM SURVEYS - OCEANA HOLES ZT-80-7, 8 AND 9

137

AMOCO MINERALS AUSTRALIA COMPANY INTER-OFFICE MEMO

DATE: January 14, 1981

TO: B. Roxburgh
P. Jones

FROM: S. Collins

SUBJECT: DOWNHOLE PEM SURVEY AT OCEANA

Results of the downhole PEM surveys in holes 7,8 and 9 at Oceana show no major anomalies due to large accumulations of massive sulfides. some small anomalies in the profiles are consistent with intersected mineralization in holes 7 and 9.

The absence of any major anomalies has three possible causes, lack of conductivity, lack of total volume or lack of continuity of ore in the vicinity of the logged hole. The mineralized core is known to be highly conducting, indicating either lack of volume or continuity.

The absence of major anomalies is particularly disappointing in drillholes 8 and 9 which pass within 60 meters of the major intersection in drillhole 2. Any large sulfide accumulation surrounding the hole 2 intersection should have been indicated as 'off hole' anomalies in holes 8 and 9.

Drillhole 9 exhibits anomalous activity on late channels between 120 and 140 meters in a zone of minor sulfide mineralization. However, stronger mineralization further down the hole is not indicated in the PEM data.

Drillhole 7 shows late channel anomalies from 160 to 170 and from 200 to 210 meters with the transmitter to the east. The first of these corresponds to the mineralized intersection, the second corresponds to a zone of abundant pyrite on bedding contacts.

STEVE COLLINS
SC:jm

249/A.4

APPENDIX 5

PHYSICAL PROPERTY TESTS - OCEANA DRILL CORE SAMPLES
by Geoterrex

934139

DATE: November 21, 1980

TO: B. Roxburgh
P. Jones

FROM: S. Collins

SUBJECT: ZEEHAN DRILLCORE PHYSICAL PROPERTIES TEST

Eight samples of drillcore from the Oceana Prospect were sent to Geoterrex for physical property tests.

The samples showed a wide variation in their electrical properties and density. None of the samples showed any measurable magnetic susceptibility.

Details of the test follow.

Hole 2 (ZT-79-2)

Sample 1 Claystone (from 98.1m) 10.6% Pb
Found from 98.1 - 100.3 and 117 - 121.2m surrounding sample 2.
Density = No measurement
Resistivity = 500 Ohm-m approx.
Chargeability = 10 millisecs approx.

Sample 2 Massive lead/zinc sulfide.
Not tested as sample had disintegrated during shipping.

Sample 3 Ankeritic dolomite (from 146m)
Found from 134 - 173.5, 176 - 199 and 229 - 236m
Density = 3.0 gm/cc
Resistivity = 480 ohm-m
Chargeability = 26 millisecs

Hole 4 (ZT-80-4)

Sample 4 Limestone breccia (from 56.6m)
Found from 42 - 58m
Density = 2.6 gm/cc
Resistivity = 800 ohm-m
Chargeability = 47 millisecs

Sample 5 Silty Dolomite (from 69.3m)
Found from 62.2 - 76.2m
Density = 2.7 gm/cc
Resistivity = 1200 ohm-m
Chargeability = 34 millisecs

Sample 6 Interbedded calcareous shale/sandstone (from 157.8m)
Found extensively through hole
Density = 2.5 gm/cc
Resistivity = 3500 ohm-m
Chargeability = 0

Sample 7 Semi massive siderite/galena/sphalerite (from 255.3)
Pb = 11.9% Zn = 3.74%
Found from 247 - 258m
Density = 3.3 gm/cc

249/Ap 5

Resistivity = 2 ohm - m
Chargeability = 10 milliseconds

Sample 8 Mineralized breccia (from 306.5) Pb = 36.4% Zn = 5.3%
Found from 298.8 - 308m
Density = 5 gm/cc
Resistivity = 0.2 ohm-m
Chargeability = 0 - 10 millisecs

Density and resistivity are the properties which best define the mineralized zones. Densities of unmineralized zone range from 2.5 to 3.0 gm/cc while mineralized core ranges in density from 3.3 to 5.5 gm/cc. The density of the massive lead/zinc sulfide (sample 2) is estimated to be greater than 6 gm/cc. The bulk density of the unmineralized rock is estimated to be about 2.6 gm/cc. Resistivities of the unmineralized rock are greater than 500 ohm - meters with probable bulk resistivities in excess of 1000 ohm-m. Resistivities of the mineralized rock are all less than 10 ohm-m with the lowest measurement at 0.2 ohm-m.

Chargeabilites are opposite to what would normally be expected. Mineralized rock has low chargeability and, with the exception of the shale/sandstone, unmineralized rock has a high chargeability. It is likely that previous IP work has in effect mapped the limestone/dolomite rocks which have chargeabilities in excess of 30 milliseconds.

Core test of physical properties suggest that a rational geophysical approach to exploration in this area should be based on electromagnetics with gravity follow up.

STEVE COLLINS
SC:jm

APPENDIX 6

DIGHEM SURVEY

(Maps accompanying this report are included with the enclosures)

142

REPORT NO. 508

934142

DIGHEM^{II} SURVEY

OF

ZEEHAN AREA, TASMANIA

FOR

AMOCO MINERALS AUSTRALIA COMPANY

BY

DIGHEM LIMITED

D.C. FRASER
PRESIDENT

Z. DVORAK
GEOPHYSICIST

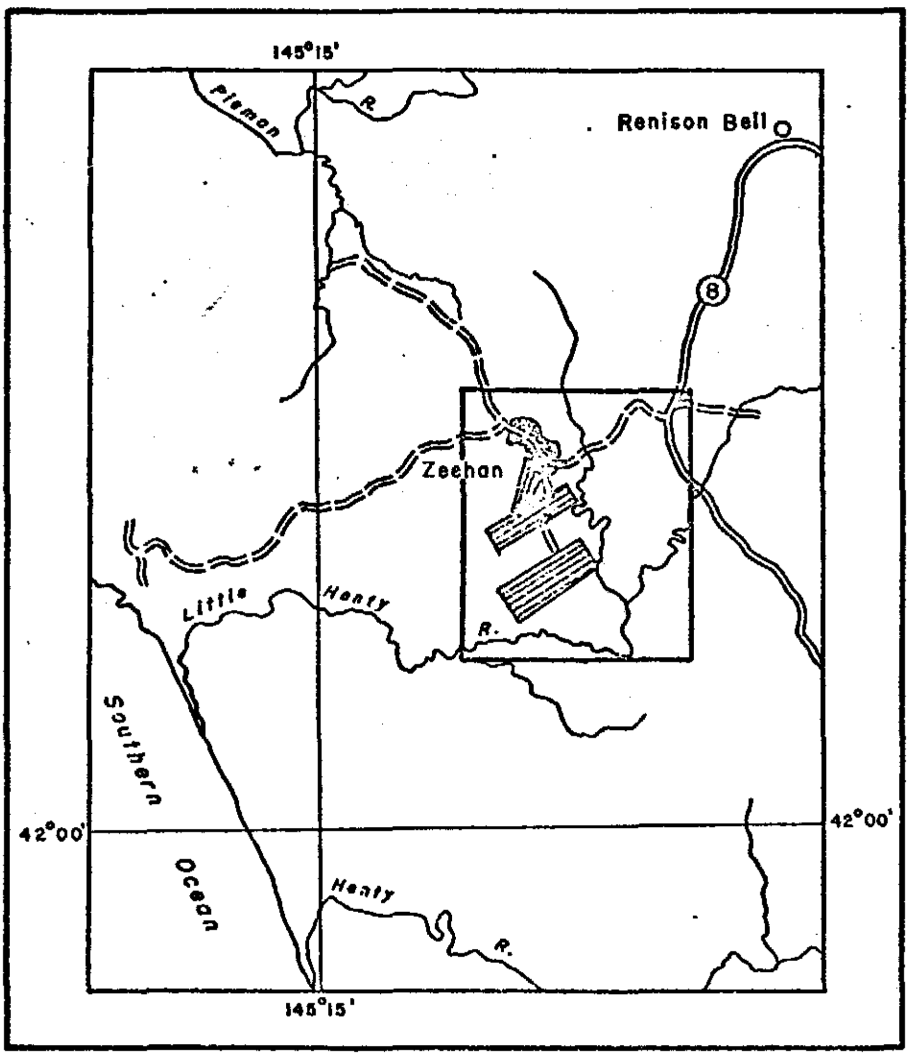
TORONTO, ONTARIO
JUNE 23, 1980

SUMMARY

A DIGHEM^{II} airborne electromagnetic/resistivity/magnetic survey of 21 line-km was flown in March, 1980, for Amoco Minerals Australia Company, over two areas in Tasmania.

No bedrock conductors were detected in the survey areas. The airborne resistivity and magnetic maps, however, show similar general features as the corresponding ground survey maps.

LOCATION MAP



Scale 1:250,000

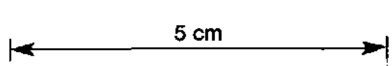


Figure 1. The Survey Area

INTRODUCTION

A DIGHEM^{II} survey of 21 line-km was flown with a line spacing of 250 m for Amoco Minerals Australia Company over two areas near Zeehan, Tasmania (Figure 1). The survey was flown on March 6, 1980. The Lama jet helicopter VH-PDU flew with an average airspeed of 115 km/h and EM bird height of 35 m. Ancillary equipment consisted of a Geometrics 803 magnetometer with its bird at an average height of 50 m, a Sperry radio altimeter, Geocam sequence camera, 50 Hz monitor, Barringer 8-channel hot pen analog recorder, and a Geometrics G-714 digital data acquisition system with a Kennedy 9700 9-track 800-bpi magnetic tape recorder. The analog equipment recorded six channels of EM data at approximately 900 Hz and one of magnetics and radio altitude. The digital equipment recorded the EM data with a sensitivity of 0.25 ppm/bit and the magnetic field to an accuracy of one gamma.

The Appendix provides details on the data channels, their respective noise levels, and the data reduction procedure. The quoted noise levels are generally valid for wind speeds up to 35 km/h. Higher winds may cause the system to be grounded because excessive bird swinging produces control difficulties in piloting the helicopter. The swinging results from the 5 m^2 of area which is presented by the bird to broadside gusts. The DIGHEM system nevertheless can be flown under wind conditions that seriously degrade other AEM systems.

DATA PRESENTATION

DIGHEM electromagnetic responses fall into two general classes, discrete and broad. The discrete class consists of sharp well defined anomalies from discrete conductors such as sulfide lenses and steeply dipping sheets of graphite and sulfides. The broad class consists of wide anomalies from conductors having a large horizontal surface such as flatly dipping graphite or sulfide sheets, saline water-saturated sedimentary formations, conductive overburden and rock, and geothermal zones. A vertical conductive slab with a width of 200 m would straddle these two classes.

The vertical sheet (half plane) model is the most common model used for the analysis of discrete conductors. All anomalies plotted on the electromagnetic map are interpreted according to this model. The following section entitled <u>Discrete conductor analysis</u> describes this model in detail, including the effect of using it on anomalies caused by broad conductors such as conductive overburden.

The conductive earth (half space) model is the most suitable model for broad conductors. Resistivity contour maps result from the use of this model. Resistivity contour maps should be prepared when the EM responses predominantly are of the broad class. A later section entitled <u>Resistivity mapping</u> describes the method further, including the effect of using it on anomalies caused by discrete conductors such as sulfide bodies.

Discrete conductor analysis

The EM anomalies appearing on the electromagnetic map are interpreted by computer to give the conductance (i.e., conductivity-thickness product) in mhos of a vertical sheet model. DIGHEM anomalies are divided into six grades of conductance, as shown in Table I. The conductance in mhos is the reciprocal of resistance in ohms.

Table I. EM Anomaly Grades

Anomaly Grade	Mho Range
6	≥ 100
5	50 - 99
4	20 - 49
3	10 - 19
2	5 - 9
1	≤ 4

The mho value is a geological parameter because it is a characteristic of the conductor alone; it generally is independent of frequency, and of flying height or depth of burial apart from the averaging over a greater portion of the conductor as height increases.* Small anomalies from deeply buried strong conductors are not confused with small anomalies from shallow weak conductors because the former will have larger mho values.

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* This statement is an approximation. DIGHEM, with its short coil separation, tends to yield larger and more accurate mho values than airborne systems having a larger coil separation.

Conductive overburden generally produces broad EM responses which are not plotted on the EM maps. However, patchy conductive overburden in otherwise resistive areas can yield discrete-like anomalies with a conductance grade (cf. Table I) of 1, or even of 2 for conducting clays which have resistivities as low as 50 ohm-m. In areas where ground resistivities can be as low as 1 ohm-m, anomalies caused by weathering variations and similar causes can have conductance grades as high as 4. The anomaly shapes from the multiple coils often allow such surface conductors to be recognized, and these are indicated by the letter S on the map. The remaining anomalies in such areas could be bedrock conductors. The higher grades indicate increasingly higher conductances. Examples: DIGHEM's New Insco copper discovery (Noranda, Quebec, Canada) yielded a grade 4 anomaly, as did the neighbouring copper-zinc Magusi River ore body; Mattabi (copper-zinc, Sturgeon Lake, Ontario, Canada) and Whistle (nickel, Sudbury, Ontario, Canada) gave grade 5; and DIGHEM's Montcalm nickel-copper discovery (Timmins, Ontario, Canada) yielded a grade 6 anomaly. Graphite and sulfides can span all grades but, in any particular survey area, field work may show that the different grades indicate different types of conductors.

Strong conductors (i.e., grades 5 and 6) are characteristic of massive sulfides or graphite. Moderate conductors (grades 3 and 4) typically reflect sulfides of a less massive character or graphite, while weak bedrock conductors (grades 1 and 2) can signify poorly connected graphite or heavily disseminated sulfides. Grade 1 conductors may not respond to ground EM equipment using frequencies less than 2000 Hz.

The presence of sphalerite or gangue can result in ore deposits having weak to moderate conductances. As an example, the three million ton lead-zinc deposit of Restigouche Mining Corporation near Bathurst, New Brunswick, yielded a well defined grade 1 conductor. The 10 percent by volume of sphalerite occurs as a coating around the fine grained massive pyrite, thereby inhibiting electrical conduction.

On the electromagnetic map, the actual mho value and a letter are plotted beside the EM grade symbol. The letter is the anomaly identifier. The horizontal rows of dots, beside each anomaly symbol, indicate the anomaly amplitude of the flight record. The vertical column of dots gives the estimated depth. In areas where anomalies are crowded, the identifiers, dots and mho values may be obliterated. The EM grade symbols, however, will always be discernible, and the obliterated information can be obtained from the anomaly listing appended to this report.

The purpose of indicating the anomaly amplitude by dots is to provide an estimate of the reliability of the conductance calculation. Thus, a conductance value obtained from a large ppm anomaly (3 or 4 dots) will be accurate whereas one obtained from a small ppm anomaly (no dots) could be inaccurate.

The absence of amplitude dots indicates that the anomaly from the standard (coaxial maximum-coupled) coil is 5 ppm or less on both the inphase and quadrature channels. Such small anomalies could reflect a weak conductor at the surface, or a stronger conductor at depth. The mho value and depth estimate will illustrate which of these possibilities best fits the recorded data. The depth estimate, however, can be erroneous. The anomaly from a near-surface conductor, which exists only to one side of a flight line, will yield a large depth estimate because the computer assumes that the conductor occurs directly beneath the flight line.

Flight line deviations occasionally yield cases where two anomalies, having similar mho values but dramatically different depth estimates, occur close together on the same conductor. Such examples illustrate the reliability of the conductance measurement while showing that the depth estimate can be unreliable. There are a number of factors which can produce an error in the depth estimate, including the averaging of topographic variations by the altimeter, overlying conductive overburden, and the location and attitude of the conductor relative to the flight line. Conductor location and attitude can provide an erroneous depth estimate because the stronger part of the conductor may be deeper or to one side of the flight line, or because it has a shallow dip.

A further interpretation is presented on the EM map by means of the line-to-line correlation of anomalies. This provides conductor axes which may define the geological structure over portions of the survey area.

The majority of massive sulfide ore deposits have strike lengths of a hundred to a thousand metres. Consequently, it is important to recognize short conductors which may exist in close proximity to long conductive bands. The high resolution of the DIGHEM system, and the line-to-line correlation given on the EM map, are especially important for a proper strike length evaluation.

DIGHEM electromagnetic maps are designed to provide a correct impression of conductor quality by means of the conductance grade symbols. The symbols can stand alone with geology when planning a followup program. The actual mho values are plotted for those who wish quantitative data. The anomaly ppm and depth are indicated by inconspicuous dots which should not distract from the conductor patterns, while being helpful to those who wish this information. The map provides an interpretation of conductors in terms of length, strike direction, conductance and depth. The accuracy is comparable to an interpretation from a ground EM survey having the same line spacing.

An EM anomaly list attached to each survey report provides a tabulation of anomalies in ppm, and in mhos and estimated depth for the vertical sheet model. The anomalies are listed from top to bottom of the map for each line.

The EM anomaly list also shows the conductance in mhos and the depth for a thin horizontal sheet (whole plane) model, but only the vertical sheet parameters appear on the EM map. The horizontal sheet model is suitable for a flatly dipping thin bedrock conductor such as a sulfide sheet having a thickness less than 15 m. The list also shows the resistivity and depth for a conductive earth (half space) model, which is suitable for thicker slabs such as thick conductive overburden. In the EM anomaly list, a depth value of zero for the conductive earth model, in an area of thick cover, warns that the anomaly may be caused by conductive overburden. Since discrete bodies normally are the targets of EM surveys, local base (or zero) levels are used to compute anomaly amplitudes rather than true zero levels. The use of local base levels may distort the horizontal sheet and conductive earth parameters. True zero levels, however, are used for resistivity mapping, discussed below.

Resistivity mapping

Areas of widespread conductivity have been encountered while surveying for base metals. In such areas, anomalies can be generated by decreases of only 5 m in survey altitude, as well as by increases in conductivity. The typical flight record in conductive areas is characterized by inphase and quadrature channels which are continuously active; local peaks reflect either increases in conductivity of the earth or decreases in survey altitude. For such conductive areas, apparent resistivity profiles and contour maps can aid the interpretation of the airborne data. The advantage of the resistivity parameter is that anomalies caused by altitude changes are virtually eliminated, so the resistivity data reflect those anomalies caused by conductivity changes. This helps the interpreter to differentiate between conductive trends in the bedrock and those patterns typical of conductive overburden. Discrete conductors will generally appear as narrow lows on the contour map and broad conductors will appear as wide lows.

Conductive overburden diminishes the ability of any EM system to effectively explore the bedrock. For example, the lower the resistivity of the cover, the more active the EM channels, and the less the likelihood of recognizing that a particular anomaly might be caused by a bedrock conductor. As a general rule of thumb, the effectiveness of most EM systems for base metal exploration is given in Table II.

Table II. Influence of Conductive Cover On Base Metal Surveys.

Resistivity	Exploration effectiveness for most EM systems
> 300 ohm-m	excellent
100 to 300	good
30 to 100	moderate
< 30	poor

Apparent resistivity maps should always be constructed when the exploration effectiveness (Table II) is moderate to poor. DIGHEM^{II} surveys yield apparent resistivity maps as a standard product.

Channel 40 (see Appendix) presents the apparent resistivity using the so-called pseudo-layer half space model defined in Fraser (1978)*. This model consists of a resistive layer overlying a conductive half space. Channel 41 gives the apparent depth below surface of the conductive material.

* Resistivity mapping with an airborne multicoil electromagnetic system: Geophysics, v. 43, p. 144-172.

The apparent depth therefore is simply the apparent thickness of the overlying resistive layer. The apparent depth (or thickness) parameter will be positive when the upper layer is more resistive than the underlying material, in which case the apparent depth may be quite close to the true depth.

The apparent depth will be negative when the upper layer is more conductive than the underlying material, and will be zero when a homogeneous half space exists. The apparent depth parameter must be interpreted cautiously because it will contain any errors which may exist in the measured altitude of the EM bird (e.g., as caused by a dense tree cover).

The apparent depth parameter is a useful indicator of simple layering in areas lacking a heavy tree cover. The DIGHEM^{II} system has been flown for the purpose of permafrost mapping, where positive apparent depths were used as a measure of permafrost thickness. However, little quantitative use has been made of negative apparent depths because the absolute value of the negative depth is not a measure of the thickness of the conductive upper layer and, therefore, is not meaningful physically. Qualitatively, however, negative values for parameter indicates that the EM response is caused by conductive overburden, and so this channel 41 can be quite useful.

X-type electromagnetic responses

DIGHEM^{II} maps contain x-type EM responses in addition to EM anomalies. An x-type response is below the noise threshold of 2 ppm, and reflects one of the following: a weak conductor near the surface, a strong conductor at depth (e.g., 100 to 120 m below surface), or noise. Those responses that have the appearance of valid bedrock anomalies on the flight profiles are mentioned in the report. The others should not be followed up unless their locations are of considerable geological interest.

The thickness parameter

DIGHEM^{II} can provide an indication of the thickness of a steeply dipping conductor. The ratio of the anomaly amplitude of channel 24/channel 22 generally increases as the apparent thickness increases, i.e., the thickness in the horizontal plane. This thickness is equal to the conductor width if the conductor dips at 90 degrees and strikes at right angles to the flight line. This report refers to a conductor as thin when the thickness is likely to be less than 3 m, and thick when in excess of 10 m. Thick conductors can be high priority targets because most massive sulfide ore bodies are thick, whereas non-economic bedrock conductors are usually thin. An estimate of thickness cannot be obtained when the strike of the conductor is subparallel to the flight line, when the conductor has a shallow dip, when the anomaly amplitudes are small, or when the resistivity of the environment is below 100 ohm-m.

Reduction of conductive overburden response

The DIGHEM^{II} system yields four channels which generally are free of the response of conductive overburden. These are the inphase difference channel 33, the quadrature difference channel 34, and the two anomaly recognition functions of channels 35 and 36. Channels 35 and 36 are used to trigger the conductance channel 37 which identifies discrete conductors. In highly conducting environments, channel 36 is not generated because it is subject to some corruption by highly conductive earth signals.

Discrete conductors usually occur in the bedrock, such as sulfides or graphite, rather than in the overburden, such as conductive clay. Only discrete conductors are plotted on the EM map. Broad (i.e., non-discrete) conductors are not plotted on this map, but are identified by lows on the resistivity contour map.

Reduction of magnetite response

Magnetite produces a form of geological noise on the inphase channels of all EM systems. Rocks containing as little as 1% magnetite can yield negative inphase anomalies. When magnetite is widely distributed throughout a survey area, the inphase EM channels may continuously rise and fall reflecting variations in the magnetite percentage, flying height, and overburden thickness. This can lead to difficulties in recognizing deeply buried bedrock conductors, particularly if conductive overburden also exists. However, the response of magnetite generally vanishes on the inphase differences channel 33. This feature can be a significant aid in the recognition of conductors which occur in rocks containing accessory magnetite.

MAGNETICS

The existence of a magnetic correlation with an EM anomaly is indicated directly on the EM map. An EM anomaly with magnetic correlation has a greater likelihood of being produced by sulfides than one that is non-magnetic. However, sulfide ore bodies may be non-magnetic (e.g., Kidd Creek near Timmins, Ontario, Canada) as well as magnetic (e.g., Mattabi).

The magnetometer data are digitally recorded in the aircraft to an accuracy of one gamma. The digital tape is processed by computer to yield a standard total field magnetic map contoured at 25 gamma intervals. The magnetic data also are treated mathematically to enhance the magnetic response of the near-surface geology, and an enhanced magnetic map is produced with a 100 gamma contour interval. The response of the enhancement operator in the frequency domain is shown in Figure 2. The 100 gamma contour interval is equivalent to a 5 gamma interval for the passband components of the airborne data. This is because these components are amplified 20 times by the operator of Figure 2.

The enhanced magnetic map bears a resemblance to a ground magnetic map. It therefore simplifies the recognition of trends in the rock strata and the interpretation of

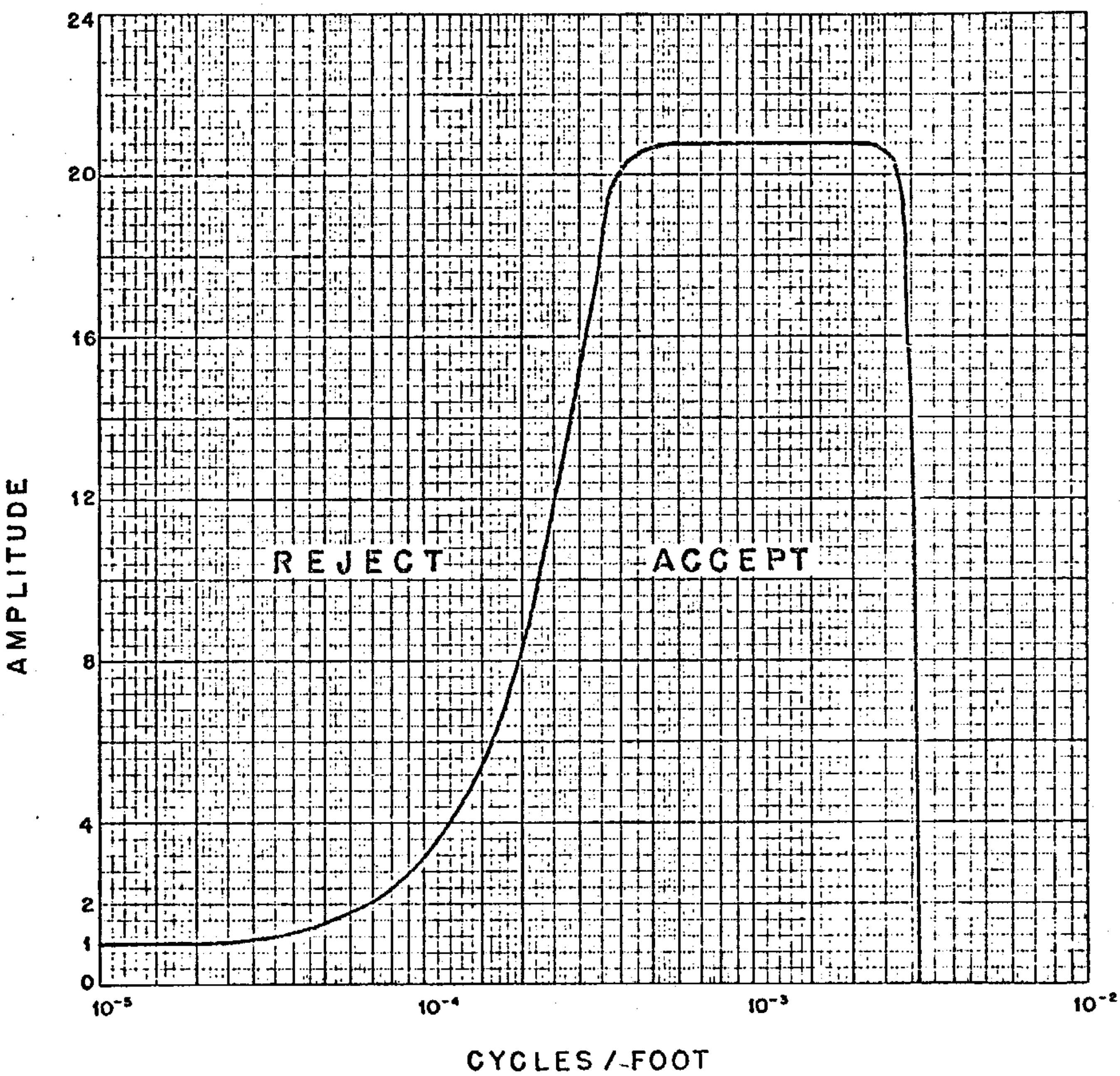

Figure 2 Frequency response of magnetic operator

geological structure. The contour interval of 100 gammas is suitable for defining the near-surface local geology while de-emphasizing deep-seated regional features.

Apart from the difference in the contour interval, the enhanced magnetic map and the standard magnetic map are identical when magnetic basement rocks underlie a thousand metres of non-magnetic cover. The difference between the two maps increase with the amount of magnetization of the near-surface geology.

The presence of a magnetic coincidence with an EM anomaly can result because the conductor is magnetic or because a magnetic body occurs in juxtaposition with the conductor. The majority of magnetic conductors represent sulfides containing pyrrhotite or magnetite. However, graphite and magnetite in close association can provide coinciding EM-magnetic anomalies. The truly magnetic conductors tend to follow closely the contoured magnetic highs. Such coincidence may be more evident on the enhanced magnetic map than on the standard magnetic map because of less disturbance from regional magnetic features. The enhancement, therefore, provides data maps which contribute to the evaluation of EM anomalies.

CONDUCTORS IN THE SURVEY AREA

The electromagnetic map shows the locations of conductors and their interpreted conductance (i.e., conductivity-thickness product) and depth. When studying the EM maps for followup planning, consult the anomaly listings appended to this report to ensure that none of the conductors are overlooked.

No obvious bedrock conductors were detected in the survey area. All the EM anomalies and responses appear to reflect surficial or cultural sources. Anomaly 5B might possibly be a bedrock conductor. Similarly, the x-type response 6xB may reflect a weak magnetic conductor. Its close correlation with a road makes it, however, suspect for culture.

The airborne resistivity and enhanced magnetic maps show the same general features and range of values as the ground surveys, when consideration is given to the considerable disparities in scale.

Respectfully submitted,

DIGHEM LIMITED

D.C. Fraser
President

Z. Dvorak
Geophysicist

Four map sheets accompany this report:

Electromagnetics	1 map sheet
Resistivity	1 map sheet
Magnetics	1 map sheet
Enhanced magnetics	1 map sheet

A P P E N D I X

THE FLIGHT RECORD AND PATH RECOVERY

The flight record is a roll of chart paper containing the geophysical profiles. The profiles are generated by computer at a scale identical to the geophysical maps. The flight record contains up to 15 channels of information, as follows:

Channel Number	Parameter	Scale units/mm	Noise
20	magnetics	10 gamma	2 gamma
21	altitude	3 m	2 m
22	standard* coil-pair inphase	1 ppm	1-2 ppm
23	standard coil-pair quadrature	1 ppm	1-2 ppm
24	whaletail** coil-pair inphase	1 ppm	1-2 ppm
25	whaletail coil-pair quadrature	1 ppm	1-2 ppm
28	ambient noise monitor (standard receiver)	1 ppm	1-2 ppm
29	ambient noise monitor (whaletail receiver)	1 ppm	1-2 ppm
33	difference function inphase	1 ppm	1-2 ppm
34	difference function quadrature	1 ppm	1-2 ppm
35	first anomaly recognition function	1 ppm	1-2 ppm
36	second anomaly recognition function	1 ppm	1-2 ppm
37	conductance	1 mho	
40	log resistivity	.03 decade	
41	apparent depth to conductive half space	3 m	

* coaxial
** horizontal coplanar

The log resistivity scale of 0.03 decade/mm means that the resistivity changes by an order of magnitude in 33 mm. The resistivities at 0, 33, 67 and 100 mm up from the bottom of the chart are respectively 1, 10, 100 and 1000 ohm-m.

The fiducial marks on the flight record represent points on the ground which were recognized by the aircraft navigator. Continuous photographic coverage allowed accurate photo-path recovery locations for the fiducials, which were then plotted on the geophysical maps to provide the track of the aircraft.

The fiducial locations on both the flight records and flight path maps were examined by a computer for unusual helicopter speed changes. Such changes often denote an error in flight path recovery. The resulting flight path locations therefore reflect a more stringent checking than is provided by standard flight path recovery techniques.

The following brief description of DIGHEM^{II} illustrates the information content of the various profiles*.

The DIGHEM^{II} system has two transmitter coils which are mounted at right angles to each other. (The transmitted frequency is given in the Introduction.) Thus, the system provides two completely independent surveys at one pass. In addition, the flight chart profiles (generated by computer) include an inphase channel and a quadrature channel which essentially are free of the response of conductive overburden. Also, the EM channels may indicate whether the conductor is thin (e.g., less than 3 m), or has a substantial width (e.g., greater than 15 m). Further, the EM channels include a channel of resistivity and another of conductance. A minimum of 10 EM channels are provided. The DIGHEM^{II} system therefore gives information in one pass which cannot be obtained by any other airborne or ground EM technique.

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*For a detailed description see D.C. Fraser; Geophysics, v.44, p.1367-1394.

Figure A1 shows a DIGHEM^{II} flight profile over the massive pyrrhotite ore body in Montcalm Township, Ontario. It will serve to identify the various channels.

The two upper channels (numbered 20 and 21) are respectively the magnetics and the radio altitude. Channels 22 and 23 are respectively the inphase and quadrature of the coaxial coil-pair, which is termed the standard coil-pair. This coil-pair is equivalent to the standard coil-pair of all inphase-quadrature airborne EM systems. Channels 24 and 25 are the inphase and quadrature of the additional coplanar coil-pair which is termed the whaletail coil-pair.

Channels 31 and 32 are inphase and quadrature sums functions of the standard and whaletail channels; they provide a condensed view of the four basic channels 22 to 25. The sums channels normally are not plotted.

Channels 33 and 34 are inphase and quadrature differences functions of the standard and whaletail channels. The differences channels are almost free from the response of conductive overburden. Channel 37 is the conductance. The conductance channel essentially is an automatic anomaly picker calibrated in conductance units of mhos; it is triggered by the anomaly recognition functions shown as channels 35 and 36.

Channel 40 is the resistivity, which is derived from the whaletail channels 24 and 25. The resistivity channel 40 yields data which can be contoured, and so the DIGHEM^{II} system yields a resistivity contour map in addition to an electromagnetic map, a magnetic contour map, and an enhanced magnetic contour map. The enhanced magnetic contour map is similar to the filtered magnetic map discussed by Fraser.*

Figure A2 presents the DIGHEM^{II} results for a line flown perpendicularly to the Montcalm ore body. Channel 20 shows the 175 gamma magnetic anomaly caused by the massive pyrrhotite deposit. For the EM channels, the following points are of interest:

1. On channels 22-25 and 31-34, the ore body essentially yields only an inphase response. The quadrature response is almost completely caused by conductive overburden (which also gives a small inphase response). The hachures show the EM response from the overburden. The overburden response vanishes on the difference EM channels, as can be seen by comparing the quadrature channels 25 and 34. This is an important point to note because DIGHEM^{II} is the only EM system which provides an inphase channel and a quadrature channel which are essentially free of conductive overburden response.

2. The whaletail anomaly of channel 24 has a single peak. This shows that the conductor has a substantial width. If the width had been under 3 m, the conductor would have produced a weak m-shaped anomaly on channel 24.

3. The ore body yields a resistivity of 5 ohm-m in a background of about 200 ohm-m (cf. channel 40). A dipole-dipole ground resistivity survey with an a-spacing of 50 m showed a similar background, but the ore body gave a low of only 53 ohm-m

* Cdn. Inst. Mng., Bull., April 1974.

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934167

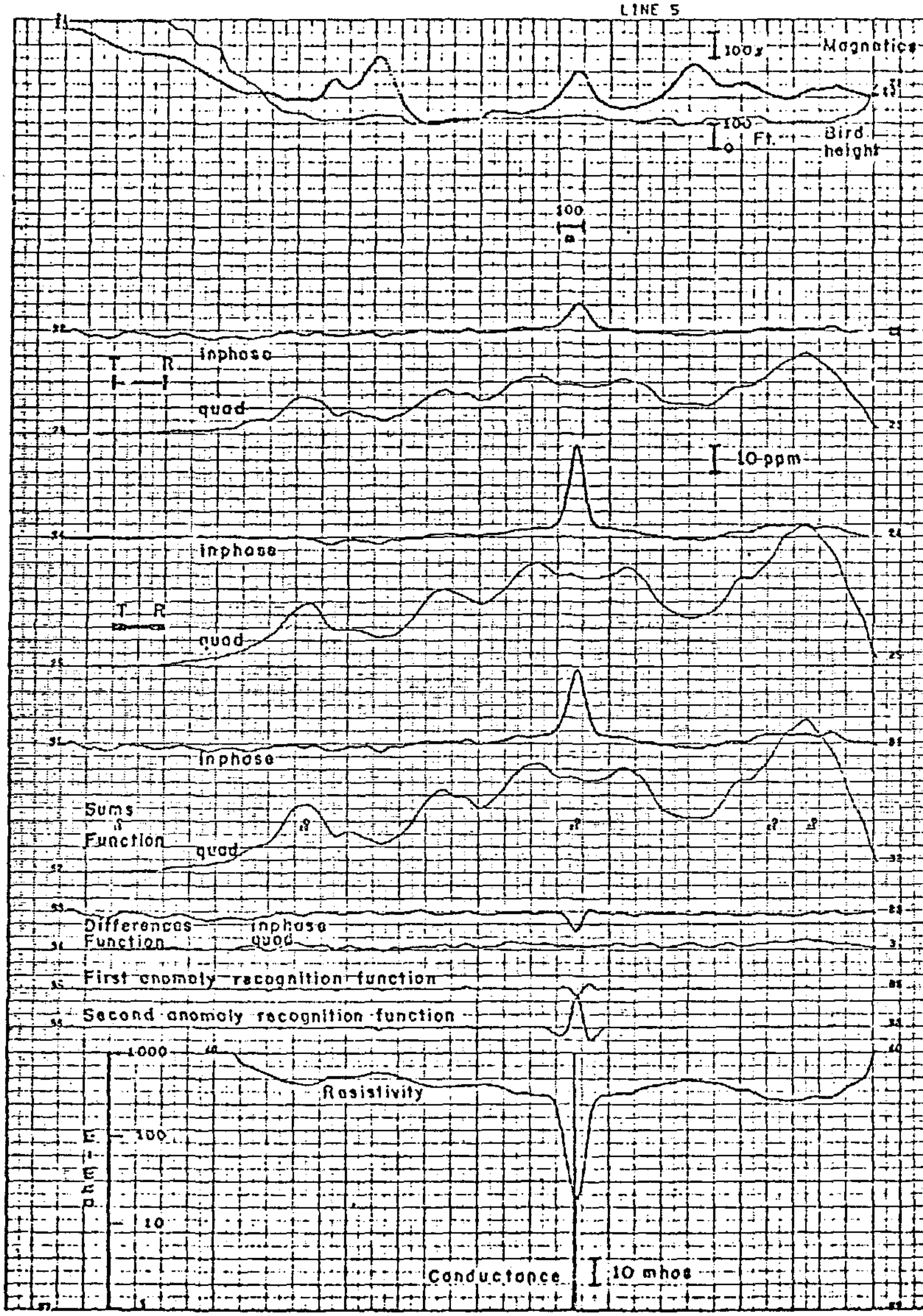

Fig. A1. Flight over Montcalm deposit, with line parallel to strike.

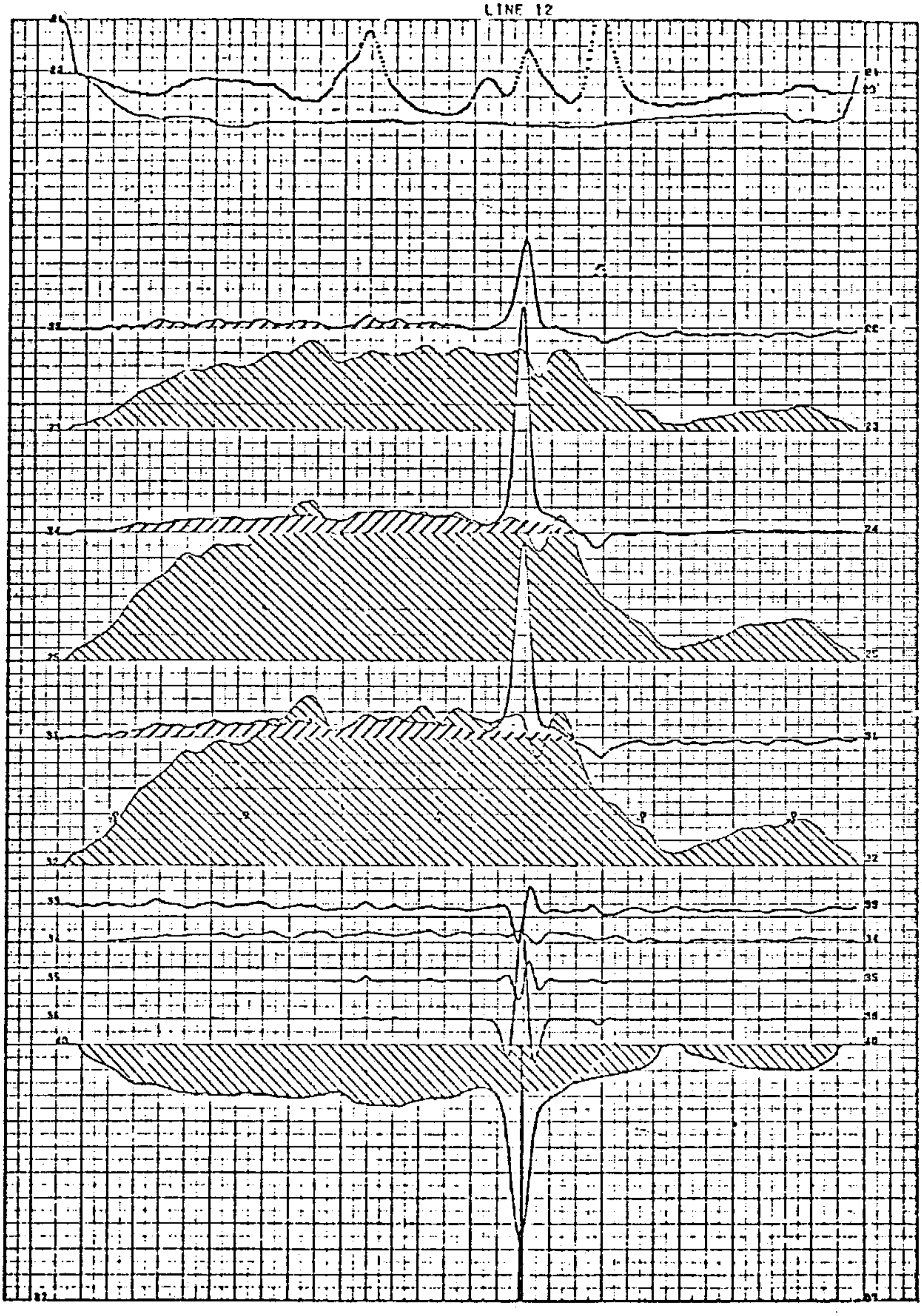

Fig. A2. Flight over Montcalm deposit, with line perpendicular to strike.

because of the averaging effect inherent in the ground technique.

4. The ore body has a conductance of 330 mhos according to its EM response on this particular flight line. The conductance channel 37 saturates at 100 mhos, and so the deposit is indicated by a 100-mho spike.

Figure A1 illustrates the DIGHEM^{II} results for a line flown subparallel to the ore body. The ore body anomaly is small on the standard coil-pair (channel 22) but shows up strongly on the whaletail coil-pair (channel 24).

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	STANDARD COIL		WHALETAIL COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
5A	1	16	1	20	1	0	1	79	709	0
5B	1	12	2	20	1	44	1	166	515	34
8B	0	5	0	7	1	11	1	263	1034	0

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

APPENDIX 7

DRILL LOGS AND SECTIONS ZT-80-6, 7, 8 AND 9

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934172

OCEANA PROSPECT

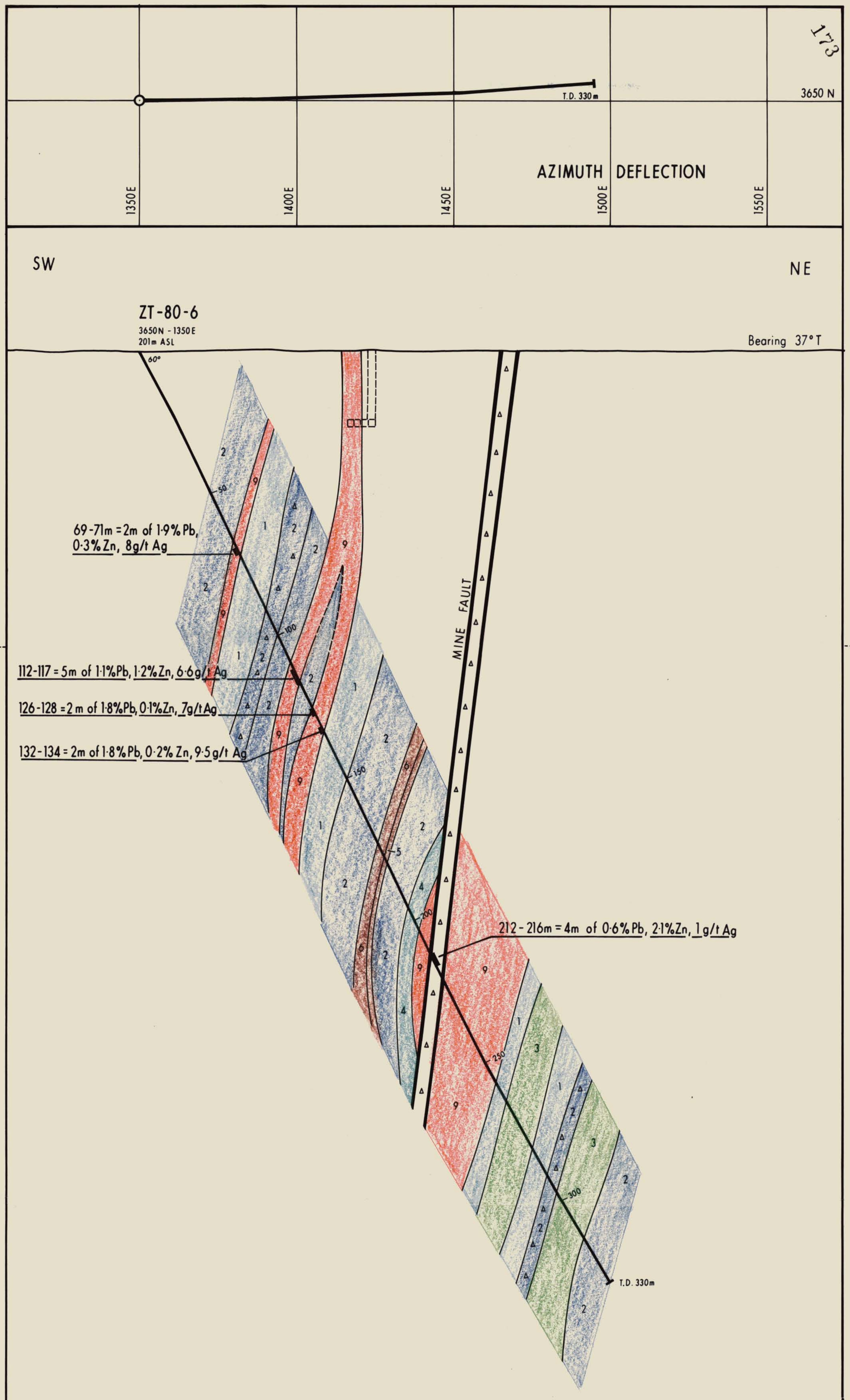
DRILLHOLE DATA

ZT-80-6

Location	:	3650N : 1350E
Declination	:	60°
Azimuth	:	37°T
Total Depth	:	330 meters

Assay Results

69- 72= 3m @ 1.52% Pb + 0.28% Zn + 13.3g/t Ag
112-117= 5m @ 1.76% Pb + 1.20% Zn + 6.6g/t Ag
126-134= 8m @ 1.22% Pb + 0.24% Zn + 5.5g/t Ag
212-220= 8m @ 0.45% Pb + 1.39% Zn + 1.0g/t Ag



LEGEND

Limestone	1
Dolomite	2
Fossil Breccia	3
Slump Breccia	4
Sandstone	5
Siltstone	6
Shale	7
Mineralization	8
Siderite/ankerite Breccia	9
Brecciated unit	Δ

5 cm

Amoco Minerals Australia Company

ZEEHAN PROJECT: TASMANIA
A-78-60
EXPLORATION LICENCE 4/78

PROSPECT: OCEANA

CROSS SECTION DRILLHOLE ZT-80-6

Scale: Vertical and horizontal - 1:1000

DRAWING M81-1707

934173

Amoco Minerals Australia Company

DRILL LOG

HOLE No. ZT-80-6

PROJECT ZEEHAN - TAS No. A7860	ELEVATION meters	COMMENCED 6.8.80	
PROSPECT OCEANA	DIP COLLAR 60°	COMPLETED 14.9.80	
CO-ORDINATES 3650 mN 1350 mE	CORE SIZE HQ, NQ	TOTAL LENGTH 330 meters	
BEARING 037 TN MN GN	LOGGED BY PHIL JONES		

BORE HOLE SURVEY Bearings mN. INSTRUMENT EASTMAN CAMERA

Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing
50	65°	N/A	200	63.5	035	330	60.5	032
100	64°	035	266	61.0	033			
150	64°	034	300	59.0	034			

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag.
0.00	66.00	TRICONE Through black and grey dolomitic		22351	66	67	1	30	590	7300	1
		clays. Poor water return.		22352	67	68	1	20	290	4200	2
		HQ CORING.		22353	68	69	1	10	4050	2200	4
66.00	68.10	SILTY DOLOMITE : Black, clayey and		22354	69	70	1	22	2.55%	3900	10
		silty, completely weathered dolomite.		22355	70	71	1	10	1.20%	2400	6
				22356	71	72	1	8	8000	1950	24
68.10	71.60	SIDERITE / ANKERITE ROCK : Grey, very dense,	Weakly Pb/Zn	22357	72	73	1	8	750	1250	2
		vughy in part with open space filling textures	mineralized < 1%	22358	73	74	1	8	200	550	1
		observed, weakly mineralized with platey	combined.	22359	74	75	1	8	160	570	7
		and disseminated galena and sphalerite		22360	75	76	1	8	630	4800	6
		sideritic and ankeritic dolomite.		22361	76	77	1	18	1450	3900	2
					77	78	1	NO	CORE	RECOVERED.	
71.60	75.40	DOLOMITIC SILTY CALCLUTITE : Dark grey	Minor fine grained	22362	78	79	1	12	830	3400	2
		to black, completely weathered, pughy,	pyrite.	22363	79	80	1	8	610	1800	1
		silty and dolomitic calclutite. Minor fine		22364	80	81	1	6	310	1100	35
		grained bedded ? pyrite.		22365	81	82	1	5	1100	1000	5
				22366	82	83	1	6	420	1150	4
75.40	92.00	CALCLUTITE : Interbedded, massive, fresh,	Trace galena /	22367	83	84	1	12	1650	2100	1
		grey limestone sedimentary breccias and	sphalerite in	22368	84	85	1	18	170	930	2
		very weathered light grey, silty porous	Calcite/Siderite veins.	22369	85	86	1	6	910	1000	<1
		calclutites. Minor to moderate calcite		22370	86	87	1	12	490	670	<1
		veining with superimposed minor siderite		22371	87	88	1	6	135	750	<1
		veining. Trace of galena / sphalerite in		22372	88	89	1	6	80	600	<1
		some of the sideritic veins. Ground		22373	89	90	1	4	115	600	<1
		extensively broken with clayey intervals		22374	90	91	1	22	380	1150	<1
		very prominent. Possible bedding trace		22375	91	92	1	8	270	1950	<1
		40° to c.a. at 88.70 metres.		22376	92	93	1	12	520	3100	2
				22377	93	94	1	12	2300	1.15%	2
92.00	100.50	DOLOMITE BRECCIA : Black, completely	Trace / Minor Pb-Zn	22378	94	95	1	10	1800	8100	8
		weathered, clayey, silty, pyritic in part,	as disseminations.	22379	95	96	1	10	5200	9200	7
		sideritic dolomite breccia. Open space		22380	96	97	1	8	3300	7300	3
		filling by siderite (vughs & fractures) very		22381	97	98	1	18	1.35%	1.76%	50
		prevalent, minor to trace Pb/Zn as dissemin-		22382	98	99	1	8	1200	7400	2
		ations. Possible relict bedding ≈ 15° to c.a at 99.5m.		22383	99	100	1	10	2300	4500	3

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag
100.5	110.0	SILTY DOLOMITE: Fine grained, very		22384	100	101	1	8	530	3700	1
		weathered, pughy, grey to dark grey, silty		22385	101	102	1	8	135	3900	1
		ankeritic dolomite. Ground moderately		22386	102	103	1	16	185	4100	1
		broken. Minor relict laminar bedding?		22387	103	104	1	10	860	7200	3
		≈ 40° to c.a. at 105 metres. Weakly		22388	104	105	1	16	2900	1.82%	14
		weathered sections tend to be dark, massive		22389	105	106	1	8	590	6900	2
		and dense.		22390	106	107	1	8	430	6700	1
				22391	107	108	1	12	570	5100	1
110.0	134.5	SIDERITE/ANKERITE DOLOMITE BRECCIA:	Minor galena/	22392	108	109	1	10	980	4800	2
		Cream, grey to black, extensively brecciated,	sphalerite randomly	22393	109	110	1	22	1600	5400	2
		open pore space infilled, weakly mineralized	distributed throughout	22394	110	111	1	10	4000	3300	2
		rock. Minor disseminated sphalerite (pale	the breccia.	22395	111	112	1	10	5000	6900	2
		pink in colour) and blebby to platey galena.		22396	112	113	1	14	3700	1.44%	6
		Breccia fragments very angular, and		22397	113	114	1	14	6000	1.39%	13
		average 1-3cm in diameter. Core shows		22398	114	115	1	16	2.25%	9400	7
		strong preferred orientation of sideritic		22399	115	116	1	16	1.75%	1.21%	5
		infilling material ≈ 30° to ca. Core extensive-		22400	116	117	1	14	2950	1.04%	2
		ly fractured and broken with minor inter-		22401	117	118	1	12	2750	8600	2
		bedded clay zones.		22402	118	119	1	18	310	5100	1
				22403	119	120	1	8	3150	5600	2
134.5	151.00	SILTY LIMESTONE: Completely weathered,		22404	120	121	1	10	1900	1.06%	2
		weakly calcite veined, occaissionally brecciated,		22405	121	122	1	10	1950	1.04%	2
		grey to dark grey dolomitic silty limestone. Very		22406	122	123	1	10	7300	6800	4
		minor siderite with calcite. Minor coralline		22407	123	124	1	8	870	5500	1
		fossil imprints.		22408	124	125	1	10	4100	3600	3
				22409	125	126	1	14	8600	2800	5
151.0	159.5	SIDERITIC DOLOMITE: Dark grey, massive	Minor disseminated	22410	126	127	1	10	2.00%	1300	8
		crystalline dolomite, strongly calcite/siderite	sphalerite - trace	22411	127	128	1	8	1.55%	670	6
		veined with minor quartz?? Minor pyrite is	galena.	22412	128	129	1	4	2750	960	2
		associated with disseminated minor sphalerite		22413	129	130	1	10	1.70%	3000	8
		and trace galena. Ground intensely brecciated		22414	130	131	1	8	3600	4700	2
		and broken with numerous pugh zones present.		22415	131	132	1	24	2900	4600	1
		Sections of core vughy. Disseminated sulphides		22416	132	133	1	10	1.05%	2600	5
		at times oriented parallel to sideritic veining.		22417	133	134	1	24	2.50%	1550	12
				22418	134	135	1	10	2700	4900	2
159.5	173.0	SILTY DOLOMITE: Completely weathered,		22419	135	136	1	16	2450	6600	3
		dark grey to black, silty dolomite. Minor		22420	136	137	1	10	900	4900	1
		relict fine bedding at 40° to ca at 166 metres.		22421	137	138	1	12	1000	4400	1
		CONT OVER.		22422	138	139	1	10	1850	5300	2

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag.
159.5	173.0	SILTY DOLOMITE CON'T : Minor sideritic		22423	139	140	1	20	630	3300	6
		veinleted sections of core quite vughy. Core		22424	140	141	1	12	550	2500	1
		broken and very pughy.		22425	141	142	1	18	360	2600	1
				22426	142	143	1	12	50	135	2
173.0	177.0	DOLOMITIC SILTSTONE : Light grey, massive,		22427	143	144	1	38	65	380	<1
		very well sorted, weakly calcareous and ankeritic		22428	144	145	1	12	370	2050	1
		veined, in part pelletal siltstone.		22429	145	146	1	12	80	300	<1
				22430	146	147	1	10	48	140	<1
177.0	180.8	CALCAREOUS SANDSTONE : Light grey,		22431	147	148	1	10	65	38	<1
		speckled, extensively siderite/ankerite veined		22432	148	149	1	10	440	1950	1
		brecciated, coarse grained sandstone. Core		22433	149	150	1	14	230	890	1
		moderately broken, pughy in later part.		22434	150	151	1	16	2650	3000	1
		Ankerite forming grey white rosettes. Breccia's		22435	151	152	1	14	5450	4600	2
		composed mainly of angular fragments of		22436	152	153	1	14	2250	3700	2
		country rock in a siderite/ankerite matrix.		22437	153	154	1	10	2350	4600	2
				22438	154	155	1	8	540	2300	1
180.8	195.5	SILTY DOLOMITE : Completely weathered,		22439	155	156	1	18	3850	4600	3
		dark grey to grey, silty, weakly calcite/ankerite		22440	156	157	1	12	4350	3500	3
		veinleted dolomite. Minor fossiliferous			157	158	1	NO	CORE	RECOVERED	
		bed composed of oolitic a coralline debris.			158	159	1	"	"	"	
		Minor siderite.		22441	159	160	1	14	1800	4500	2
				22442	160	161	1	14	540	2800	2
195.5	203.0	SEDIMENTARY SLUMP BRECCIA : Rounded to	Trace sphalerite in	22443	161	162	1	32	470	1850	1
		angular fragments of silty sparitic limestone,	veinlets.	22444	162	163	1	18	630	830	1
		in a dark grey to black muddy dolomitic		22445	163	164	1	20	330	930	1
		matrix. Fragments up to 5 cm in length,		22446	164	165	1	18	220	1050	<1
		generally rounded (due to rolling??). Fragments		22447	165	166	1	14	160	2000	1
		are composed almost entirely of shell fragments		22448	166	167	1	14	165	1650	1
		and oolitic pieces of sparry limestone. Minor		22449	167	168	1	14	270	2000	1
		ankerite/siderite veinlets with trace sphalerite.		22450	168	169	1	14	490	3400	1
				26401	169	170	1	16	760	5400	2
203.0	219.00	ANKERITIC COLLAPSE BRECCIA ? : Angular		26402	170	171	1	16	610	4300	1
		breccia fragments up to 5 cm in length, of		26403	171	172	1	75	180	1550	<1
		ankeritic material in a dark black/green		26404	172	173	1	18	85	1150	<1
		matrix of pyritic dolomite. Rock is stained		26405	173	174	1	8	16	320	<1
		brown/yellow/green due to large amounts		26406	174	175	1	10	44	390	<1
		of very fine grained pyrite. Rock very dense,		26407	175	176	1	8	36	310	<1
		but very weathered, very clayey in part.		26408	176	177	1	8	55	630	<1
		Cavity 216 - 217. Minor siderite veining.		26409	177	178	1	8	60	195	<1

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag
219.0	240.5	SIDERITE / ANKERITE BRECCIA: Cream/grey/	Minor Pb/Zn/Py	26410	178	179	1	8	55	810	<1
		white, vughy, weakly galena, sphalerite, pyrite	mineralization.	26411	179	180	1	6	10	125	<1
		mineralized, extremely shattered and		26412	180	181	1	8	24	195	<1
		brecciated, dolomitized rock. Concretionary		26413	181	182	1	10	105	630	<1
		growth rings of calcite, siderite and ankerite		26414	182	183	1	10	65	370	<1
		present. Pb/Zn mineralization present as diss-	Fragments of massive	26415	183	184	1	10	210	340	<1
		eminations and thin veinlets or blebs. Moderate	galena occur in sections	26416	184	185	1	8	90	300	<1
		pyrite veining present or as disseminations in	of breccia." (0.5-10cm) (size)	26417	185	186	1	8	85	440	<1
		the darker dolomitic matrix of the breccia. Minor		26418	186	187	1	10	230	630	<1
		pugh zones present. Cavity 220.5-222.0 m. Breccia		26419	187	188	1	10	130	1500	<1
		fragments range in size from 0.5 cm to 4cm.		26420	188	189	1	10	115	1500	<1
		Breccia matrix composed of fine grained black		26421	189	190	1	10	32	240	<1
		silty dolomite. Fragments in breccia generally		26422	190	191	1	18	48	105	<1
		angular, some sub angular. Lot of open		26423	191	192	1	8	40	135	<1
		space pore filling by ankerite and siderite.		26424	192	193	1	8	38	150	<1
		Core recovery averaged approx. 50%.		26425	193	194	1	12	34	85	<1
				26426	194	195	1	10	40	105	<1
240.5	257.9	ANKERITIC COLLAPSE BRECCIA?: Grey to		26427	195	196	1	8	34	80	<1
		greeny black, very dense, massive, brecciated		26428	196	197	1	8	22	28	<1
HQ → NQ		in part, vughy, fine grained ankeritic		26429	197	198	1	8	40	90	<1
242.20m.		dolomite breccia. Angular breccia fragments		26430	198	199	1	8	36	44	<1
		up to 2cm in diam. Minor clayey zones		26431	199	200	1	10	38	115	<1
		of completely weathered material. Poor		26432	200	201	1	10	32	510	<1
		core recoveries through zone.		26433	201	202	1	8	40	75	<1
				26434	202	203	1	8	40	85	<1
257.9	261.0	CALCLUTITE: Grey, occaissionally peletal		26435	203	204	1	10	40	1050	<1
		(concretionary nodules up to 2cm in diam)		26436	204	205	1	8	22	640	<1
		moderately qtz/calcite veined, fine grained,		26437	205	206	1	18	310	1750	<1
		massive calclutite with minor interbeds of		26438	206	207	1	8	95	810	<1
		browny grey muddy dolomite (Beds < 5cm).		26439	207	208	1	10	490	5000	<1
				26440	208	209	1	10	780	5100	<1
261.0	264.0	ANGULAR DOLOMITE BRECCIA: greeny grey		26441	209	210	1	8	1500	9700	<1
		to black, vughy, weakly siderite veined,		—	210	212	2	CAVITY.			
		clayey, angular breccia. Rock very dense,		26442	212	213	1	14	4800	1.14%	<1
		massive? possibly pyritic (very fine grained).		26443	213	214	1	12	6950	1.06%	<1
		Breccia fragments are both angular to sub-		26444	214	215	1	10	5000	2.60%	<1
		angular and of numerous lithologies – not		26445	215	216	1	10	5500	3.50%	<1
		only host material (Sedimentary breccia?).			216	217	1	CAVITY			
				26446	217	218	1	14	7450	1.73%	1

DRILL LOG HOLE No. ZT-80-6

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag
264.0	281.40	FOSSIL BRECCIA: Massive, grey, heavily calcite/		26447	218	219	1	8	2850	3.00%	<1
		aukerite veined fossil breccia. (sedimentary		26448	219	220	1	12	3800	1.09%	3
		slump breccia!) Fossils include coraline		26449	220	221	1	16	5200	8800	3
		fragments, stromatolites, nodules, shelly			221	222	1	CAVITY			
		fragments and oolites indicating a possible		26450	222	223	1	14	2900	8700	2
		shallow water environment. Fragments vary		26451	223	224	1	20	2900	8900	2
		in size up to 10's of cm. Zones of pughy		26452	224	225	1	16	1700	7600	1
		material indicating karsting? Calcite/		26453	225	226	1	14	7600	5700	4
		Aukerite (minor siderite) veining contains		26454	226	227	1	12	2600	8900	1
		traces of very fine grained pink/white		26455	227	228	1	14	580	4300	1
		coloured sphalerite + fine grained galena.		26456	228	229	1	12	1600	5400	1
		Breccia very dolomitized, lot of pervasive		26457	229	230	1	16	570	4500	1
		fine grained aukerite present.		26458	230	231	1	10	310	1850	<1
					231	232	1	NO	CORE	RECOVERED	
281.4	289.5	CALCLUTITE: Dark grey and light grey, massive,		26459	232	233	1	26	1.45%	8000	7
		silty dolomites and calclutites. Possibly soft		26460	233	234	1	18	1.50%	5300	5
		sediment slumped. Minor thin interbeds of		26461	234	235	1	28	5000	1.46%	4
		oolitic and shelly calcarenites present. (5-10		26462	235	236	1	18	1600	7600	2
		cm in width). Weak to moderate qtz/calcite		26463	236	237	1	55	2200	4200	1
		veining, minor aukerite, minor stylolites		26464	237	238	1	16	5500	3200	2
		present. Good core recoveries (>80%) even		26465	238	239	1	18	5800	5900	2
		in pughy zones.		26466	239	240	1	14	2000	5500	1
				26467	240	241	1	12	1950	1.10%	<1
289.5	291.5	DOLOMITE/CALCLUTITE BRECCIA: Silty, black,		26468	241	242	1	14	1150	1.25%	<1
		moderately qtz/calcite veined dolomite		26469	242	243	1	18	940	7200	<1
		containing grey/brown, porous, weakly		26470	243	244	1	18	270	3400	<1
		fossiliferous calclutite fragments or slumped		26471	244	245	1	14	1850	6200	1
		calclutite interbeds. Minor siderite veining		26472	245	246	1	20	1800	7000	1
		associated with calcite. Numerous clayey		26473	246	247	1	14	1200	1.55%	<1
		zones present representing cw host rock		26474	247	248	1	14	960	7800	<1
		(ie Karsting).		26475	248	249	1	12	780	1.15%	<1
				26476	249	250	1	12	680	3000	<1
291.5	297.0	TECTONIC BRECCIA: Strongly calcite/siderite	Trace of sphalerite	26477	250	251	1	10	560	4700	<1
		/aukerite veined, brecciated, weakly	and galena.	26478	251	252	1	10	850	3700	<1
		fossiliferous dolomitised calclutites. The breccia		26479	252	253	1	10	540	3700	<1
		contains abundant disseminated aukerite		26480	253	254	1	12	2100	2200	1
		with trace amounts of yellow fine grained		26481	254	255	1	16	3900	3300	3
		sphalerite and blebby fine grained galena.		26482	255	256	1	10	4800	1300	2
		Core badly shattered in sections with poor recoveries.		26483	256	257	1	12	2600	1150	1

Meterage From	Meterage To	Description	Mineralization %	Sample Number	Meterage From	Meterage To	Length	Cu	Pb	Zn	Ag
291.5	297.0	TECTONIC BRECCIA CON'T: Minor fine	Minor pyrite.	26484	257	258	1	14	75	720	<1
		grained, disseminated pyrite occurs in the	(very fine grained)	26485	258	259	1	14	130	630	<1
		darker dolomitic material. Fragments in		26486	259	260	1	12	50	160	<1
		the breccia are very angular and of host		26487	260	261	1	14	310	640	<1
		rock material.		26488	261	262	1	14	850	2800	<1
				26489	262	263	1	20	550	4500	<1
297.0	315.6	FOSSIL BRECCIA: Predominantly light	Abundant fine	26490	263	264	1	16	290	7600	1
		grey stromatolitic, coralline, oolitic and	grained pyrite.	26491	264	265	1	14	32	170	<1
		laminar fragments up to 10's of cm in	(Syngenetic &	26492	265	266	1	70	230	1100	1
		width, cemented in a black dolomitic	remobilized.)	26493	266	267	1	12	105	300	<1
		matrix containing abundant fine grained		26494	267	268	1	12	360	1000	1
		pyrite. (From 297.0 to 300.) Very minor	Trace of galena and	26495	268	269	1	20	260	1000	1
		calcite veining in massive competent sequence	sphalerite in thin	26496	269	270	1	22	260	1450	1
		From 300 to 315.6m the sequence is comprised	calcite veinlets.	26497	270	271	1	10	55	2200	<1
		of darker grey, oolitic, minor coralline,		26498	271	272	1	12	440	5700	1
		pelletal (nodules vary from pea size to the		26499	272	273	1	18	1400	9600	2
		size of a walnut) shelly fragments with		26500	273	274	1	6	80	3000	1
		numerous fragments of black dolomite or		27451	274	275	1	16	50	2000	1
		lighter grey calcilutite cemented in a very		27452	275	276	1	14	32	420	<1
		black, silty dolomite matrix containing		27453	276	277	1	16	80	1100	1
		abundant syngenetic, laminar and/or		27454	277	278	1	12	135	1250	1
		bleby pyrite up to ≈ 3% laminar pyrite		27455	278	279	1	6	32	350	<1
		parallels the dolomite laminations. Frag-		27456	279	280	1	6	36	330	<1
		ments in breccia have a rough alignment		27457	280	281	1	12	105	1300	<1
		in places at 35° to the ca possibly		27458	281	282	1	24	85	580	<1
		representing crude bedding. Minor thin		27459	282	283	1	10	40	720	<1
		pughy zones due to karsting ie cw		27460	283	284	1	8	40	620	<1
		breccia material.		27461	284	285	1	12	135	470	<1
				27462	285	286	1	8	36	530	<1
315.6	330.0	DOLOMITE: Black, massive to laminar,		27463	286	287	1	8	32	880	<1
		silty dolomite with minor dark grey to grey		27464	287	288	1	8	44	400	<1
		muddy calcilutite interbeds and/or		27465	288	289	1	6	140	640	<1
		fragments. Very minor shelly detritus present.		27466	289	290	1	8	160	1200	<1
		Tectonic breccia with associated qtz/		27467	290	291	1	6	110	800	<1
		carbonate veining occurs from 319.40 -		27468	291	292	1	10	3100	1800	2
		320.40 m. The zone was intensely		27469	292	293	1	8	740	270	1
		shattered giving rise to v. poor recoveries		27470	293	294	1	10	390	620	<1
		(≈ 30%.) Vein has an attitude ≈ 25° to ca.		27471	294	295	1	12	240	2.45%	1
		Bedding at 325m ~ 40° to ca. (interbed		27472	295	296	1	8	750	480	<1

DRILL LOG HOLE No. ZT-80-6 PAGE 7 OF 7

Meterage From	Meterage To	Description	Mineralization %	Sample Number	Meterage From	Meterage To	Length	Cu	Pb	Zn	Ag.
315.6	330.0	DOLOMITE CON'T: of light grey calclutile	Minor fine grained	27473	296	297	1	32	55	210	1
		in black dolomitic sequence). A distinct	pyrite.	27474	297	298	1	24	70	80	<1
		foliation masks bedding attitudes by shearing		27475	298	299	1	6	16	30	<1
		out the delicate laminations. Minor very fine	Trace galena /	27476	299	300	1	10	8	14	<1
		grained pyrite occurs as disseminations and	sphalerite in thin	27477	300	301	1	8	16	18	<1
		as thin beds throughout dolomite. A trace	qtz/calcite veinlets.	27478	301	302	1	8	12	16	<1
		of galena and sphalerite occurs in thin		27479	302	303	1	8	20	24	<1
		qtz/calcite veinlets. Core badly broken		27480	303	304	1	8	24	16	<1
		in sections with recoveries over the last		27481	304	305	1	10	65	300	<1
		3 metres generally averaging 30-50%.		27482	305	306	1	10	12	18	<1
				27483	306	307	1	6	12	14	<1
		END OF HOLE 330.0 metres.		27484	307	308	1	10	16	16	<1
				27485	308	309	1	10	16	24	<1
				27486	309	310	1	14	16	16	<1
				27487	310	311	1	10	8	10	<1
				27488	311	312	1	12	16	18	<1
					312	313	1	NO	CORE	RECOVERY.	
				27489	313	314	1	6	16	32	<1
				27490	314	315	1	8	100	150	<1
				27491	315	316	1	14	450	700	<1
				27492	316	317	1	12	65	260	<1
				27493	317	318	1	28	85	75	<1
				27494	318	319	1	32	390	100	<1
				27495	319	320	1	20	75	350	<1
				27496	320	321	1	115	270	60	<1
				27497	321	322	1	20	180	200	<1
				27498	322	323	1	12	80	125	<1
				27499	323	324	1	10	370	90	<1
				27500	324	325	1	8	210	310	<1
				27501	325	326	1	12	580	310	<1
				27502	326	327	1	125	320	34	<1
				27503	327	328	1	10	145	190	<1
				27504	328	329	1	10	165	160	<1
				27505	329	330	1	10	195	26	<1
					EOH.						

OCEANA PROSPECT

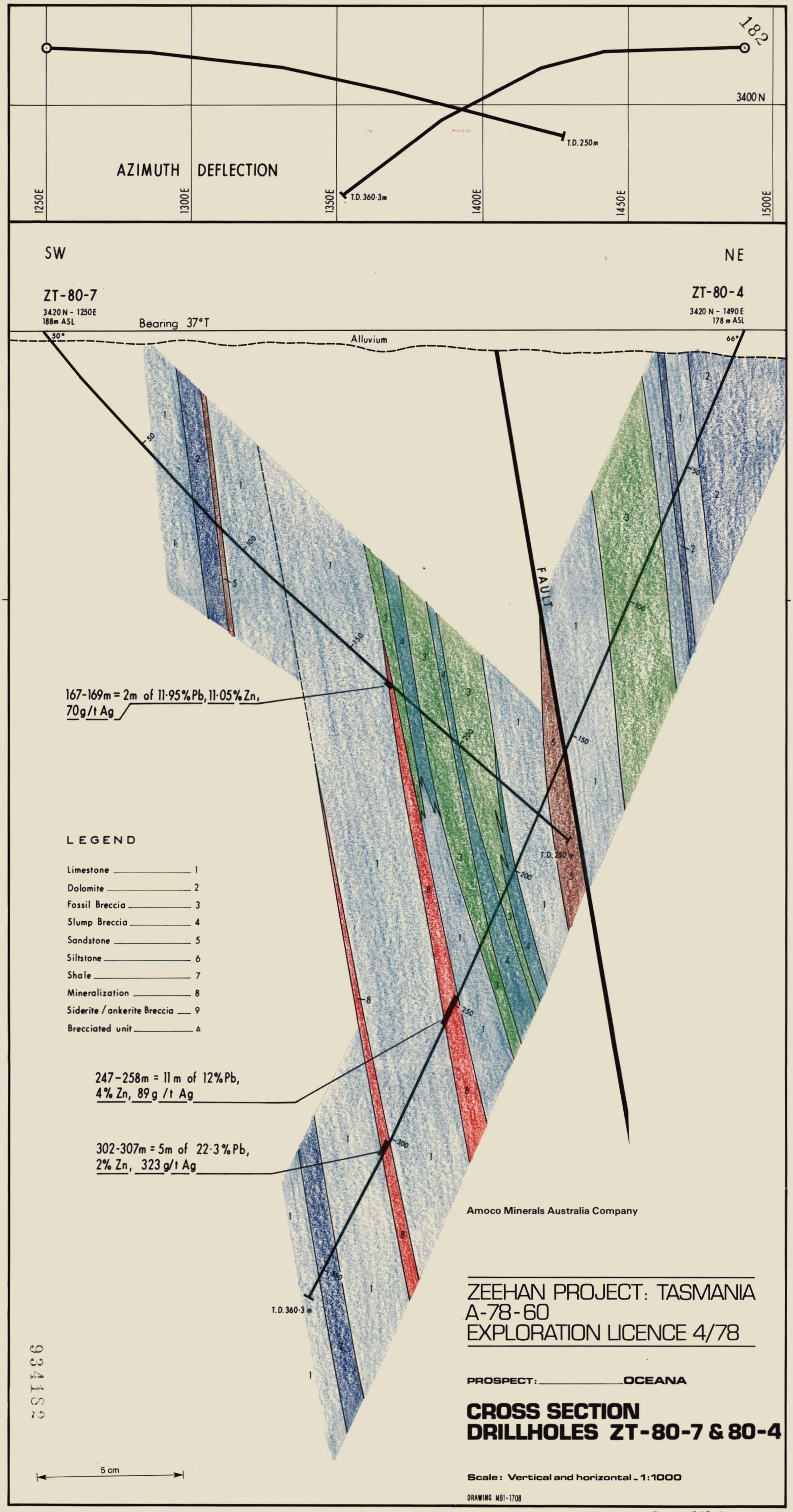
DRILLHOLE DATA

ZT-80-7

Location	:	3420N : 1250E
Declination	:	50°
Azimuth	:	37°T
Total Depth	:	250 meters

Assay Results

167-169= 2m @ 12.0% Pb + 11.0% Zn + 70g/t Ag.pa


182
AZIMUTH DEFLECTION
1250E
1300E
1350E
1400E
1450E
1500E
3400 N
T.D. 250 m
T.D. 360·3 m
SW
NE
ZT-80-7
3420 N - 1250E
188m ASL
ZT-80-4
3420 N - 1490 E
178 m ASL
Bearing 37°T
50°
66°
Alluvium
FAULT
167-169m = 2m of 11·95%Pb, 11·05%Zn, 70g/t Ag
247-258m = 11 m of 12%Pb, 4% Zn, 89 g /t Ag
302-307m = 5m of 22·3%Pb, 2% Zn, 323 g/t Ag
LEGEND
Limestone 1
Dolomite 2
Fossil Breccia 3
Slump Breccia 4
Sandstone 5
Siltstone 6
Shale 7
Mineralization 8
Siderite / ankerite Breccia 9
Brecciated unit Δ
5 cm
Amoco Minerals Australia Company
ZEEHAN PROJECT: TASMANIA
A-78-60
EXPLORATION LICENCE 4/78
PROSPECT: OCEANA
CROSS SECTION
DRILLHOLES ZT-80-7 & 80-4
Scale: Vertical and horizontal - 1:1000
DRAWING M81-1708

Doris 10 692.

Amoco Minerals Australia Company

DRILL LOG HOLE No. ZT-80-7

PROJECT ZEEHAN	No. A7860	ELEVATION 188 meters	COMMENCED 18-9-80
PROSPECT OCEANA		DIP COLLAR 50° GE	COMPLETED 25-9-80
CO-ORDINATES 3420 mN	1250 mE	CORE SIZE HQ	TOTAL LENGTH 250 meters
BEARING 037 TN	MN GN	LOGGED BY PHILIP JONES	

BORE HOLE SURVEY			INSTRUMENT					
Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing
50	48	040	125	41.5	048			
75	46	043	200	41.5	052			
100	44	045	250	40.5	051			

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag
0	16	TRICONE Gravels to 4 metres,		27351	16.3	19.3	3	110	65	165	<1
		weathered dolomitic clays to 16.0 metres		27352	19.3	22.3	3	26	16	90	<1
HQ Coring.				27353	22.3	25.3	3	16	16	55	<1
16.0	38.0	INTERBEDDED CALCLUTITE/DOLOMITE/CARENITE :	Disseminated and	27354	25.3	28.3	3	250	24	180	<1
		massive grey, weakly calcite (minor siderite)	laminar pyrite in	27355	28.3	31.3	3	12	12	30	<1
		veined calclutites interbedded with dark grey	black dolomite.	27356	31.3	34.3	3	16	20	65	<1
		laminar to thickly bedded carbonaceous		27357	34.3	37.3	3	20	16	55	<1
		dolomites with minor fossiliferous (shelly)		27358	37.3	40.3	3	16	8	34	<1
		calcarenites and laminar micritic muds. Beds		27359	40.3	43.3	3	26	24	135	<1
		generally <5cm in thickness, dolomite contains		27360	43.3	46.3	3	10	12	16	<1
		fine grained disseminated pyrite, moderate		27361	46.3	49.3	3	8	12	14	<1
		number of stylolites within calclutites. Calcite/		27362	49.3	52.3	3	8	12	16	<1
		siderite cemented tectonic breccia 22.50-23.35		27363	52.3	55.3	3	10	8	16	<1
		metres. Veining weak to moderate - calcite.		27364	55.3	58.3	3	10	8	18	<1
		Rock moderately micro faulted. Bedding 21m		27365	58.3	61.3	3	14	12	40	<1
		40° to c.a., 27m 43° to c.a.		27366	61.3	64.3	3	14	16	280	<1
38.0	45.8	LAMINAR CALCLUTITE: light grey to grey,	Minor laminar	27367	64.3	67.3	3	18	12	48	<1
		laminar, to thickly bedded, cleaved, muddy	pyrite	27368	67.3	70.3	3	14	12	34	<1
		calclutites and dolomitic calclutites. Minor		27369	70.3	73.3	3	22	44	210	<1
		thin beds of calcirudites (plus qtz frags) and		27370	73.3	76.3	3	14	20	85	<1
		Stylolitized massive calclutites. Calcite/siderite		27371	76.3	79.3	3	16	8	32	<1
		healed tectonic breccia 43.10 to 43.50 metres.		27372	79.3	82.3	3	10	8	20	<1
		Minor thinly bedded laminar pyrite present.		27373	82.3	85.3	3	8	8	14	<1
		Bedding 39m 42° to ca, cleavage 55° to ca,		27374	85.3	88.3	3	590	8	560	<1
		44.50 metres 48° to ca, cleavage 65° to ca		27375	88.3	91.3	3	10	8	18	<1
		Core breaking along cleavage planes.		27376	91.3	94.3	3	8	8	14	<1
45.8	53.60	FOLIATED CALCLUTITE: foliated (cleaved?)		27377	94.3	97.3	3	10	12	28	<1
		grey, massive, weakly calcite veined,		27378	97.3	100.3	3	6	8	14	<1
		stylolitized, calcite with rare thin fossiliferous		27379	100.3	103.3	3	6	8	16	<1
		calcarenite interbeds. Minor zone of		27380	103.3	106.3	3	8	8	16	<1
		tectonism from 49.70 to 50.0 metres.		27381	106.3	109.3	3	8	12	18	<1
				27382	109.3	112.3	3	10	16	75	<1
				27383	112.3	115.3	3	12	8	24	<1
				27384	115.3	118.3	3	8	8	16	<1

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag	Cd	Sb
53.6	64.5	INTERBEDDED CALCLUTITE/CALCARENITE/DOLOMITE:	Minor disseminated	27385	118.3	121.3	3	6	490	150	<1		
		Soft sediment deformed calcilutites and silty	pyrite.	27386	121.3	124.3	3	6	20	22	<1		
		dolomites interbedded with thin (2-5cm		27387	124.3	127.3	3	8	8	16	<1		
		width) shelly calcarenites. Rare dolomites		27388	127.3	130.3	3	6	4	12	<1		
		generally < 2cm in width. Bedding 54.5m		27389	130.3	133.3	3	6	8	16	<1		
		40° to ca, cleavage 75° to ca; 63m 30° to ca,		27390	133.3	136.3	3	8	12	18	<1		
		cleavage 63° to ca. Disseminated pyrite		27391	136.3	139.3	3	8	20	310	<1		
		in calcarenites as fine blebs. Rock competent,		27392	139.3	142.3	3	16	32	95	<1		
		foliated, minor broken areas due to		27393	142.3	145.3	3	6	16	40	<1		
		fracturing along carbonaceous cleavage planes.		27394	145.3	148.3	3	6	20	38	<1		
64.5	71.3	INTERBEDDED CALCLUTITE/CALCARENITE/DOLOMITE:	Trace Pyrite.	27395	148.3	151.3	3	6	16	40	<1		
		Massive, rhythmically bedded, silty to sandy grey		27396	151.3	154.3	3	4	16	80	<1		
		calcilutites and shelly calcarenites containing		27397	154.3	157.3	3	4	60	250	<1		
		abundant 'rip up clasts'. Minor thin interbeds		27398	157.3	160.3	3	4	120	500	<1		
		of dark grey carbonaceous, silty, laminar		27399	160.3	163.3	3	6	175	860	<1		
		dolomite. Minor calcite veining. Graded bedding		27400	163.3	165	1.7	4	290	1350	<1		
		at 68m indicates the sequence youngs		27564	165	166	1	6	240	1400	<1		
		downhole (as do flame structures). Bedding		27565	166	167	1	4	210	1100	<1		
		68m 40° to ca; Calcilutites have abundant		27551	167	168	1	130	10.4%	4.6%	55	290	<0.005%
		stylolites parallel to bedding and also		27552	168	169	1	270	13.5%	17.5%	85	1150	0.01%
		transgressive. Trace pyrite in dolomite.		27566	169	170	1	4	680	1350	<1		
71.3	75.0	BRECCIATED CALCLUTITE: grey to dark grey,	Trace pyrite	27567	170	171	1	6	230	5200	<1		
		sandy and silty, soft sediment deformed,		36001	171	174	3	4	320	1250	<1		
		tectonically brecciated and strongly calcite		36002	174	177	3	4	190	900	<1		
		healed calcilutites. Breccia's 72.6-73.0;		36003	177	180	3	2	100	410	<1		
		73.5-73.7; 74.0-74.3; 74.6-74.8; Coarsely		36004	180	183	3	2	75	360	<1		
		crystalline calcite comprises breccia matrix		36005	183	186	3	2	140	450	<1		
		(plus minor carbonaceous, host rock fragment		36006	186	189	3	4	32	195	<1		
		content) Trace pyrite.		36007	189	192	3	2	16	150	<1		
75.0	85.7	INTERBEDDED DOLOMITE/CALCLUTITE: laminar	Trace pyrite	36008	192	195	3	4	16	95	<1		
		and pelletal, black, silty and carbonaceous		36009	195	198	3	4	44	37	<1		
		dolomites containing minor bedded and		36010	198	201	3	4	24	36	<1		
		disseminated pyrite, interbedded with grey,		36011	201	204	3	4	12	30	<1		
		foliated, massive, in part weakly fossiliferous,		36012	204	207	3	4	12	28	<1		
		calcilutites. Shelly fragments predominate over		36013	207	210	3	6	28	140	<1		
		coral and other detritus in beds generally 2cm		36014	210	213	3	6	16	28	<1		
		in width or less. Pelletal units contain abundant		36015	213	216	3	8	8	12	<1		
		shelly and broken fossil detritus. Carbonaceous		36016	216	219	3	10	8	22	<1		
		dolomite beds vary from 2mm in width to	con't.	36017	219	222	3	8	8	22	<1		

DRILL LOG **HOLE No.** ZT-80-7

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %
75.0	85.7	CONT. 10's of cm's in width. Rock is weakly calcite veined. Bedding 78.5m 35° to ca. Calcite veining 65° to ca (≈ 90° to bedding) 84.50 m 50° to ca. Minor pyrite on cleavage faces along with carbonaceous material. Minor stylolites.	
85.7	87.9	CALCAREOUS SANDSTONE: speckled light grey to white, medium grained calcareous sandstone containing numerous thin interbeds of soft sediment deformed calclutite and minor carbonaceous dolomite. Unit is quartz carbonate veined. Foliation enhanced by carbonaceous material. Minor tectonic brecciation. Flame structures indicate sequence youngs down hole. Sandstone pelletal near its base.	
87.9	109.0	INTERBEDDED CALCLUTITES / DOLOMITE: massive to laminar, light grey, unfossiliferous, calclutites interbedded with thin (<2cm in width) dark grey silty and carbonaceous dolomite. Rare interbeds of fossiliferous calcarenite occur sporadically. Massive calclutites contain numerous stylolites. Minor zones of tectonism at 90.3-90.5m; 96.8-96.9m; 108.3-108.5m; (all filled with calcite/carbonaceous matrix). Pronounced bedding flexure at 106.5m 20° to ca cleavage 55° to ca; 95.5m 45° to ca; 106m 30° to ca (laminar micritic muds) Minor to moderate calcite veining (trace siderite). Minor fossiliferous sections generally contain coralline and some shelly fragments. Sections of core intensely microfaulted. Core very competent.	
109.0	123.0	INTERBEDDED DOLOMITE / CALCLUTITE: Dark grey in part pelletal, foliated, pyritic, silty dolomite beds generally <5 cm in width rhythmically interbedded with fossiliferous grey massive calclutites. Beds show signs of soft sediment deformation.	Trace Pb/Zn in tectonic angular breccia. CON'T

SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	ASSAYS Cu	Pb	Zn	Ag
36018	222	225	3	8	12	28	<1
36019	225	228	3	10	24	40	<1
36020	228	231	3	6	16	48	<1
36021	231	234	3	6	12	44	<1
36022	234	237	3	4	12	28	<1
36023	237	240	3	6	12	22	<1
36024	240	243	3	32	12	110	<1
36025	243	246	3	400	12	360	<1
36026	246	250	4	155	16	175	<1
EOH.							

DRILL LOG HOLE No. ZT-80-7 PAGE 4 OF 7

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	ASSAYS					
109.0	123.0	CONT: tectonic breccia 119.75 to 119.9 m with calcite/siderite matrix containing trace Pb/Zn sulphides. Bedding 121.7 m 42° to ca; 113.5 m 30° to ca and cleavage 65° to ca. Minor to moderate calcite veining. Core relatively unbroken and competent. Minor breakage along carbonaceous filled cleavage surfaces.											
123.0	129.0	INTERBEDDED CALCLUTITE/DOLOMITE: Very strongly calcite veined and healed, tectonically brecciated sequence of very fossiliferous calcarenites, weakly fossiliferous calclutites and laminar pyritic dolomites.											
129.0	144.5	INTERBEDDED DOLOMITE/CALCLUTITE/CALCARENITE: Fissile and laminar, black, carbonaceous, silty and occaissionally pyritic dolomite rhythmically interbedded with massive fossiliferous and unfossiliferous grey calclutites and coarsely crystalline very fossiliferous light grey sparry calcarenites. Moderately calcite veined. Minor calcite/siderite breccia infill from 143.5 to 144.5 containing minor pyrite and trace galena. Fossil fragments generally large shells with abundant shell grit detritus as matrix. Minor pelletal sections. Rip up clasts and flame structures indicate the sequence youngs down hole. Minor stylolites present. Bedding 138.5 m 46° to ca.	Minor pyrite with trace galena										
144.5	158.0	CALCLUTITE: Soft sediment slumped, or load casted, massive dark grey to grey calclutite with minor dark grey silty dolomite as thin interbeds. Rock strongly calcite healed and brecciated from 147-151 m. Abundant stylolites present. Carbonaceous material remobilized along bedding interfaces.											
158.0	166.9	INTERBEDDED CALCLUTITE/DOLOMITE: interbedded rhythmically, laminar to massive (5-20 cm in width) grey fossiliferous and unfossiliferous calclutites and dark											

DRILL LOG HOLE No. ZT-80-7 PAGE 5 OF 7

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	ASSAYS
158.0	166.9	CON'T grey silty and carbonaceous (2-5 cm in width) dolomite. Very minor fossiliferous calcarenites. Moderate calcite veining with minor siderite and trace sphalerite. Some veins autobrecciation. Bedding 159 m 40° to ca; 165.5 m 38° to c.a. Stylolites present within massive calcilutites. Calcite veins both parallel and crosscutting to bedding. Fossils made up of shells, oolites, and broken debris						
166.9	169.0	SEMI MASSIVE ZINC-LEAD SULPHIDE: yellow brown, blebby and veinleted sphalerite and galena appears to be selectively replacing the afore mentioned unit in conjunction with a siderite/ankerite/calcite gangue. Brecciation has occurred and angular fragments vary in size from a mm to a number of cm's in width. Zn/Pb ratio roughly 60:40. Grades approximately 15% combined Zn/Pb and sulphides very fine grained. No pyrite. Open pore space infilling evident as is vugh infilling. Initial calcite infilling is rimmed by siderite and followed by Zn/Pb sulphide pulse. Mineralized veining trends c 30° to ca.	Semi massive Zn/Pb sulphide over 2m.					
169.0	173.7	FOSSIL BRECCIA: massive sedimentary slump breccia containing angular fragments (to sub angular) of host rock material, coralline limestone, oolitic material, cemented in a dark grey silty dolomitic matrix. Strongly calcite veined. Strongly stylolitized. 0.5cm wide vein of sphalerite from 169.95 to 170.0 Fragments in breccia vary in size up to 10's of cm's.	Trace sphalerite.					
173.7	182.0	SLUMP BRECCIA: soft sediment slump brecciated or load casted calcilutites with a dark grey silty dolomitic matrix. Lot of oolitic and fossil debris material in excess of 10cm diam. Moderate to strong calcite veining. Minor disseminated pyrite Minor siderite rimming calcite veins. Moderate Number of stylolites.	Trace pyrite					

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DRILL LOG HOLE No. ZT-80-7

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	ASSAYS
182.0	195.6	FOSSIL BRECCIA: massive sedimentary slump breccia containing angular fragments of host rock material, coralline limestone, oolites, cemented in a dark grey silty dolomitic matrix.						
195.6	199.0	SLUMPED CALCLUTITE: soft sediment slumped and brecciated, interbedded calclutite with minor dark grey silty dolomite. Minor calcite veining with minor disseminated pyrite	Trace pyrite.					
199.0	217.0	FOSSIL BRECCIA: predominantly an oolitic grey to black, micritic to calcarenitic dolomite. matrix with angular to rounded coralline fragments, pisoliths, shells, laminar muds (exotic to sequence) and other fossil debris slumped into it. Moderate calcite veining with minor disseminated pyrite	Trace pyrite.					
217.0	227.7	INTERBEDDED DOLOMITE/CALCLUTITE: the fossil breccia grades down hole into a rhythmically bedded dolomite/calclutite sequence. Dolomite is laminar, pyritic, carbonaceous and silty, generally in beds varying between 1cm and 15cm. Minor very fossiliferous sections of dolomite occur close to fossil breccia. Calclutite generally grey, massive, stylolitized, unfossiliferous with beds varying in width from 1-10 cm's. Minor calcarenites present. Bedding 223.5 m 40° to ca; 219.5 m 50° to ca; 227.5 m 42° to ca, Abundant pyrite occurs along bedding contacts as blebs or as disseminations parallel to bedding. Minor to moderate calcite veining, minor tectonic (healed with calcite) breccia's with minor siderite.	Trace pyrite.					
227.7	234.0	SLUMPED CALCLUTITE: grey, massive, slump brecciated (angular to sub rounded fragments) stylolitized calclutite containing numerous thin interbeds of slumped dark grey silty carbonaceous dolomite (beds < 1.5 cm width) Dolomite occurs also as matrix to breccia. Minor tectonic breccia's with calcite cement.						

DRILL LOG HOLE No. ZT-80-7

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS
234.0	240.5	LAMINAR CALCLUTITE: light grey, laminar, carbonaceous and pyritic calclutite interbedded with thin carbonaceous layers and massive calcarenites. Moderate number of stylolites. Moderate calcite (trace siderite) veining. Bedding 239m 45° to ca. Rock very competent.						
240.5	250.0	LAMINAR SLUMPED DOLARENITE: Finely laminar to massive dark grey to black, speckled sandy and weakly pyritic in part slump brecciated dolomitic arenite. Bedding very apparent but breccia fragments within individual beds are very chaotic in orientation. The fragments are subrounded but generally have lengths 3 to 5 times their widths. Minor calcite veining. Minor tension fractures are calcite healed. Minor to trace siderite. Bedding 242.5m 42° to ca, 247.5 m 45° to ca.						
		END OF HOLE 250.0 metres.						

OCEANA PROSPECT

DRILLHOLE DATA

ZT-80-8

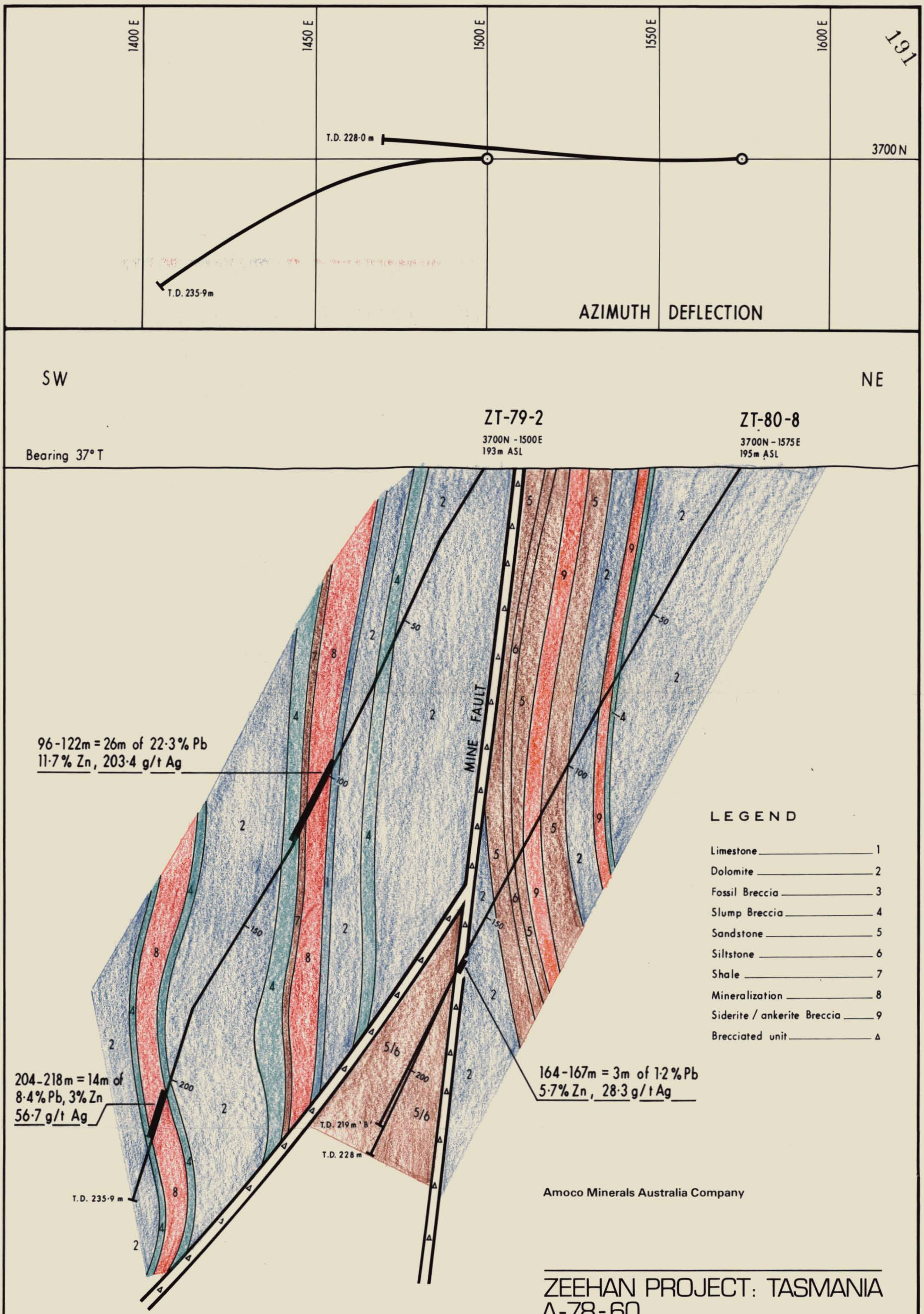
Location	:	3700N : 1575E
Declination	:	55°
Azimuth	:	217°T
Total Depth	:	228.6 meters

Assay Results

160-167= 7m @ 0.6% Pb + 3.12% Zn + 13.7g/t Ag

incl

165-167= 2m @ 1.7% Pb + 7.7% Zn + 29.0g/t Ag



Amoco Minerals Australia Company

ZEEHAN PROJECT: TASMANIA
A-78-60
EXPLORATION LICENCE 4/78

PROSPECT: OCEANA

CROSS SECTION DRILLHOLES ZT-79-2 and ZT-80-8

Scale: Vertical and horizontal - 1:1000

5 cm

DRAWING M81-1709

934191

Amoco Minerals Australia Company

DRILL LOG

HOLE No. ZT- 80- 9

PROJECT ZEEHAN - TAS No. A7860	ELEVATION meters	COMMENCED 17-10-80
PROSPECT OCEANA	DIP COLLAR 50°	COMPLETED 26-10-80
CO-ORDINATES 3600 mN 1400 mE	CORE SIZE HQ, NQ	TOTAL LENGTH 200.2 meters
BEARING TN 313° MN GN	LOGGED BY PHILIP JONES	

BORE HOLE SURVEY — INSTRUMENT EASTMAN CAMERA.

Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing
50	50.5	317	200	54	319			
100	52.0	317						
150	53.0	316						

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	To	Length	ASSAYS Cu	Pb	Zn	Ag		
0	1.5	TRICONE : Gravel 0.5m, Black brown silty		29501	1	2	1m	105	2.95%	5750	6		
		clays 0.5 to 1.5metres.		29502	2	3	1	18	1.80%	1.00%	8		
				29503	3	4	1	22	1.55%	1.35%	6		
		HQ CORING		29504	4	5	1	40	7.10%	2.90%	14		
				29505	5	6	1	32	14.4%	1.50%	32		
1.5	13.5	DOLOMITE : Completely weathered, grey to black		29506	6	7	1	50	6.15%	3.25%	28		
		brown, silty, in part brecciated dolomite. Ferrug-		29507	7	8	1	22	5.80%	1.50%	8		
		inous from 4.5 metres with mottled black orange		29508	8	9	1	12	3.05%	2500	2		
		clays with abundant hematite staining on		29509	9	10	2m	16	1.95%	7000	6		
		fracture surfaces. 75% Core recovery			10	11							
				29510	11	12	1	18	1.30%	1.65%	6		
13.5	29.6	ANKERITE SIDERITE BRECCIA: Weakly mineralized,	15% Pb-Zn 18-19 m	29511	12	13	1	16	1.15%	1.25%	2		
		disseminated and blebby galena and sphalerite,	5% Pb-Zn 22.24 m	29512	13	14	2m	12	1.05%	8500	4		
		massive but badly broken, clay infilled in part,			14	15							
		cavernous, vughy ankeritic and sideritic veined and		29513	15	16	2m	10	4500	3150	2		
		infilled breccia. Semi massive mineralization from			16	17							
		18-19m @ ≃ 15% Zn/Pb and 22-24 ≈ 5% Pb/Zn. Poor		29514	17	18	1	8	6500	6750	2		
		core recoveries averaging 45%. Sand and clay		29515	18	19	1	110	5.85%	19.0%	46		
		filled cavities encountered from 21-22m and 24-27		29516	19	20	1	16	1.25%	1.35%	8		
		metres. Breccia is composed of fine and coarse		29517	20	21	1	10	4700	1500	4		
		grained crystalline ankerite in a dark dolomitic			21	22		NO	CORE	RECOVERY - SAND SEAM			
		matrix siderite veined during dolomitisation.		29518	22	23	2m	26	2.25%	1.20%	16		
					23	24							
29.6	57.3	INTERBEDDED CLAYS : (DOLOMITE) Grey to black	5% pyrite		24	25		NO	CORE	RECOVERY - SAND SEAM			
		with minor olive grey (pyrite stained) massive			25	26		"	"	"		"	
		silty clays containing minor thin seams of rubbly			26	27		"	"	"		"	
		relatively unaltered silty, dense, grey, dolomite.		29519	27	28	2m	10	4300	3900	4		
		Minor siderite & calcite (quartz?) Some sections			28	29							
		of clay more porous & siltier than others. Up		29520	29	30	2m	8	1200	1.00%	2		
		to 5% pyrite in clays from 51.5 to 57.3 metres.			30	31							
				29521	31	32	1m	8	330	3100	<1		
57.3	59.0	ANKERITE PYRITE BRECCIA: Angular breccia frag-	Trace galena	29522	32	33	1	8	340	2200	1		
		ments of ankerite in a fine grained pyrite (minor	5-10% pyrite	29523	33	34	2m	10	34	1550	<1		
		siderite) matrix. Trace galena. Pyrite 5-10%			34	35							

DRILL LOG HOLE No. ZT-80-9

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag
57.3	59.0	ANKERITE PYRITE BRECCIA: Con't Ground	Trace galena	29524	35	36	1m	20	55	1850	< 1
		very broken, core recovery ≈ 65%.		29525	36	37	1	10	390	3900	< 1
				29526	37	38	1	8	520	2800	< 1
59.0	74.5	INTERBEDDED CLAYS: (DOLOMITE) Grey to black,	Minor pyrite	29527	38	39	1	10	24	870	< 1
		silty, weakly calcite veined, pyritic completely		29528	39	40	1	10	34	1100	< 1
		weathered dolomite.		29623	40	41	1	10	135	370	< 1
				29624	41	42	1	8	420	1300	< 1
74.5	78.0	DOLOMITE: Massive, dense, fine grained, dark	Trace galena	29625	42	43	1	8	710	3700	1
		grey ankeritic dolomite. Possibly brecciated,		29626	43	44	1	8	1850	31500	2
		moderately clay zoned, trace siderite and galena.		29627	44	45	1	10	1.42%	1850	8
		Massive material badly fractured. Recoveries		29628	45	46	1	8	200	1050	1
		generally good > 90%.		29629	46	47	1	8	105	480	< 1
				29630	47	48	1	8	80	280	< 1
78.0	83.5	MINERALIZED CLAY BRECCIA: Mottled black,	80-83 m 10% Pb/Zn ??	29631	48	49	1	10	45	220	< 1
		orange, yellow, grey silty clays with minor	pyrite. ~5%	29632	49	50	1	12	95	460	< 1
		massive angular brecciated, dense sideritic		29633	50	51	1	10	55	250	< 1
		and ankeritic dolomite. Weakly to moderately		29634	51	52	1	10	32	100	< 1
		mineralized. Galena and sphalerite visible as		29635	52	53	1	10	24	110	< 1
		coarse grained disseminations in mottled clays.		29636	53	54	1	12	32	135	< 1
		Moderate amount of pyrite present as blebs		29637	54	56	2	12	50	270	< 1
		and as breccia infill material. Minor quartz.		29638	56	57	1	12	400	1850	2
				29639	57	58	1	28	1.65%	1.05%	6
83.5	95.4	COLLAPSE BRECCIA: Angular and rounded,	Minor Pb/Zn	29640	58	59	1	12	3300	4300	2
		small and large sized fragments occur in a	5-10% pyrite.	29641	59	60	1	14	1550	3950	2
		matrix of pyritic, black, silty dolomitic clay.		29642	60	61	1	12	80	390	< 1
		Fragments include Moina Sandstone (both		29643	61	62	1	14	60	310	< 1
		white & pink coarse grained sandstone) olive		29644	62	63	1	12	105	320	< 1
		green, oxidised? massive ankeritic dolomite,		29645	63	64	1	18	90	530	< 1
		pyrite fragments, quartz fragments and black		29646	64	65	1	16	80	350	< 1
		carbonaceous material (WOOD!) along with		29647	65	66	1	12	135	610	< 1
		dolomite fragments. Minor galena and		29648	66	67	1	16	115	980	< 1
		sphalerite in sulphide smelling core. Fragments		29649	67	68	1	18	140	660	< 1
		vary in size up to 35 cm across down to 1-2		29650	68	69	1	20	970	4800	< 1
		mm. in diameter. Abundant very weathered		29651	69	70	1	12	420	4500	< 1
		pyrite fragments. Fosil leaves 91-92		29652	70	71	1	12	75	1500	< 1
		Sequence possibly Karstic collapse breccia		29653	71	72	1	10	145	100	1
		& infill with material derived from surface		29654	72	73	1	16	660	4500	2
		ie Moina fragments.		29655	73	74	1	14	980	7700	2
				29656	74	75	1	10	1250	6350	2

DRILL LOG HOLE No. ZT-80-9

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag		
95.4	119.6	MASSIVE PYRITIC CLAY (DOLOMITE): Generally	Minor Pyrite.	29657	75	76	1						
		black, massive, silty clays with minor grey		29658	76	77	1	10	2550	6150	2		
		clay interbeds. Mottled orange and grey clay		29659	77	78	1	12	2750	1.00%	3		
		from 99.7 to 101.0. Light grey, dense,		29660	78	79	1	16	1350	1.60%	3		
		sideritic veined dolomite from 95.4 to 97.5.		29661	79	80	1	14	1050	8400	3		
		containing abundant pyrite possibly as		29662	80	81	1	14	3350	1.20%	8		
		vugh infill as seen by filigree texture.		29663	81	82	1	12	8600	1.70%	12		
				29664	82	83	1	8	970	1.30%	2		
119.6	183.0	SIDERITE / ANKERITE MINERALIZED ROCK: Coarse	Minor mineralization	29665	83	84	1	10	1750	9150	2		
		grained white ankerite crystals and cream	apart from intercepts	29666	84	85	1	16	3150	7600	4		
		coloured fine grained siderite set in a matrix of	reported in description.	29667	85	86	1	16	4300	1.5%	4		
		dark grey ankeritic dolomite. Core vughy and		29668	86	87	1	20	1.00%	7900	8		
		porous in part, brecciated (dolomitisation)		29669	87	88	1	18	5100	1.05%	7		
		very fractured, clay veined and weakly mineraliz-		29670	88	89	1	20	4150	1.30%	8		
		ed. Siderite veinleting gives 'brain texture' to		29671	89	90	1	16	3550	6200	6		
		core. Minor clay zones present and numerous		29672	90	91	1	16	3750	5100	6		
		cavities: 125.2 - 128; 159 - 160.2; 162.2 - 163.8;		29673	91	92	1	14	9550	9900	16		
		163.9 - 166; 167 - 168; 171 - 172.10; 175.2 - 181.8.		29674	92	93	1	12	4170	2600	11		
		Lead/Zinc mineralization occurs as dissemin-		29675	93	94	1	14	6050	5300	6		
		ations, blebs, thin veinlets, as coarse grained		29676	94	95	1	14	1800	1.55%	3		
		accumulations and to a minor extent as		29677	95	96	1	12	1950	4150	2		
		semi massive and massive. Grades vary from		29678	96	97	1	12	2150	1.65%	2		
		metre to metre, however, the following are		29679	97	98	1	14	1100	1.05%	2		
		the higher grade intercepts. Zinc grades seem		29680	98	99	1	14	290	2300	7		
		to increase downhole.		29681	99	100	1	22	4500	8200	6		
NQ CORING		148 - 150 5% Pb/Zn 20% Core Recovery.		29682	100	101	1	28	4250	1.15%	12		
FROM 148 m.		160 - 162 7½% Pb/Zn		29683	101	102	1	14	3000	1.85%	2		
		166 - 173.5 5-10% Pb/Zn 20% Core Recovery.		29684	102	103	1	22	2500	1.65%	6		
		173.5 - 175.5 20% Pb Recovery 10%.		29685	103	104	1	14	450	7500	1		
		181.8 - 183 60% Pb/Zn (60:40) Recovery 15%.		29686	104	105	1	14	320	4700	1		
				29687	105	106	1	12	490	9100	1		
183.0	195.0	MASSIVE CLAYS: Mottled, ferruginous, orange,		29688	106	107	1	12	1000	7550	5		
		red and yellow (minor grey) silty clays.		29689	107	108	1	10	380	1.30%	1		
		Ironstone 183.0 - 183.10. Ground badly		29690	108	109	1	16	890	6800	1		
		cavernous: 183.10 - 184.50; 186.0 - 187.50; 188.4-		29691	109	110	1	18	530	4900	2		
		191.0; 192 - 195. Minor quartz from 191.0 to		29692	110	111	1	20	390	2750	1		
		192.0 possibly marking OCEANA FAULT ZONE!		29693	111	112	1	18	200	2500	1		
				29694	112	113	1	14	140	3000	<1		
				29695	113	114	1	16	170	2500	1		

DRILL LOG HOLE No. Zr-80-9

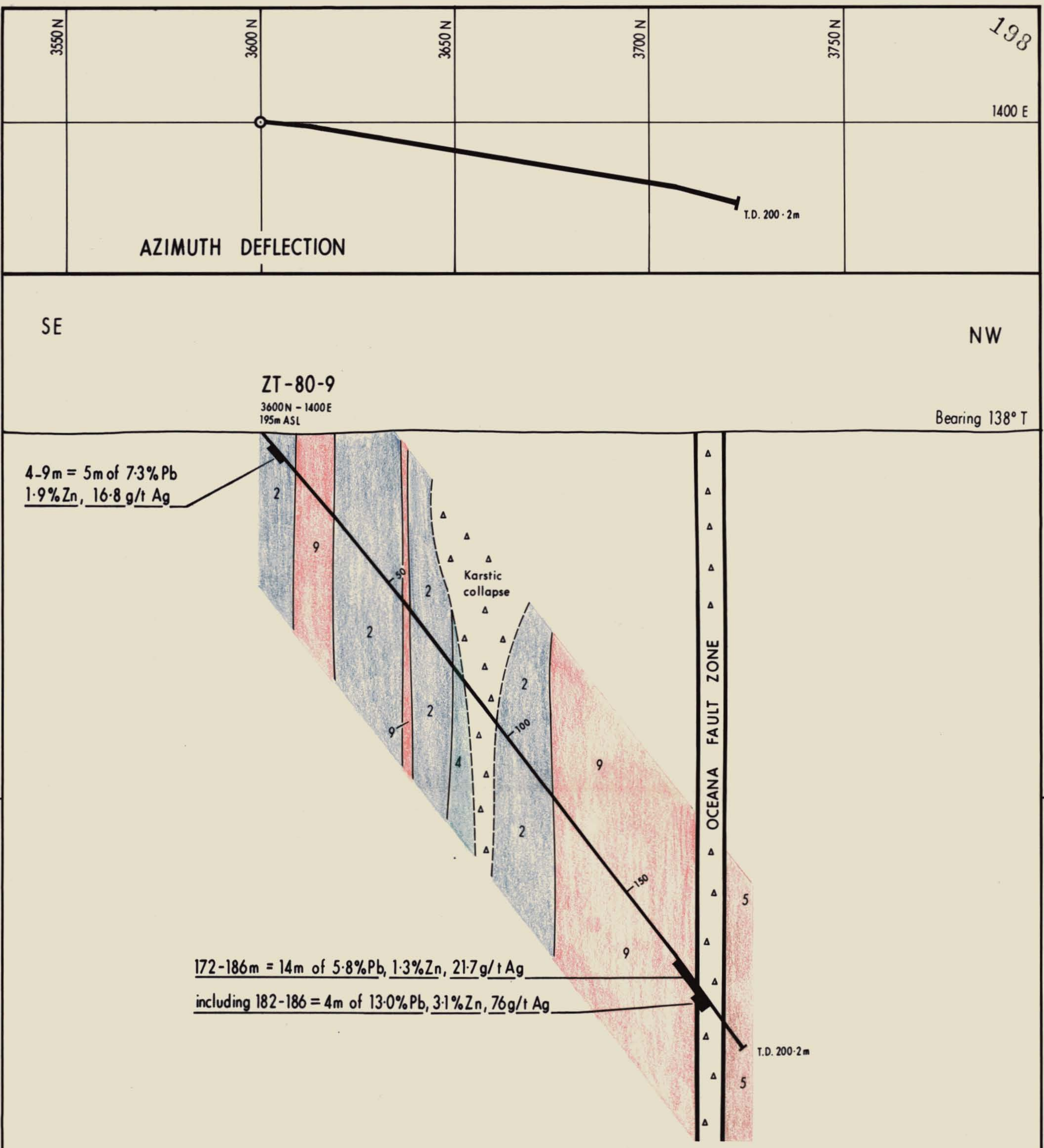
METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	ASSAYS Cu	Pb	Zn	Ag
195.0	200.2	SANDSTONE BRECCIA: Moina Sandstone on		29696	114	115	1	18	370	3100	1
		northern side of Oceana Fault. Coarse grained		29697	115	116	1	14	2150	7100	2
		light grey sandstone fragments set in a matrix		29698	116	117	1	18	3500	8600	2
		of grey to dark grey silty and micaceous		29699	117	118	1	18	6800	1.00%	3
		fine grained sandstones. Rounded fragments		29700	118	119	1	14	3600	8950	2
		to sub rounded comprise sedimentary breccia.		29701	119	120	1	18	5250	3700	3
				29529	120	122	2	10	7700	1.00%	4
E.O.H	200.2			29530	122	123	1	8	9000	3600	4
				29531	123	124	1	14	1.4%	8000	6
				29532	124	125	1	8	5900	2900	4
					125	128	3	CAVITY - NO CORE RECOVERY.			
				29533	128	129	1	10	1.15%	7500	4
				29534	129	131	2	90	3700	7000	2
				29535	131	133	2	12	4100	5000	2
				29536	133	134	1	10	8100	2100	4
				29537	134	135	1	46	5900	2850	2
				29538	135	136	1	14	9600	5250	4
				29539	136	137	1	16	5700	8750	2
				29540	137	138	1	10	4500	3750	2
				29541	138	139	1	18	1.90%	8750	6
				29542	139	140	1	18	1.65%	9250	6
				29543	140	141	1	36	1.58%	1.55%	6
				29544	141	143	2	30	1.05%	3.25%	4
				29545	143	144	1	36	1.00%	1.80%	4
				29546	144	145	1	16	1.00%	4350	4
				29547	145	146	1	10	7000	3100	2
				29548	146	147	1	14	1.95%	4550	10
				29549	147	148	1	10	1.60%	3900	4
				29550	148	150	2	16	9.30%	2500	22
				29601	150	152	2	6	1.00%	3450	4
				29602	152	153	1	10	1.60%	2850	4
				29603	153	154	1	10	2.80%	2000	8
				29604	154	155	1	10	4.25%	1750	14
				29605	155	156	1	16	1.30%	5500	6
				29606	156	157	1	14	2.05%	3800	8
				29607	157	159	2	14	1.45%	5750	6
					159	160		CAVITY - NO CORE RECOVERY			
				29608	160	161	1	28	5.90%	7500	22
				29609	161	162	1	34	4.20%	1.30%	18

DRILL LOG HOLE No.

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	ASSAYS Cu	ASSAYS Pb	ASSAYS Zn	ASSAYS Ag
				29610	162	164	2	8	2700	1900	2
				29611	164	166	2	26	1.05%	1.30%	4
				29612	166	168	2	34	2.25%	1.80%	12
				29613	168	170	2	12	1.68%	5000	8
				29614	170	171	1	16	7500	7750	4
					171	172	1	NO	CORE	RECOVERY	
				29615	172	175	3	55	3.80%	1.85%	75
					175	182	7	No	CORE	RECOVERY	
				29616	182	183	1	430	44.0%	9.75%	250
				29617	183	186	3	90	2.60%	8750	18
				29618	186	188	2	34	9600	3800	16
					188	191	3	NO	CORE	RECOVERY	
				29619	191	192	1	22	3300	2400	4
					192	195	3	NO	CORE	RECOVERY	
				29620	195	198	3	90	720	50	8
				29621	198	199	1	36	550	175	<1
				29622	199	200	1	95	700	160	<1

END OF HOLE 200.20 metres.

198



LEGEND

Limestone	1
Dolomite	2
Fossil Breccia	3
Slump Breccia	4
Sandstone	5
Siltstone	6
Shale	7
Mineralization	8
Siderite / ankerite Breccia	9
Brecciated unit	Δ

5 cm

Amoco Minerals Australia Company

ZEEHAN PROJECT: TASMANIA
A-78-60
EXPLORATION LICENCE 4/78

PROSPECT: OCEANA

CROSS SECTION DRILLHOLE ZT-80-9

Scale: Vertical and horizontal - 1:1000

DRAWING M81-1709

934197 198

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Amoco Minerals Australia Company

DRILL LOG — HOLE No. ZT- 80 - 8 — PAGE 1 OF 5

PROJECT ZEEHAN - TAS No. A7860	ELEVATION meters	COMMENCED 26·9·80	
PROSPECT OCEANA	DIP COLLAR 55° GW	COMPLETED 15·10·80	
CO-ORDINATES 3700 mN 1575 mE	CORE SIZE HQ	TOTAL LENGTH 228.6 meters	
BEARING 217° TN MN GN	LOGGED BY PHILIP JONES		

BORE HOLE SURVEY — INSTRUMENT EASTMAN CAMERA

Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing
50	61.5	217.5	200	64.5	222			
100	61.5	222						
150	62.5	222						

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	Cu	Pb	Zn	Ag
		TRICONE		27612	24	25	1	26	1500	3800	3
0	24.0	Black, dark grey to brown massive silty clays	NO SLUDGE.	27613	25	27	2	16	1000	4900	3
		HQ CORING		27614	27	28	1	14	1400	5200	2
24.0	35.0	DOLOMITE: Black to grey, completely weathered,		27615	28	30	2	12	310	760	1
		silty, carbonaceous? rubbly dolomite with minor			30	31	1	NO	CORE	+ CAVITY	
		thin sections of relatively unweathered, very		27616	31	33	2	10	65	250	<1
		dense, massive, ankeritic dolomite. Very poor		27617	33	34	1	12	28	180	<1
		recoveries through loose ground. (≈ 45%)		27618	34	35	1	10	14	100	<1
				27619	35	36	1	10	30	100	<1
35.0	40.4	ANKERITIC DOLOMITE: Massive, very dense,		27620	36	37	1	10	26	75	<1
		ankerite veinleted, black to dark olive brown		27621	37	38	1	6	24	90	<1
		dolomite. Core extensively broken, vughy in		27622	38	39	1	18	26	85	<1
		part. Recovery ≈ 75%.		27623	39	41	2	10	18	80	<1
				27624	41	42	1	8	22	95	<1
40.4	48.2	SILTY DOLOMITE: Dark grey to grey, very silty	Pyrite staining.	27625	42	43	1	6	14	160	<1
		clayey, dolomite. CWeathered, Minor cw siderite		27626	43	44	1	8	12	180	<1
		veinlets and possibly very fine grained pyrite (olive		27627	44	45	1	8	24	105	<1
		yellow staining of clays). Minor thin zones of dense,		27628	45	47	2	12	20	90	<1
		very weathered vughy dolomite (Breccia's ??).		27629	47	48	1	38	16	90	<1
		Core recovery ≈ 65%.		27630	48	49	1	10	30	180	<1
				27631	49	50	1	8	26	230	<1
48.2	49.6	TECTONIC BRECCIA: Core very weathered but		27632	50	51	1	10	22	510	<1
		showing relict brecciation textures with angular		27633	51	52	1	8	20	730	<1
		fragments of light grey ankeritic dolomite in a		27634	52	53	1	10	30	660	<1
		matrix of dark grey silty dolomite. Minor		27635	53	54	1	8	60	760	<1
		ankerite & siderite vugh fillings and veinlets. Core		27636	54	55	1	8	65	650	1
		Recovery ≈ 95%.		27637	55	57	2	6	75	840	<1
				27638	57	58	1	6	50	520	<1
49.6	66.0	DOLOMITE: Interbedded olive grey, grey and black	Pyrite staining?	27639	58	59	1	6	32	500	<1
		silty carbonaceous clays - Dolomite. Minor zones		27640	59	60	1	6	18	460	<1
		of fresher material being very dense ankeritic,		27641	60	61	1	24	65	770	<1
		massive dolomite. Minor cw sideritic veinlets,		27642	61	62	1	6	140	1050	<1
		possibly minor very fine grained pyrite. Core		27643	62	63	1	8	170	1250	<1
		recovery ≈ 80%.		27644	63	64	1	6	115	740	<1

DRILL LOG HOLE No. ZT-80-8

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag
66.0	69.8	BRECCIA: Angular to sub-rounded fragments of	Trace galena	27645	64	66	2	100	310	890	2
		ankeritic dolomite in a black silty dolomite matrix.		27646	66	67	1	6	920	800	1
		Ankeritic dolomite fragments are compised of		27647	67	68	1	4	340	1650	1
		coarse grained crystalline white to cream ankerite		27648	68	70	2	4	180	3200	<1
		in a finer ankeritic matrix. Trace galena. Breccia		27649	70	71	1	4	80	2000	<1
		moderately vughy. Dolomite moderately carbonaceous.		27650	71	72	1	68	320	1230	<1
				27651	72	74	2	24	610	2090	1
69.8	80.4	SIDERITE / ANKERITE BRECCIA: Weakly mineralized	Minor galena/sphalerite	27652	74	75	1	62	1510	2790	2
		siderite veinleted ankeritic dolomite. Minor	Trace to minor pyrite.	27653	75	76	1	70	1370	3280	2
		disseminated colloform pink sphalerite and veinlet		27654	76	77	1	185	1060	2880	3
		-ed and disseminated galena (75-76 metres).		27655	77	79	2	64	560	4160	3
		Vughs through breccia infilled or lined with		27656	79	80	1	745	430	1720	3
		siderite and or ankerite. Trace to minor pyrite.		27657	80	81	1	120	1230	3210	2
		Core very broken & rubbly - recovery ≃ 85%.		27658	81	82	1	4	180	980	1
		Massive, fractured siderite from 79.7 to 80.4 m.		27659	82	84	2	6	135	220	<1
				27660	84	85	1	2	24	120	<1
80.4	100.0	ANKERITIC DOLOMITE: Grey, massive, ankerite		27661	85	86	1	4	28	160	<1
		veinleted, in part brecciated dolomite. Coarsely		·	86	88	2	NO CORE - CAVITY			
		crystalline white to cream ankerite crystals		27662	88	90	2	4	40	180	<1
		comprise most of rock cemented in a grey/black		27663	90	91	1	4	70	50	<1
		dolomitic matrix. Ground badly broken with			91	95	4	NO CORE RECOVERY.			
		intervening soft clayey intervals. LITTLE TO NO CORE		27664	95	96	1	6	85	1750	<1
		RECOVERY from 86.3 to 88.0, 89.5 to 90.0 & 91-94		27665	96	97	1	4	34	610	<1
		metres.		27666	97	98	1	4	65	1950	<1
				27667	98	100	2	4	36	420	1
100.0	121.4	SANDSTONE: Micaceous, weakly ankerite/siderite		27668	100	101	1	8	50	165	<1
		veinleted, brecciated, grey, fine to medium		27669	101	102	1	8	28	165	<1
		grained sandstone containing thin interbeds of		27670	102	103	1	8	20	195	<1
		cw clayeyer material. Core badly broken with		27671	103	104	1	8	22	250	<1
		recoveries ≠ 100%. Some mottled yellow and grey		27672	104	105	1	8	18	210	<1
		clays suggest a brecciated texture at 110m.		27683	105	106	1	6	18	195	<1
		Possible bedding 116m - 20° to c.a.		27684	106	107	1	8	14	145	<1
				27685	107	108	1	8	20	175	<1
121.4	123.9	ANKERITIC DOLOMITE: Yellow, olive grey, massive,		27686	108	109	1	8	18	280	<1
		very dense, vughy, pyritic and very weathered		27687	109	110	1	10	12	44	1
		clayey ankeritic dolomite.		27688	110	111	1	8	10	22	<1
				27689	111	112	1	8	8	20	<1
				27690	112	113	1	8	10	20	<1
				27691	113	114	1	6	12	26	<1

DRILL LOG HOLE No. ZT-80-8

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag
123.9	127.0	DOLOMITE BRECCIA: Black and mottled, CW		27692	114	115	1	6	28	48	< 1
		massive, fat clays; calcite, ankerite veinleted,		27693	115	116	1	8	24	75	< 1
		sulphide smelling (None visible!). Weathered breccia?		27694	116	117	1	8	26	100	< 1
				27695	117	118	1	10	30	680	< 1
127.0	133.0	SANDSTONE: Completely weathered, micaceous,		27696	118	119	1	12	20	320	< 1
		grey, massive fat clays – after a fine grained		27697	119	120	1	8	14	26	< 1
		sandstone?		27698	120	121	1	8	14	185	< 1
				27699	121	122	1	6	10	180	< 1
133.0	147.0	SANDSTONE / SILTSTONE: Very weathered, &		27 700	122	123	1	8	18	55	< 1
		broken, clayey, laminar in part, micaceous fine		27673	123	124	1	52	50	65	1
		sandstones and siltstones weakly ankerite		27674	124	125	1	30	40	620	2
		veined. Minor sulphosalts present on core after		27675	125	126	1	24	60	805	33
		decomposing sulphides? Bedding 135.5 - 38° to c.a.		27676	126	127	1	35	78	655	< 1
				27701	127	128	1	10	20	100	< 1
147.0	166.80	BLACK CLAY: (DOLOMITE ??) Massive, dark		27702	128	129	1	8	16	48	< 1
		grey to black, fat silty clays. Clays show		27703	129	130	1	8	14	26	< 1
		relict brecciation textures from 163.90 m and		27704	130	131	1	8	20	24	< 1
		have relict ankerite/siderite and quartz		27705	131	132	1	8	30	30	< 1
		fragments incorporated in the clay matrix.		27706	132	133	1	8	16	36	< 1
		Minor sphalerite occurs as disseminations and		27707	133	134	1	10	10	30	< 1
		blebs of dark red sphalerite crystals from		27708	134	135	1	10	8	36	< 1
		165.5 to 166.90 m. Associated minor galena		27709	135	136	1	8	6	22	< 1
		and pyrite occurs in conjunction with the		27710	136	137	1	8	12	16	< 1
		sphalerite.		27711	137	138	1	8	16	24	< 1
		Cavities from 161.0 – 163.50 + from 166.8 - 169.5 m.		27712	138	139	1	6	10	90	< 1
166.8	169.5	CAVITY: 2.7 m wide, minor clay infilling?		27713	139	140	1	10	12	28	2
				27714	140	141	1	8	14	115	1
169.5	184.5	SEDIMENTARY SANDSTONE BRECCIA: Rounded to		27715	141	142	1	10	14	46	1
		ellipsoidal, light grey, medium grained quartzose		27716	142	143	1	8	14	16	1
		sandstone fragments cemented in a dark grey,		27717	143	144	1	10	14	16	1
		silty foliated matrix. Weakly quartz carbonate		27718	144	145	1	8	12	24	1
		veined. Core extensively shattered with minor		27719	145	146	2	10	12	26	1
		clay zones. Recovery ≈ 100 %.			146	147					
				27720	147	148	1	10	20	230	1
184.5	200.5	SANDSTONE: Well bedded, laminar in part, fine		27721	148	149	1	8	26	115	<1
		grained to coarse grained interbedded fawn +		27722	149	150	1	8	32	160	1
		light grey to grey quartzose sandstones. Grey		27723	150	151	1	16	200	940	1
		beds generally foliated and micaceous siltstones.		27724	151	152	1	12	75	510	1
		CON'T OVER		27725	152	153	1	10	28	470	<1

93200

201

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	Length	ASSAYS Cu	Pb	Zn	Ag		
184.5	200.5	SANDSTONE: CON'T. – Some cleavage faces		27726	153	154	1	8	40	560	1		
		coated with chloritic and carbonaceous		27727	154	155	1	10	100	1750	<1		
		material. Bedding is soft sediment slumped		27728	155	156	1	14	95	2400	1		
		in part, possibly load casted, with numerous		27729	156	157	1	18	105	320	1		
		flame structures prevalent. (bedding younging		27730	157	158	1	18	100	310	1		
		up the hole?)		27731	158	159	1	18	135	550	1		
		Bedding: 191m - 15° to ca; 199.5 22° to ca.		27677	159	160	1	37	250	1380	<1		
				27678	160	161	1	117	3370	3.02%	7		
200.5	211.7	BRECCIATED INTERBEDDED SHALE / SANDSTONE:			161	163	2	CAVITY - NO CORE RECOVERY					
		Grey, clayey, fissile shales rhythmically		27679	163	164	1	75	870	1.66%	4		
		interbedded with white to cream micaceous		27680	164	165	1	165	1580	1.79%	8		
		medium grained sandstones. Core badly		27681	165	166	1	1250	8350	4.40%	52		
		brecciated with bedding being very contorted.		27682	166	167	1	310	2.56%	11.00%	25		
		Minor calcite and quartz infilling. Breccia		27732	167	170	3	CAVITY - NO CORE RECOVERY					
		fragments very angular. Bedding: 209.5 - 15° to ca.		27733	170	171	1	40	3900	1.15%	6		
				27734	171	172	1	36	500	1800	4		
211.7	214.80	SEDIMENTARY SANDSTONE BRECCIA: Massive,		27735	172	173	1	8	560	2500	4		
		grey green, weakly quartz veined, pelletal		27736	173	174	3	16	470	1550	2		
		sandstone sedimentary breccia. All fragments			174	175							
		sub rounded to very rounded light cream /			175	176							
		green coarse grained sandstone cemented in		27737	176	177	1	10	680	1900	2		
		a grey silty micaceous matrix. Fragments											
		generally 0.5 to 1cm in width with minor		27738	177	180	3	22	2000	3700	4		
		larger pieces. Minor crystalline quartz in		27739	180	181	1	34	970	4600	6		
		vughs and fractures.		27740	181	182	1	22	250	800	3		
				27741	182	183	1	10	400	1800	1		
214.8	228.6	LAMINAR SILTSTONE / SANSTONE: Buff, olive		27742	183	184	1	18	180	780	2		
		micaceous siltstone rhythmically interbedded with		27743	184	185	1	18	95	660	2		
		cream coloured coarse grained micaceous		27744	185	186	1	55	70	570	2		
		sandstones. Bedding: 215m - 15° to c.a.; 221.0 m -		27745	186	187	1	30	70	590	2		
		20° to ca; 227 m - 20° to c.a.		27746	187	188	1	30	90	420	2		
				27747	188	189	1	22	70	350	2		
END OF HOLE.				27748	189	190	1	70	65	650	2		
				27749	190	191	1	26	140	1100	3		
				27750	191	192	1	28	120	1350	3		
				29702	192	193	1	24	55	630	1		
				29703	193	194	2	24	34	260	1		
					194	195							
				29704	195	196	1	16	50	620	<1		

93201

DRILL LOG HOLE No. ZT-80-8

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	ASSAYS Cu	ASSAYS Pb	ASSAYS Zn	ASSAYS Ag
				29705	196	197	1	20	50	730	1
				29706	197	198	1	20	55	550	1
				29707	198	199	1	34	36	320	1
				29708	199	200	1	36	18	230	1
				29709	200	201	1	36	18	980	1
				29710	201	202	1	50	12	470	1
				29711	202	203	1	85	75	1150	2
				29712	203	204	1	32	34	1050	1
				29713	204	205	1	46	38	920	1
				29714	205	206	1	50	46	750	2
				29715	206	207	1	70	30	620	1
				29716	207	208	1	55	65	850	1
				29717	208	209	1	34	80	760	1
				29718	209	210	1	22	140	750	2
				29719	210	211	1	28	340	2200	2
				29720	211	212	1	48	230	1450	2
				29721	212	213	1	120	105	490	1
				29722	213	214	1	24	85	420	2
				29723	214	215	1	16	155	320	4
				29724	215	216	1	16	260	380	1
				29725	216	217	1	14	900	2600	1
				29726	217	218	1	10	200	500	1
				29727	218	219	1	8	280	360	1
				29728	219	220	1	6	150	260	1
				29729	220	221	1	8	90	210	1
				29730	221	222	1	8	230	300	1
				29731	222	223	1	6	220	280	1
				29732	223	224	1	10	175	200	1
				29733	224	225	1	8	220	260	1
				29734	225	226	1	8	230	340	1
				29735	226	227	1	8	230	290	1
				29736	227	228	2	60	200	410	3
					228	229					
				END OF HOLE							

OCEANA PROSPECT

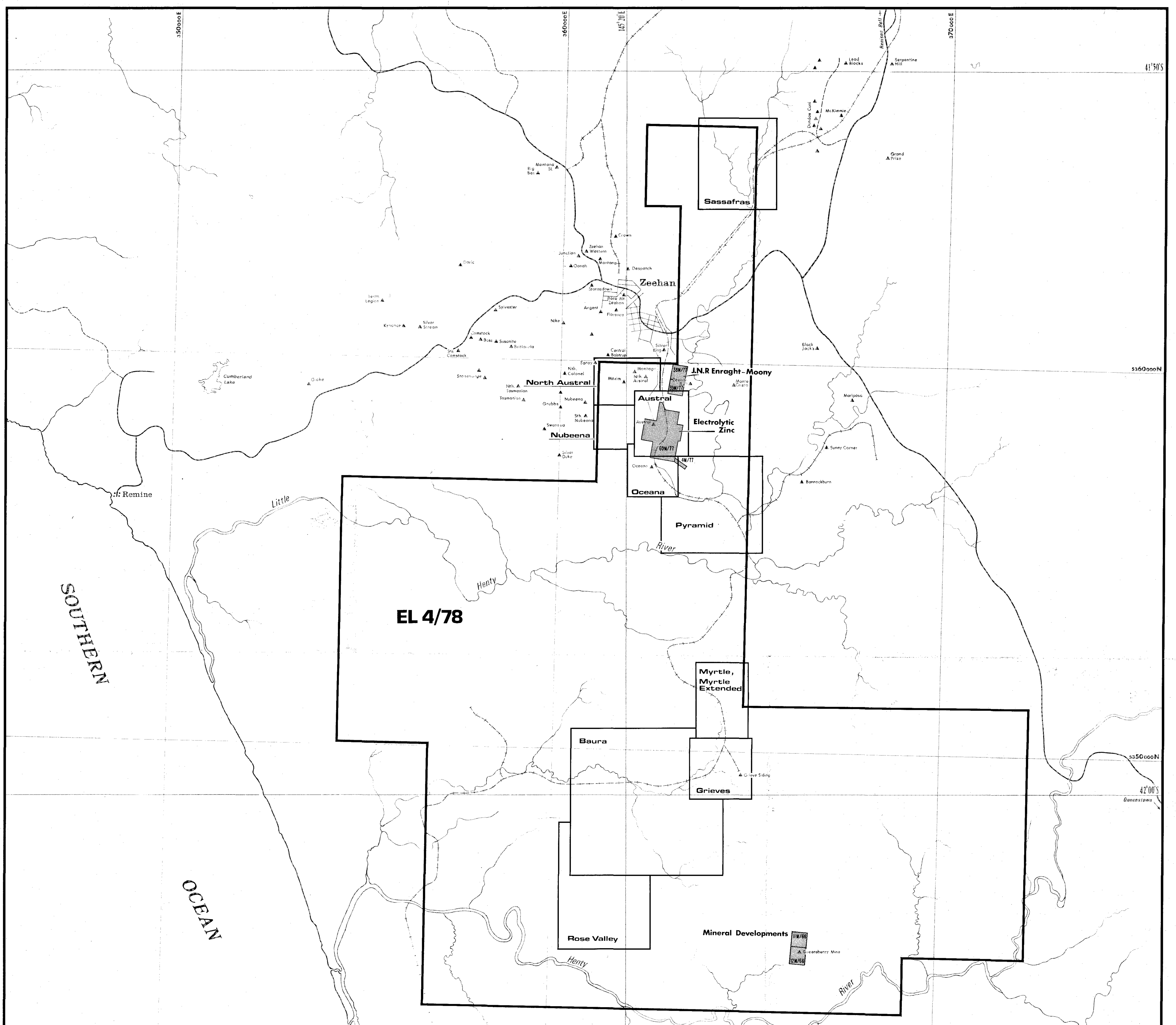
DRILLHOLE DATA

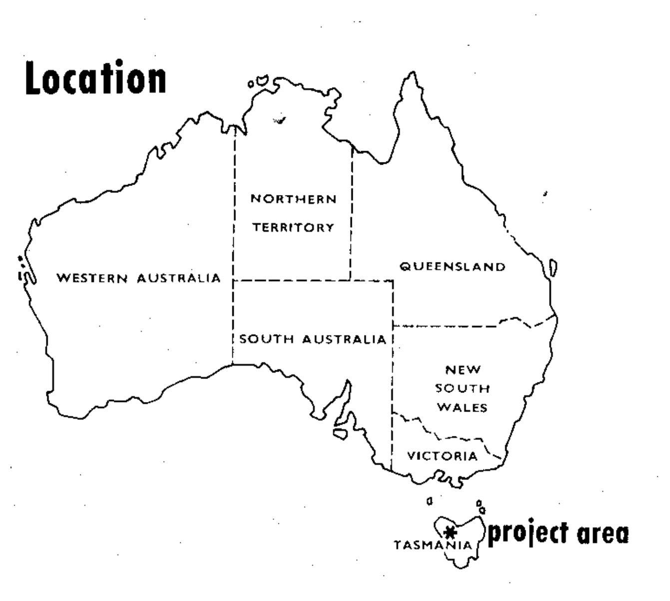
ZT-80-9

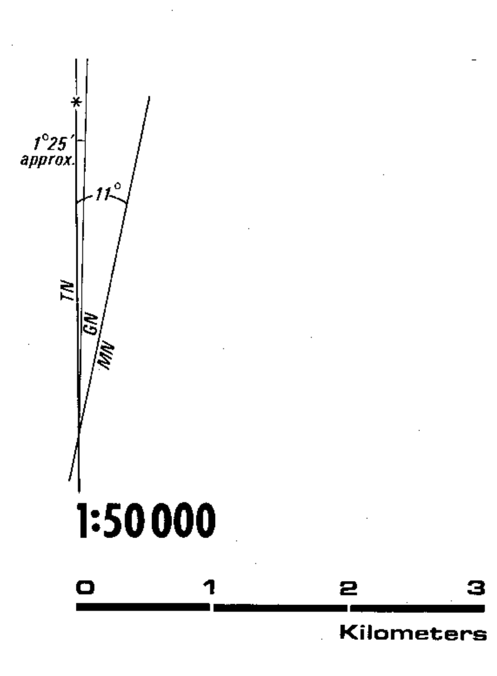
Location	:	3700N : 1575E
Declination	:	55°
Azimuth	:	217°T
Total Depth	:	228.6 meters

Assay Results

1- 24= 23m @ 2.82% Pb + 2.12% Zn + 9.9g/t Ag
incl
4- 9= 5m @ 7.30% Pb + 1.88% Zn + 16.8g/t Ag
120-186= 66m @ 2.45% Pb + 0.82% Zn + 12.5g/t Ag
incl
148-162= 14m @ 3.25% Pb, 0.4% Zn + 8.7g/t Ag
172-186= 14m @ 5.80% Pb + 1.28% Zn + 21.7g/t Ag
incl
182-186= 4m @ 12.95% Pb + 3.09% Zn + 76.0g/t Ag







Compiled from enlargement of Zeehan 1:63360 scale and Strahan 1:50000 scale geologic maps.
Transverse Mercator Projection

Amoco Minerals Australia Company

934204

Project	ZEEHAN	№ A·78·60
Project Partner		

Zeehan EL 4/78

PROSPECT LOCATION

Map Ref. ANG	K-55-5	Latitude 42°00'S	Longitude 145°20'E
Surveyed		Date	Scale 1:50000
Drawn	S.F., R. Smyth-King	Date August 1981	Drawing № M80-1476

Report 249

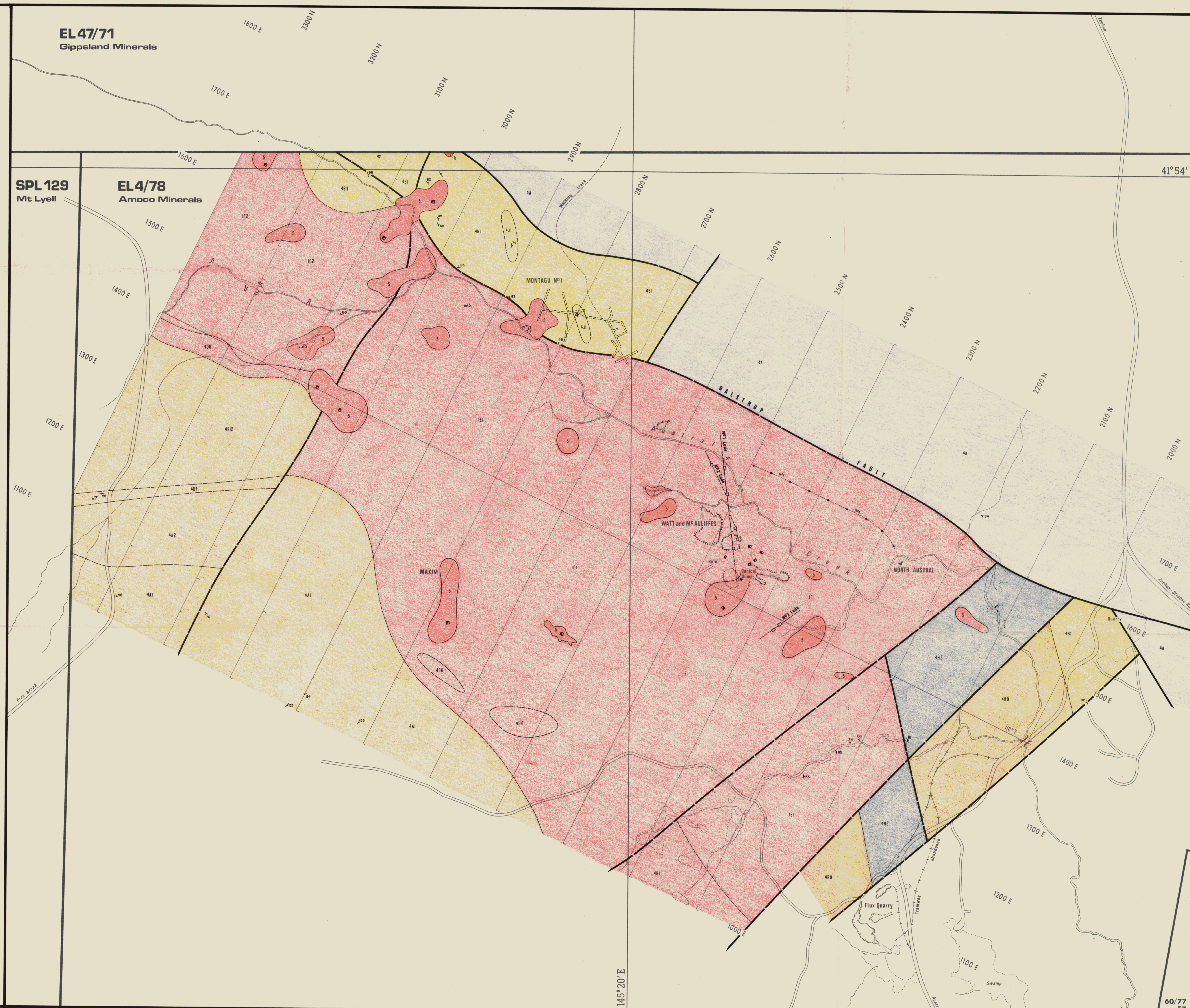
5 cm

2941

Enclosure 1

Legend

QUATERNARY		
Alluvium etc	GR	
TERTIARY		
Basalt	2C	2
DEVONIAN		
Florence Quartzite	4A	26
Undifferentiated quartzites, sandstones, siltstones		
SILURIAN		
Amber Slate	4D1	68
Siltstone interbedded with shales		
Crotty Quartzite		
Undiff. sandstones, siltstones and grits	4B1	6
Sandstone, massive	4B2	6
Sandstone, cross bedded	4B3	9
Sandstone, tubicolar	4B4	44
Sandstone, white, friable	4B5	6
Siltstone	4D2	57
Conglomerate	4I1	6
Grits	4J1	6
ORDOVICIAN		
Gordon Limestone		
Sandstone	4B6	63
Sandstone, fossiliferous	4B7	63
Sandstone breccia	4B8	63
Siltstone	4D3	63
Shale	4E1	63
Claystone	4F	63
Limestone	4G1	33
Limestone, fossil breccia	4G2	46
Limestone, slumped	4G3	41
Dolomite, black	4H1	35
Dolomite breccia	4H2	35
Dolomite, silicified	4H3	35
Conglomerate	4I2	66
Ironstone	5	14
Mineralization	5I	12
Moina Formation		
Sandstone, tubicolar	4B9	10
Sandstone	4B10	64
Undifferentiated	4D4	64
Siltstone, tubicolar	4D6	64
Dolomite	4H4	64
Conglomerate	4I3	64
Grit	4J2	64
Ironstone	5	14
Mt. Zeehan Conglomerate		
Conglomerate	4I4	58
CAMBRIAN		
Crimson Creek Formation		
Undifferentiated	1E 7	20
Tuff, volcano lith-arenite	1E 2	20
Sandstone-tuff	4B 11	20
Shale	4E 2	20
Ironstone	5	14
Siltstone	4D6	20
PRECAMBRIAN		
Oonah Quartzite		
Undifferentiated	4A1	60
Micaceous quartzite	4A2	60
Sandstone, brown	4B12	60
Siltstone	4D7	60



Location

Symbols

- Geologic contact, position accurate
- Geologic contact, position approximate
- Fault, position accurate
- Fault, position approximate
- Fault, inferred
- Unconformity
- Facies change
- Shear zone
- Zone of intense cleavage
- Brecciation
- Overturned bedding
- Measured dip and strike
- Plunging anticline (minor)
- Quartz vein
- Outcropping Pb/Zn mineralization
- Shaft/prospecting pit
- Adit
- Underground workings
- Costean
- Cutting or quarry
- Dump
- Amoco rock chip location
- Amoco costean
- Amoco drillhole

TN 11° MN

1:2500

0 100 200 meters

5 cm

Amoco Minerals Australia Company

934205

Project	ZEEHAN		Nº A-78-60B		
Project Partner					
North Austral FACTUAL **GEOLOGY**					
Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145°20'E
Surveyed	P. Jones	Date	1981	Scale	1:2500
Drawn	R. SK	Date	1981	Drawing Nº	M81-1727

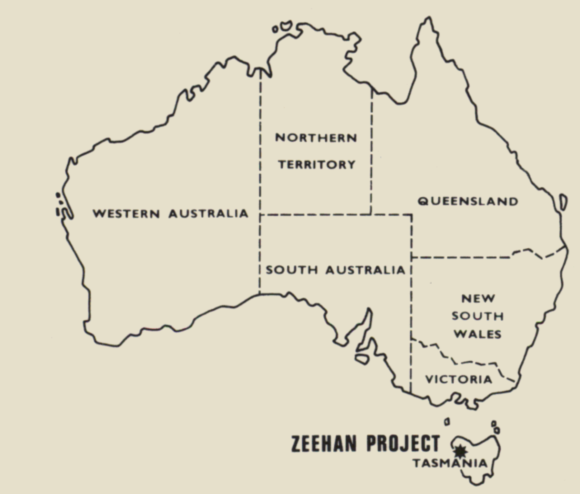
60/77 EZ

Report 249

2942

Enclosure 2

Location



Notes

Computer graphics by CEA, North Sydney

Contour Intervals

70
100
200

Values in ppm

1:2500

0 100 200 meters

5 cm

Amoco Minerals Australia Company

934206

Project	ZEEHAN			Nº A·78·60B	
Project Partner					
North Austral SOIL GEOCHEMISTRY **COPPER**					
Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145° 20' E
Surveyed	P. Jones	Date	1981	Scale	1:2500
Drawn	R. SK	Date	1981	Drawing Nº	M81-1715

60/77 EZ

Report 249

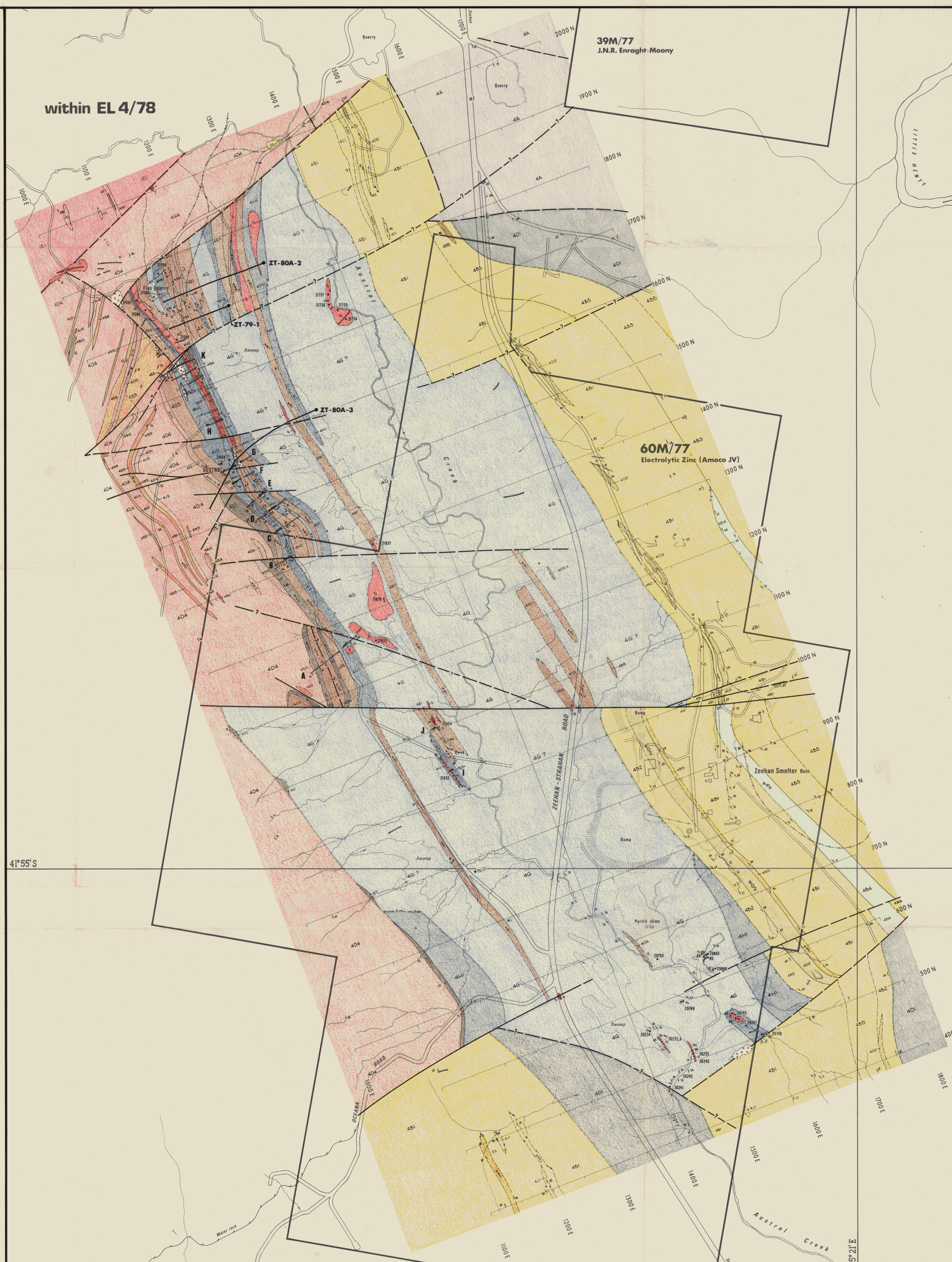
2943

Enclosure 3

2944 Enclosure 4

2945 Enclosure 5

2946 Enclosure 6



Legend

QUATERNARY

Alluvium etc	GR	

TERTIARY

Basalt	2C	2

DEVONIAN

Florence Quartzite

Undifferentiated quartzites, sandstones, siltstones	4A	26

SILURIAN

Amber Slate

Siltstone interbedded with shales	4D1	68

Crotty Quartzite

Undiff. sandstones, siltstones and grits	4B1	6
Sandstone, massive	4B2	6
Sandstone, cross bedded	4B3	9
Sandstone, tubicolar	4B4	44
Sandstone, white, friable	4B5	6
Siltstone	4D2	57
Conglomerate	4I1	6
Grits	4J1	6

ORDOVICIAN

Gordon Limestone

Sandstone	4B6	63
Sandstone, fossiliferous	4B7	63
Sandstone breccia	4B8	63
Siltstone	4D3	63
Shale	4E1	63
Claystone	4F	63
Limestone	4G1	33
Limestone, fossil breccia	4G2	46
Limestone, slumped	4G3	41
Dolomite, black	4H1	35
Dolomite breccia	4H2	35
Dolomite, silicified	4H3	35
Conglomerate	4I2	66
Ironstone	5	14
Mineralization	5I	12

Moina Formation

Sandstone, tubicolar	4B9	10
Sandstone	4B10	64
Undifferentiated	4D4	64
Siltstone, tubicolar	4D6	64
Dolomite	4H4	64
Conglomerate	4I3	64
Grit	4J2	64
Ironstone	5	14

Mt. Zeehan Conglomerate

Conglomerate	4I4	58

CAMBRIAN

Crimson Creek Formation

Undifferentiated	1E 7	20
Tuff, volcano lith-arenite	1E 2	20
Sandstone-tuff	4B 11	20
Shale	4E 2	20
Ironstone	5	14
Siltstone	4D6	20

PRECAMBRIAN

Oonah Quartzite

Undifferentiated	4A1	60
Micaceous quartzite	4A2	60
Sandstone, brown	4B12	60
Siltstone	4D7	60

Location

Symbols

- Geologic contact, position accurate
- Geologic contact, position approximate
- Fault, position accurate
- Fault, position approximate
- Fault, inferred
- Unconformity
- Facies change
- Shear zone
- Zone of intense cleavage
- Brecciation
- Overturned bedding
- Measured dip and strike
- Plunging anticline (minor)
- Quartz vein
- Outcropping Pb/Zn mineralization
- Shaft/prospecting pit
- Adit
- Underground workings
- Costean
- Cutting or quarry
- Dump
- Amoco rock chip location
- Amoco costean
- Amoco drillhole

TN MN 11°

1:2500

0 100 200 meters

5 cm

Amoco Minerals Australia Company

934210

Project	ZEEHAN		Nº A·78·60B
Project Partner			

Austral

FACTUAL GEOLOGY showing rockchip locations

Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145°20'E
Surveyed	P. Jones	Date	1981	Scale	1:2500
Drawn	S. Fowler	Date	1981	Drawing Nº	M81-1725

Report 249

2947

Enclosure 7

Legend

QUATERNARY

Alluvium etc	GR

TERTIARY

Basalt	2C

DEVONIAN

Florence Quartzite

Undifferentiated quartzites, sandstones, siltstones	4A

SILURIAN

Amber Slate

Siltstone interbedded with shales	4D1

Crotty Quartzite

Undiff. sandstones, siltstones and grits	4B1
Sandstone, massive	4B2
Sandstone, cross bedded	4B3
Sandstone, tubicolar	4B4
Sandstone, white, friable	4B5
Siltstone	4D2
Conglomerate	4I1
Grits	4J1

ORDOVICIAN

Gordon Limestone

Sandstone	4B6
Sandstone, fossiliferous	4B7
Sandstone breccia	4B8
Siltstone	4D3
Shale	4E1
Claystone	4F
Limestone	4G1
Limestone, fossil breccia	4G2
Limestone, slumped	4G3
Dolomite, black	4H1
Dolomite breccia	4H2
Dolomite, silicified	4H3
Conglomerate	4I2
Ironstone	5
Mineralization	5'

Moina Formation

Sandstone, tubicolar	4B9
Sandstone	4B10
Undifferentiated	4D4
Siltstone, tubicolar	4D6
Dolomite	4H4
Conglomerate	4I3
Grit	4J2
Ironstone	5

Mt. Zeehan Conglomerate

Conglomerate	4I4

CAMBRIAN

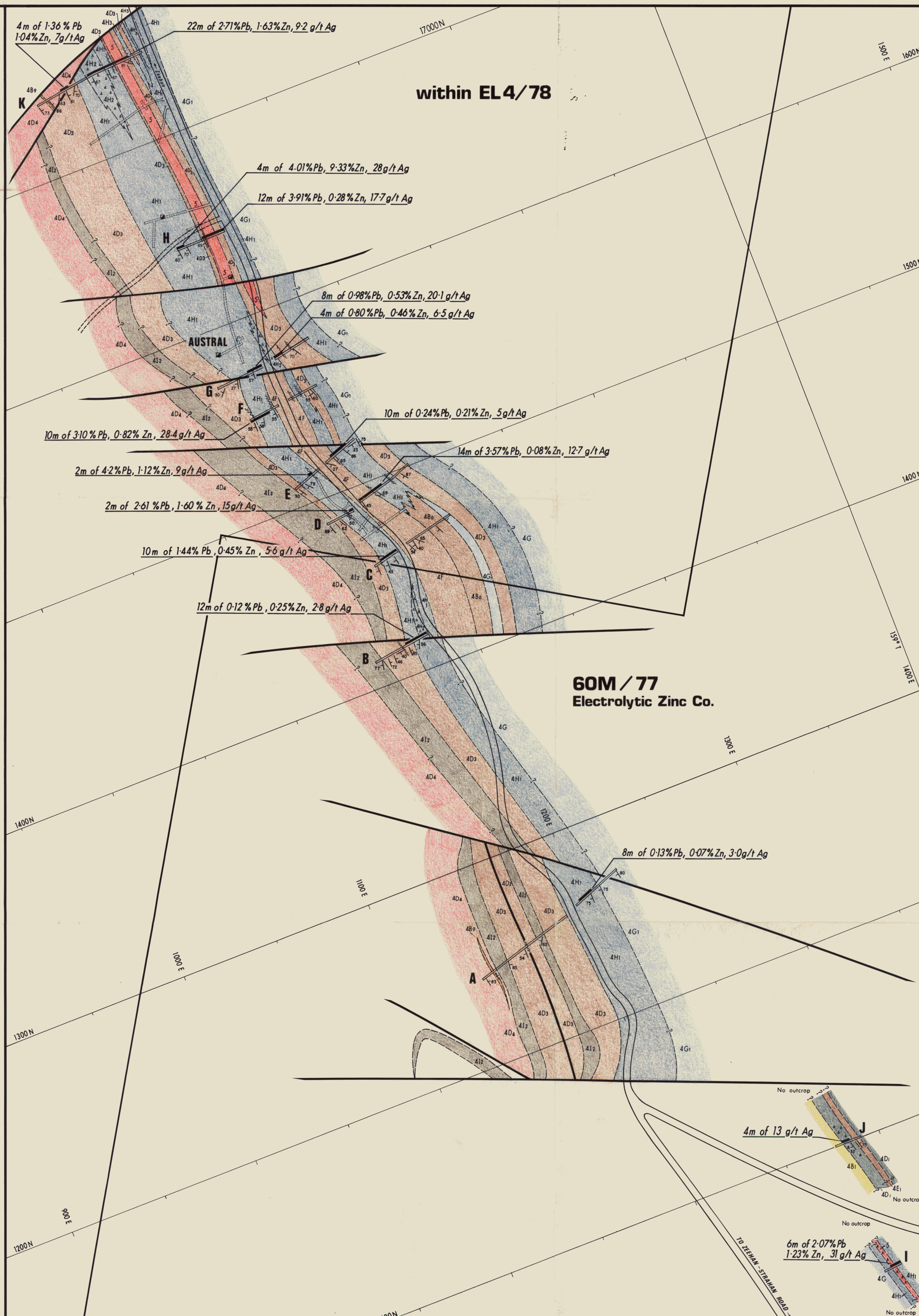
Crimson Creek Formation

Undifferentiated	1E 7
Tuff, volcano lith-arenite	1E 2
Sandstone-tuff	4B 11
Shale	4E 2
Ironstone	5
Siltstone	4D6

PRECAMBRIAN

Oonah Quartzite

Undifferentiated	4A1
Micaceous quartzite	4A2
Sandstone, brown	4B12
Siltstone	4D7



Location

Symbols

- Geologic contact, position accurate
- Geologic contact, position approximate
- Fault, position accurate
- Fault, position approximate
- Fault, inferred
- Unconformity
- Facies change
- Shear zone
- Zone of intense cleavage
- Brecciation
- Overturned bedding
- Measured dip and strike
- Plunging anticline (minor)
- Quartz vein
- Outcropping Pb/Zn mineralization
- Shaft/prospecting pit
- Adit
- Underground workings
- Costean
- Cutting or quarry
- Dump
- Amoco rock chip location
- Amoco costean
- Amoco drillhole

1:1000

5 cm

Amoco Minerals Australia Company

934211

Project	ZEEHAN	Nº A-78-60B
Project Partner		

Austral

COSTEANS Geology and geochemistry

Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145°20'E
Surveyed	P. Jones	Date	1981	Scale	1:1000
Drawn	Hovick	Date	1981	Drawing Nº	M81-1704

Report 249

2948

Enclosure 8

Location

Notes

Computer graphics by CEA, North Sydney

Contour Intervals

250
500
2500

Values in ppm

1:2500

Amoco Minerals Australia Company

934212

Project	ZEEHAN		Nº A-78-60B
Project Partner			

Austral

SOIL GEOCHEMISTRY
LEAD

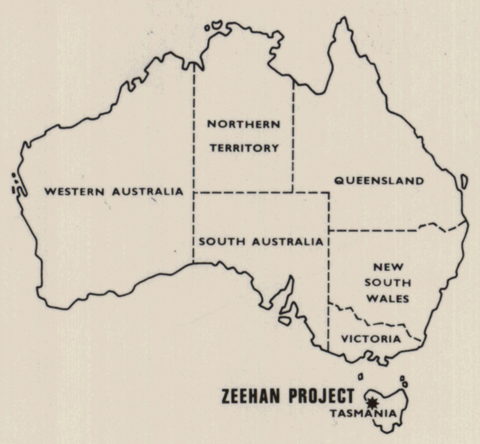
Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145° 20' E
Surveyed	P P P. Jones	Date	1981	Scale	1:2500
Drawn	S. Fowler	Date	1981	Drawing Nº	M81-1710

Report 249

2949

Enclosure 9

Location



Notes

Computer graphics by CEA, North Sydney

Contour Intervals

300
1000
3000

Values in ppm

1:2500

0 100 200 meters

5 cm

Amoco Minerals Australia Company

934213

Project	ZEEHAN		Nº A·78·60B
Project Partner			

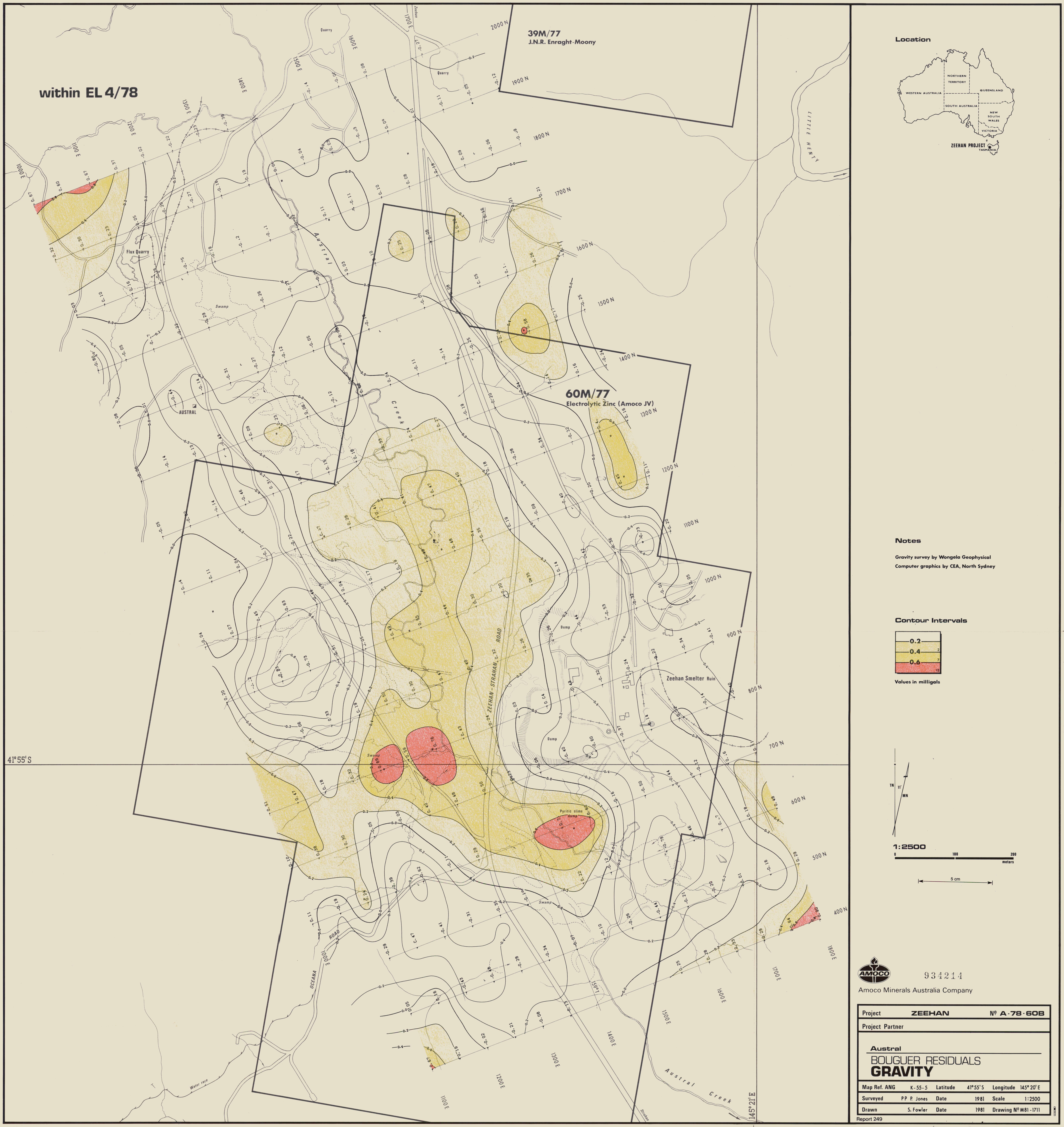
Austral

SOIL GEOCHEMISTRY
ZINC

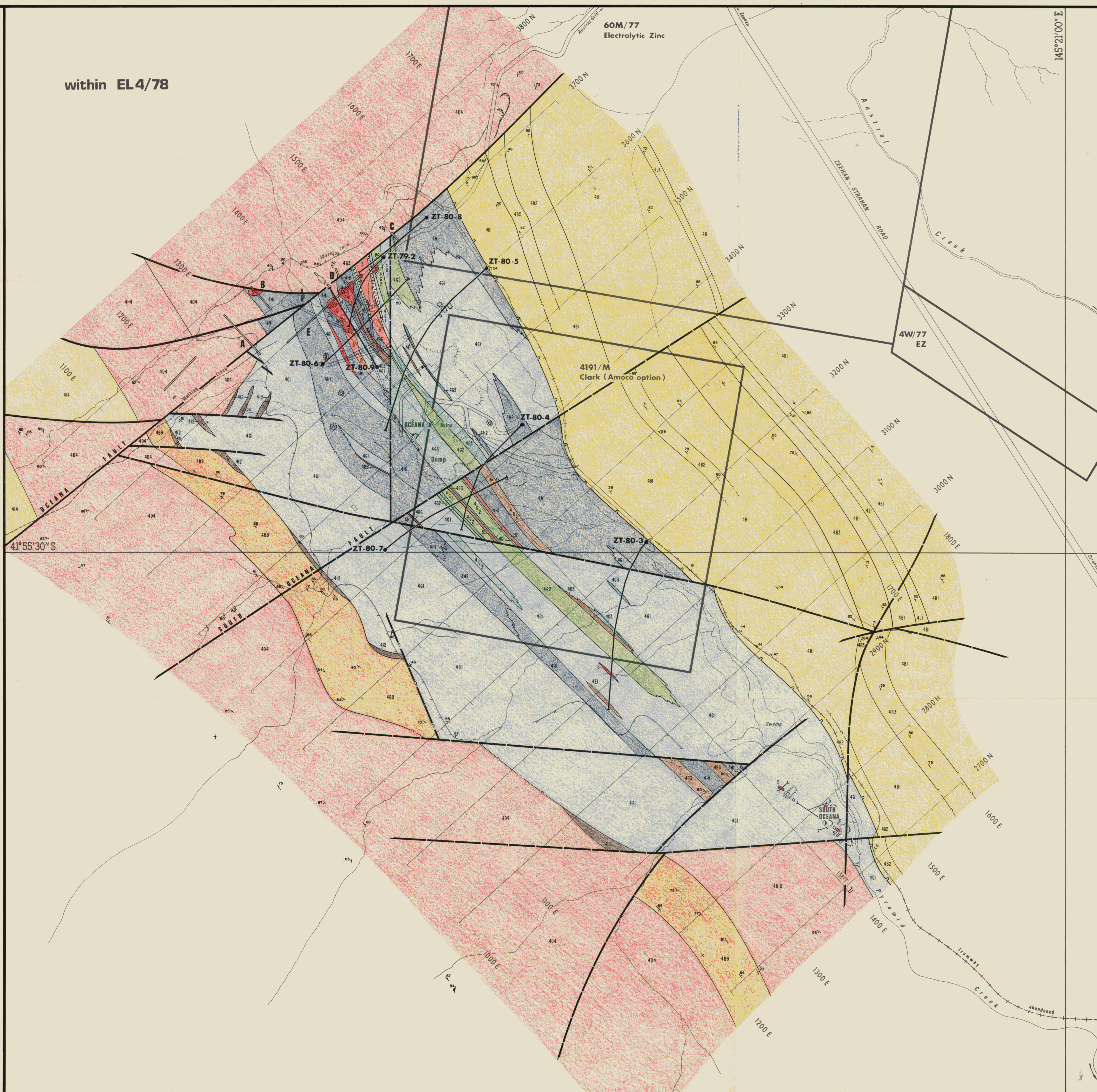
Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145°20'E
Surveyed	PP P. Jones	Date	1981	Scale	1:2500
Drawn	S. Fowler	Date	1981	Drawing Nº	M81-1712

Report 249

2950 Enclosure 10



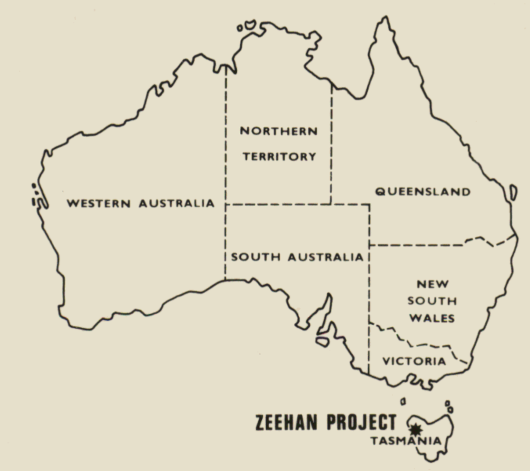
2951 Enclosure 11



Legend

QUATERNARY		
Alluvium etc	GR	
TERTIARY		
Basalt	2C	2
DEVONIAN		
Florence Quartzite	4A	26
Undifferentiated quartzites, sandstones, siltstones		
SILURIAN		
Amber Slate	4D1	68
Siltstone interbedded with shales		
Crotty Quartzite		
Undiff. sandstones, siltstones and grits	4B1	6
Sandstone, massive	4B2	6
Sandstone, cross bedded	4B3	9
Sandstone, tubicolar	4B4	44
Sandstone, white, friable	4B5	6
Siltstone	4D2	57
Conglomerate	4I1	6
Grits	4J1	6
ORDOVICIAN		
Gordon Limestone		
Sandstone	4B6	63
Sandstone, fossiliferous	4B7	63
Sandstone breccia	4B8	63
Siltstone	4D3	63
Shale	4E1	63
Claystone	4F	63
Limestone	4G1	33
Limestone, fossil breccia	4G2	46
Limestone, slumped	4G3	41
Dolomite, black	4H1	35
Dolomite breccia	4H2	35
Dolomite, silicified	4H3	35
Conglomerate	4I2	66
Ironstone	5	14
Mineralization	5ᴵ	12
Moina Formation		
Sandstone, tubicolar	4B9	10
Sandstone	4B10	64
Undifferentiated	4D4	64
Siltstone, tubicolar	4D6	64
Dolomite	4H4	64
Conglomerate	4I3	64
Grit	4J2	64
Ironstone	5	14
Mt. Zeehan Conglomerate		
Conglomerate	4I4	58
CAMBRIAN		
Crimson Creek Formation		
Undifferentiated	1E 7	20
Tuff, volcano lith-arenite	1E 2	20
Sandstone-tuff	4B 11	20
Shale	4E 2	20
Ironstone	5	14
Siltstone	4D6	20
PRECAMBRIAN		
Oonah Quartzite		
Undifferentiated	4A1	60
Micaceous quartzite	4A2	60
Sandstone, brown	4B12	60
Siltstone	4D7	60

Location



Symbols

- Geologic contact, position accurate
- Geologic contact, position approximate
- Fault, position accurate
- Fault, position approximate
- Fault, inferred
- Unconformity
- Facies change
- Shear zone
- Zone of intense cleavage
- Brecciation
- Overturned bedding
- Measured dip and strike
- Plunging anticline (minor)
- Quartz vein
- Outcropping Pb/Zn mineralization
- Shaft/prospecting pit
- Adit
- Underground workings
- Costean
- Cutting or quarry
- Dump
- Amoco rock chip location
- Amoco costean
- Amoco drillhole

TN 11° MN

1:2500

0 100 200 meters

5 cm

Amoco Minerals Australia Company

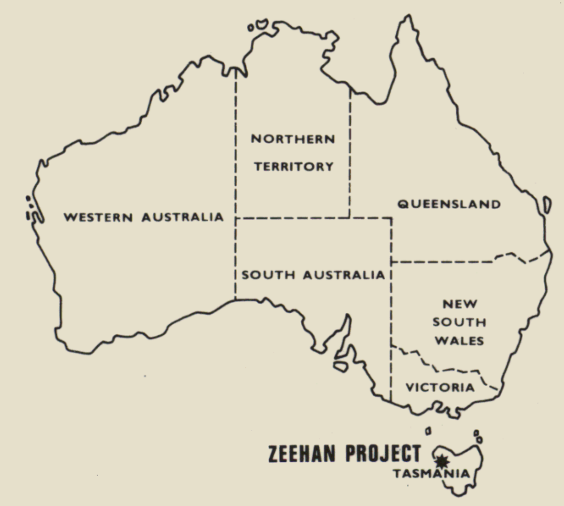
934215

Project	ZEEHAN			Nº A-78-60B	
Project Partner					
Oceana FACTUAL **GEOLOGY**					
Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145°20'E
Surveyed	P. Jones	Date	1981	Scale	1:2500
Drawn	R. SK	Date	1981	Drawing Nº	M81-1705

Report 249

2952 Enclosure 12

Location



Notes

Computer graphics by CEA, North Sydney

Contour Intervals

1000
2500
5000

Values in ppm

1:2500

0 100 200 meters

5 cm

Amoco Minerals Australia Company

934216

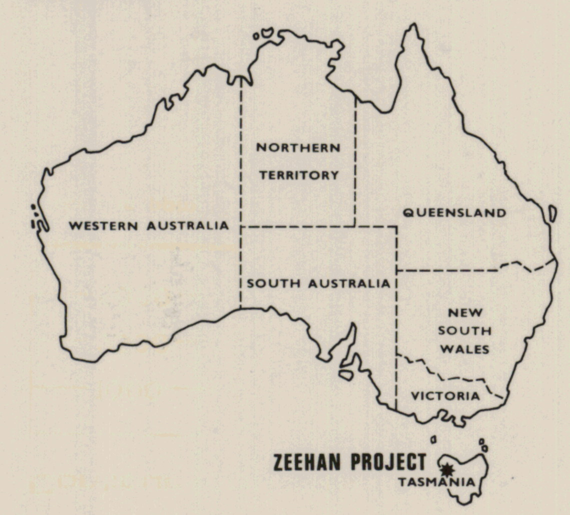
Project	ZEEHAN			Nº A-78-60B	
Project Partner					
Oceana SOIL GEOCHEMISTRY **LEAD**					
Map Ref. ANG	K-55-5	Latitude	41°55'S.	Longitude	145°20'E
Surveyed	P. Jones	Date	1981	Scale	1:2500
Drawn	R. SK	Date	1981	Drawing Nº	M81-1716

Report 249

2953

Enclosure 13

Location



Notes

Computer graphics by CEA, North Sydney

Contour Intervals

1000
2500
5000

Values in ppm

1:2500

0 100 200 meters

5 cm

Amoco Minerals Australia Company

934217

Project	ZEEHAN		Nº A·78·60B
Project Partner			

Oceana

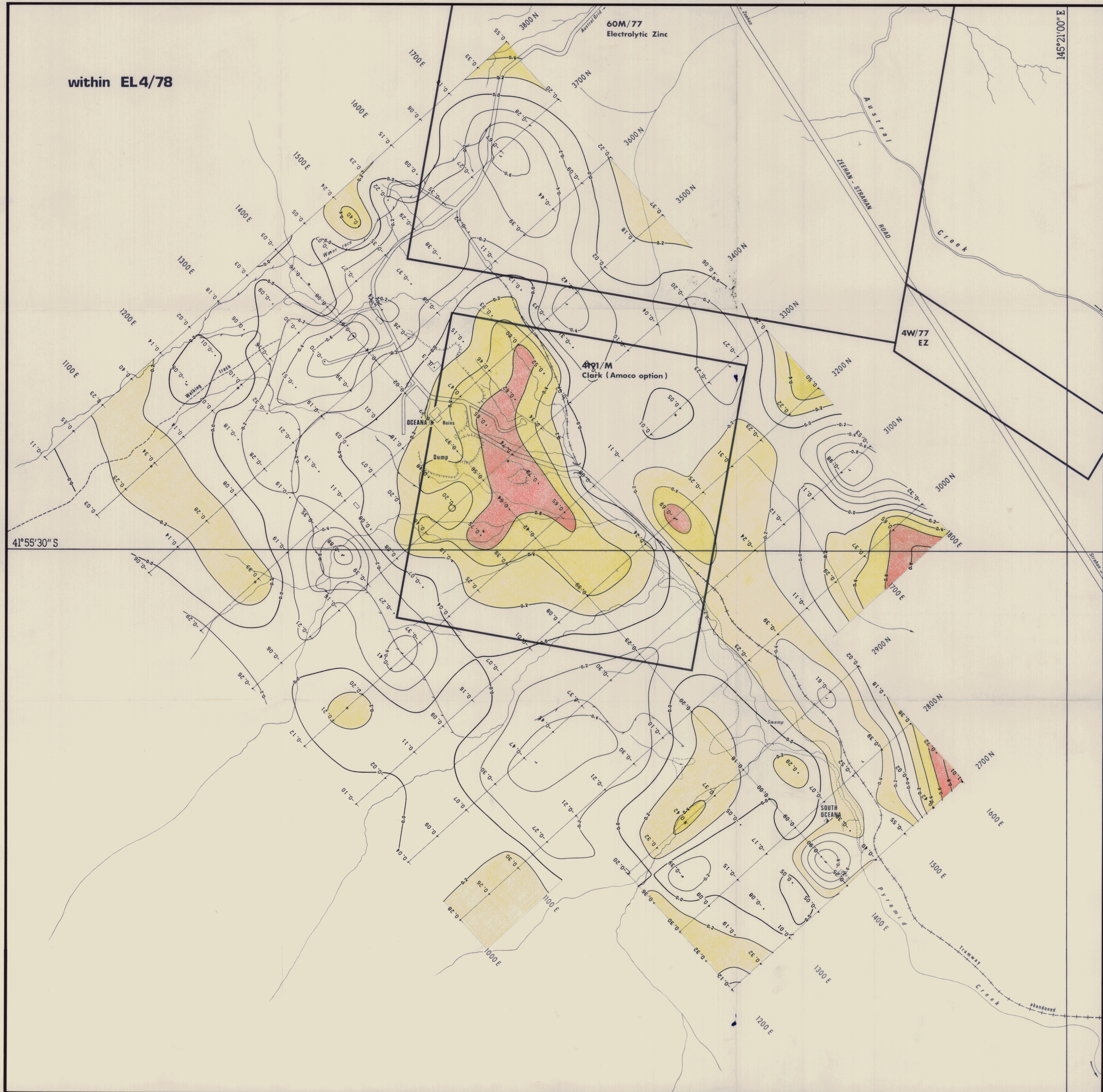
SOIL GEOCHEMISTRY
ZINC

Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145° 20' E
Surveyed	P. Jones	Date	1981	Scale	1:2500
Drawn	R. SK	Date	1981	Drawing Nº	M81-1717

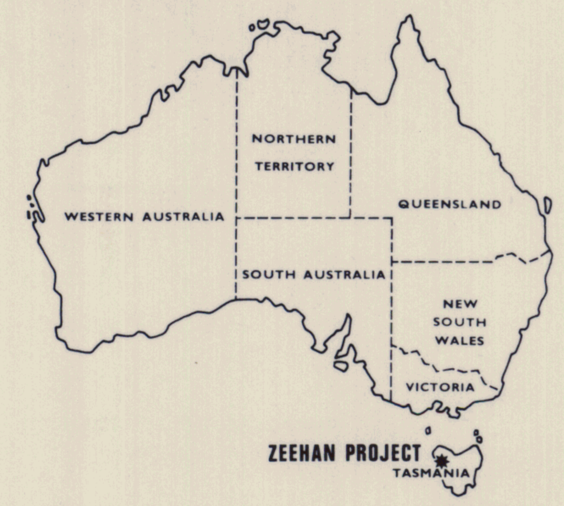
Report 249

2954

Enclosure 14



Location



Notes

Gravity survey by Wongela Geophysical
Computer graphics by CEA, North Sydney

Contour Intervals

0.2
0.4
0.6

Values in milligals

TN 11° MN

1:2500

0 100 200 meters

5 cm

Amoco Minerals Australia Company

934218

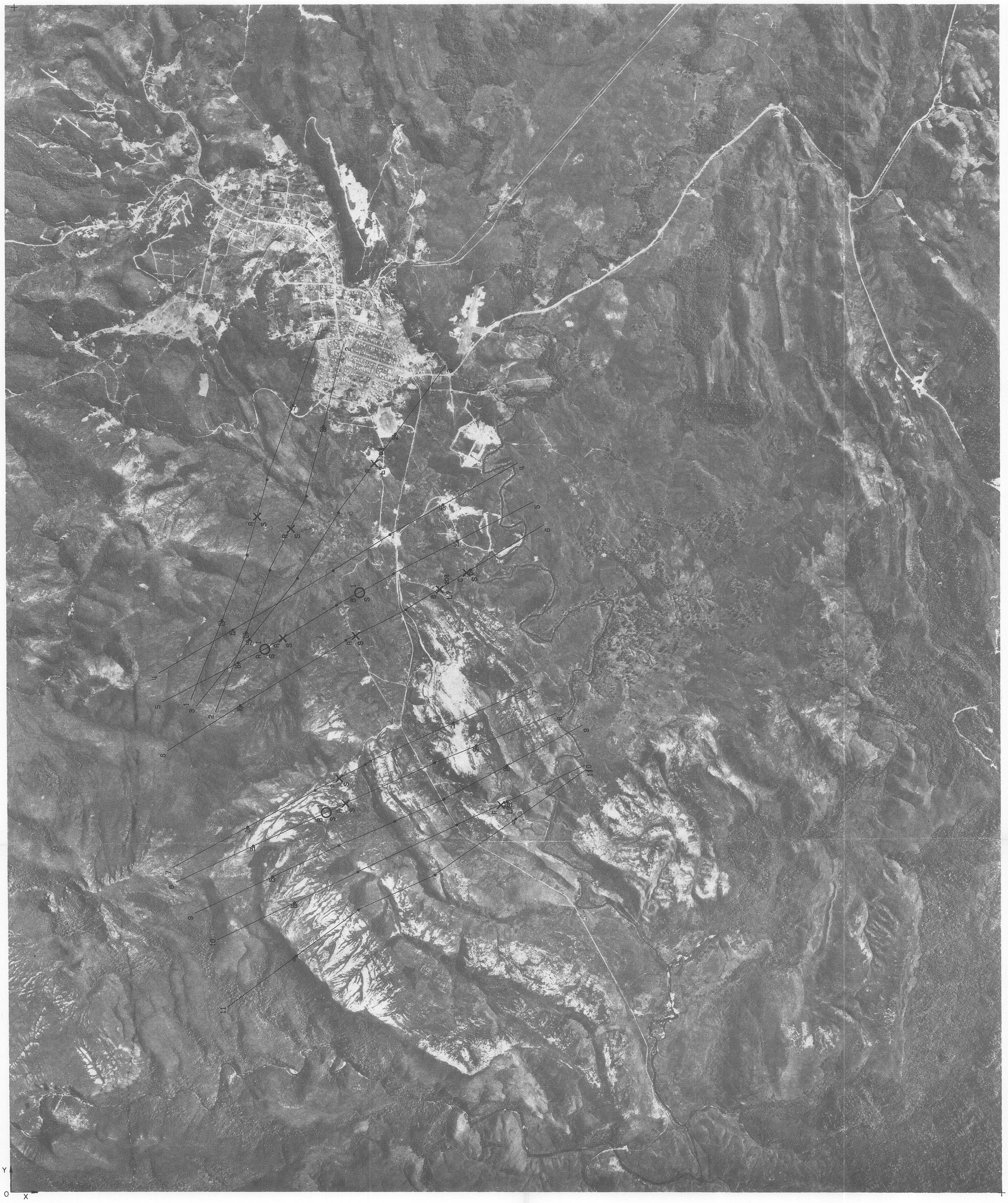
Project	ZEEHAN	Nº A-78-60B
Project Partner		

Oceana

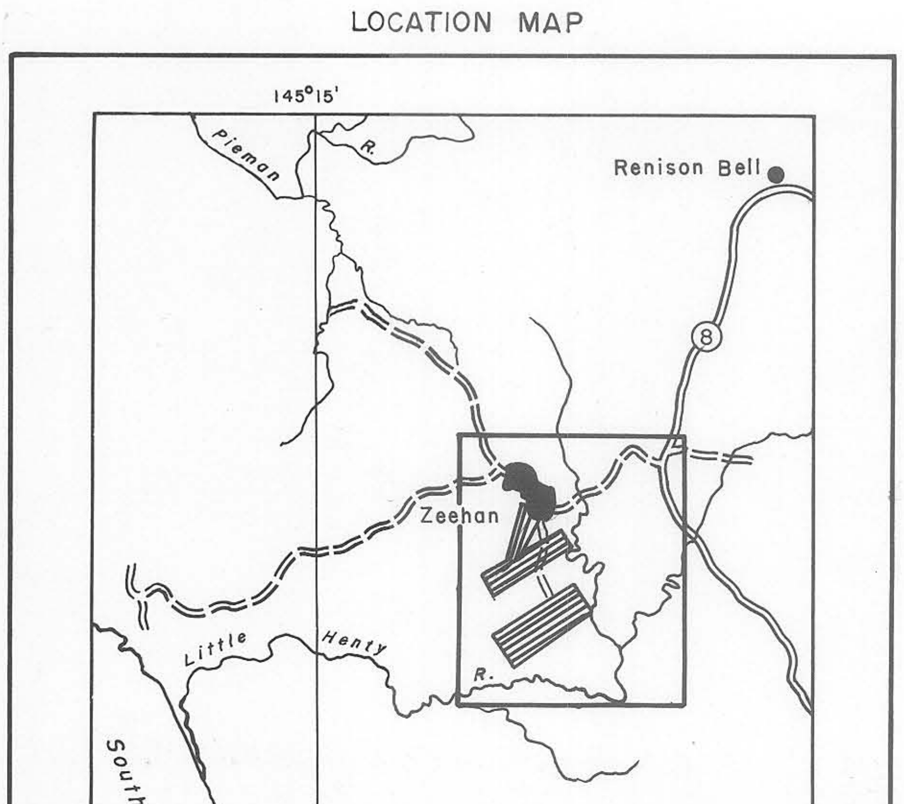
BOUGUER RESIDUALS
GRAVITY

Map Ref. ANG	K-55-5	Latitude	41°55'S	Longitude	145°20'E
Surveyed	P. Jones	Date	1981	Scale	1:2500
Drawn	R. SK	Date	1981	Drawing Nº	M81-1718

Report 249



LOCATION MAP



Scale 1:250,000

DIGHEM II SURVEY

ZEEHAN, TASMANIA

ELECTROMAGNETICS

FOR

AMOCO MINERALS AUSTRALIA COMPANY

Flight line

Fiducials and numbers

REGISTERED PROFESSIONAL ENGINEER
D. C. FRASER
PROVINCE OF ONTARIO

5 cm

SCALE 1:20,000

Kilometres

Miles

ANOMALY GRADE	EM GRADE SYMBOL	MHO RANGE
6	●	≥ 100
5	✸	50 — 99
4	●	20 — 49
3	◉	10 — 19
2	O	5 — 9
1	○	≤ 4
	×	Possible conductor

DIGHEM anomalies are divided into six grades of conductivity – thickness product. This product in mhos is the reciprocal of resistance in ohms. The mho is a measure of conductance, and is a geologic parameter. Most swamps yield Grade 1 anomalies but highly conducting clays can give Grade 2 anomalies. The multi-coil anomaly shapes often allow surface conductors to be recognized, and these are indicated by the letter S on this map. The remaining Grade 1 and 2 anomalies could be weak bedrock conductors. The higher grades indicate increasingly higher conductances. Examples: The ore bodies of the Magusi River camp yield Grade 4 anomalies, while Mattabi and Whistle give Grade 5. Graphite and sulphides can span all grades but, in this survey area, field work may show that the different grades indicate different types of conductors.

identifier → c 38 ← mho value

Depth is greater than
. 50 feet
: 100 feet
⁝ 150 feet
⁞ 200 feet

Inphase and Quadrature of Standard coil is greater than
. 5 ppm
.. 10 ppm
... 15 ppm
.... 20 ppm

Refer to list of anomalies in survey report for the actual ppm values for all coils, and for conductor depths.

The actual mho value is plotted beside the EM grade symbol. The letter is the anomaly identifier. The horizontal rows of dots indicate anomaly amplitude on the flight record, and the vertical column gives the estimated depth. This depth may be unreliable because the stronger part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or conductive overburden effects.

—	Conductor axis
S	Probable surface response
S?	Possible surface response
L	Probable line (power, telephone, pipe, or fence)
L?	Possible line
?	Questionable anomaly
O	Apparent thickness > 10 m
>	Dip
100γ	Direct magnetic correlation of 100 gammas

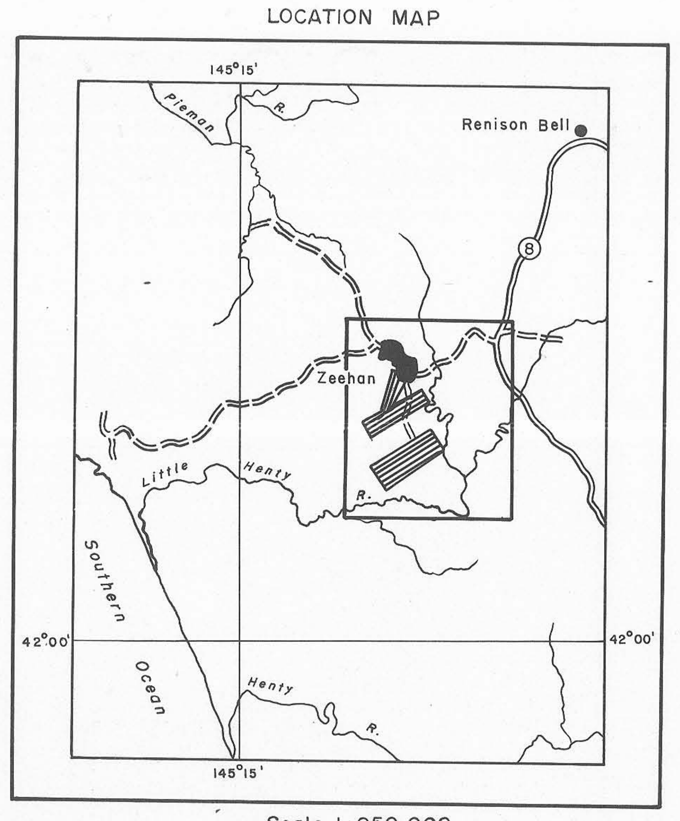
DIGHEM maps are designed to provide a correct impression of conductor quality by means of the conductance grade symbols. The symbols can stand alone with geology when planning a followup program. The actual mho values are plotted for those who wish quantitative data. The anomaly ppm and depth are indicated by inconspicuous dots which should not distract from the conductor patterns, while being helpful to those who wish this information. The map provides an interpretation of all conductors in terms of length, strike direction, conductance and depth. The accuracy is comparable to an interpretation from a ground EM survey having the same line spacing.

934219 2956

81-1593

Sheet 1 of Appendix 6, Amoco Report 249

LOCATION MAP



Scale 1:250,000

DIGHEM II SURVEY

ZEEHAN, TASMANIA

MAGNETICS

FOR

AMOCO MINERALS AUSTRALIA COMPANY

REGISTERED PROFESSIONAL ENGINEER
D. C. FRASER
PROVINCE OF ONTARIO

5 cm

SCALE 1:20,000

1 0 1 2 Kilometres

1/2 0 1/2 1 Miles

Flight line

Fiducials and numbers

ISOMAGNETIC LINES

(total field)

1000 .... 1000 gammas

200 .... 200 gammas

.... 50 gammas

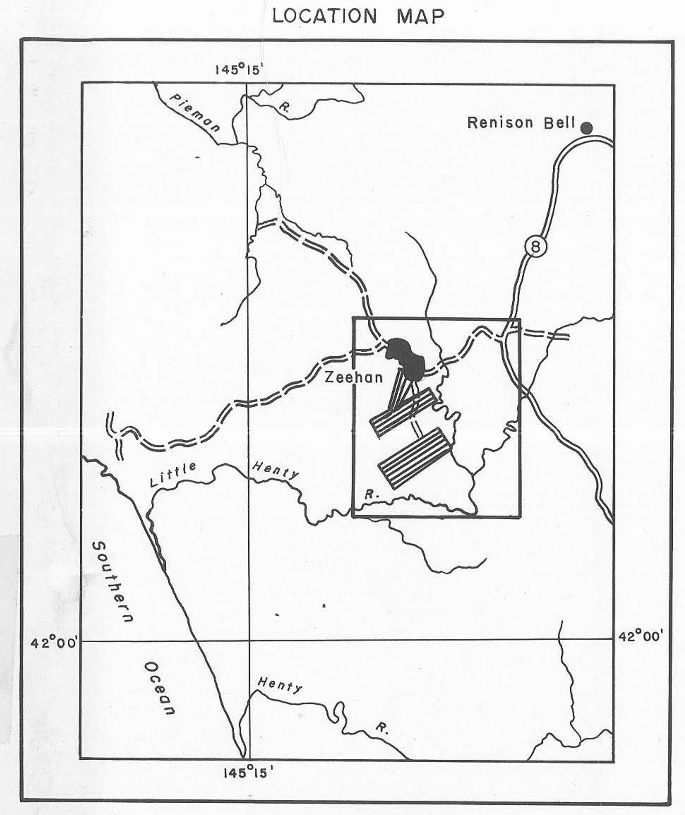
.... 25 gammas

.... magnetic depression

Magnetic Inclination within the survey area: 72°

Sheet 2 of Appendix 6, Amoco Report 24

LOCATION MAP



Scale 1:250,000

DIGHEM II SURVEY

ZEEHAN, TASMANIA

ENHANCED MAGNETICS

FOR

AMOCO MINERALS AUSTRALIA COMPANY

REGISTERED PROFESSIONAL ENGINEER
D. C. FRASER
PROVINCE OF ONTARIO

5 cm

SCALE 1:20,000

1 0 1 2 Kilometres

1/2 0 1/2 1 Miles

81-1593

Flight line

Fiducials and numbers

ISOMAGNETIC LINES

(enhanced field)

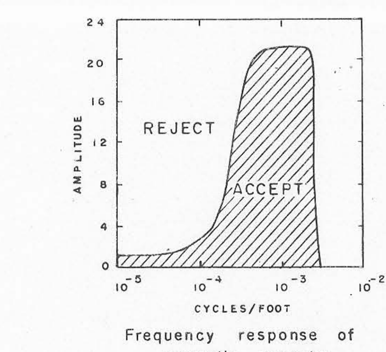
5000 .... 5000 gammas

1000 .... 1000 gammas

.... 200 gammas

.... 100 gammas

.... magnetic depression

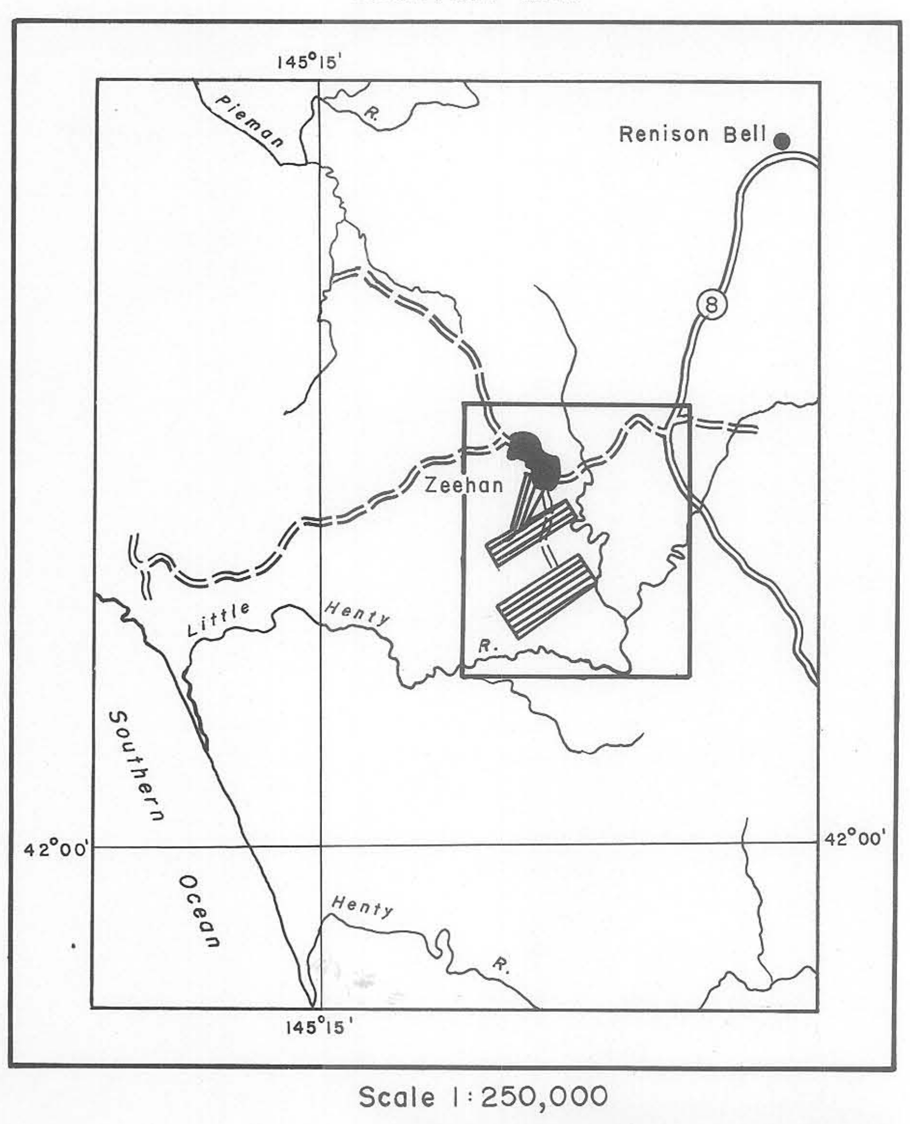


Frequency response of magnetic operator

934220),2957

Sheet 3 of Appendix 6, Amoco Report 249

LOCATION MAP



Scale 1:250,000

DIGHEM^II SURVEY

ZEEHAN, TASMANIA

RESISTIVITY

FOR

AMOCO MINERALS AUSTRALIA COMPANY

REGISTERED PROFESSIONAL ENGINEER
D. C. FRASER
PROVINCE OF ONTARIO

SCALE 1:20,000

1 0 1 2 Kilometres

1/2 0 1/2 1 Miles

5 cm

Flight line

1258

Fiducials and numbers

1256

LEGEND

Contours in ohm - m at eight intervals per decade

100
75
56
42
31
23
17
13
10

Note

The numbers face in the direction of increasing value.

934221 2958

81-1593