ANNUAL REPORT

REDBANK ERL 94

ADDENDUM

SOIL GAS ANALYSIS

AMALG SYNDICATE
P O BOX 449
KALGOORLIE WA 6430

John Cooke
December 1992

mm:jc

1 x NTDME
1 x AMALG

ADDENDUM: Soil Gas Survey, raw data results.

At the time of preparation of the Redbank Annual Report (September 1992), hard data were not available for the Soil Gas Survey that was carried out in June 1992. Since that time, the raw data have been received from Dr G. Watmuff, consultant to the South Australian DME (Appendix 1). A descriptive report of surveys carried out by Watmuff and SADME at Moonta South Australia, is appended (Appendix 2) to this report as it describes the procedure designed by Dr Watmuff. Plate 1 presents the soil gas results over the Sandy Flat pipe.

AMALG SYNDICATE: Proposed Expenditure 1993.

As outlined in the Annual Report for 1991/92, AMALG Syndicate through Redbank Copper would propose to bring the Sandy Flat ore-body into production during the current anniversary year.

To this end, the PER must be completed during late 1992 to allow time for its perusal by NTDME and affiliated departments.

The field camp and water bores will be upgraded, the air strip and company roads re-graded in preparation for mill construction and pre-stripping of the pit area.

Allowing that the mining situation proceeds on schedule with early positive indications of success, the recently completed TEM survey at Sandy Flat and Bluff will be followed up with a more detailed programme over anomalies discovered in 1992. The anticipated targets would be sulphide resources to augment reserves at the Sandy Flat operation.

Anticipated expenditure would be in the vicinity of $100,000 - 130,000 for commitment year 1992/93 (exclusive of plant and infrastructure costs).

APPENDIX 1

STATE Northern Territory AREA Red bank COMPANY AMALG Syndicate

GRID Sandy Flat West COORDINATES Start 12m SW of 38100E, 36600N
Finish 180m SW of 38180E, 36760N

BEARING Approx Grid NE DISTANCE DATE 16-6-92

COORDINATES	CO_2	O_2	Depth(cm)	Comments: Vegetation, Profile
12m SW of 38100E, 36600N	0.20	20.3	52	Half dried grass; Scrubby 'river' growth, tet radonta, camald, ironwood.
5m NW of 38100E, 36600N	0.20	20.7	75	"
5m NE of 38100E, 36600N +5m NW	0.77	20.1	55	On 2m wide track, "
10m NE of 38100E, 36600N +8m NW	0.42	20.3	62	"
10m NE of 38100E, 36600N	0.21	20.6	~~75~~	"
15m NE of 38100E, 36600N +5m NW	0.23	20.6	75	On 2m wide track, "
20m NE of 38100E, 36600N	0.67	20.1	75	"
25m NE of 38100E, 36600N	0.40	20.3	65	On 2m wide track, "
30m "	0.45	20.4	67	" "
40m "	0.30	20.6	60	" "
50m "	0.36	20.4	55	" "
60m "	0.31	20.5	75	" "
70m " or 180m SW of 38180E, 36760N	0.37	20.5	62	" "

O_2 air reading = 20.9%

STATE Northern Territory AREA Redbank COMPANY AMALG Syndicate

GRID Redbank Mine COORDINATES Start traverse at entrance to open cut

BEARING 185° magnetic DISTANCE DATE 16.6-92

COORDINATES	CO_2	O_2	Depth(cm)	Comments: Vegetation, Profile
0	0.17	20.6	75	~~Mostly bare ground~~ Bare
10m	Ground too, hard to penetrate with probe			
20m	0.26	20.5	75	Mostly bare ground, [illegible] + tree grass locally
30m	0.22	20.5	"	"
35m	0.37	20.1	"	"
40m	0.45	20.25	"	"
45m	0.46	20.1	"	" + tetradonta
50m	0.36	20.2	"	"
60m	0.15	20.3	"	"
70m	0.16	20.4	"	"
80m	0.21	20.2	"	" + ironwood
90m	0.22	20.2	"	"

O_2 Air reading = 20.9%

STATE Northern Territory AREA Redbank COMPANY AMALG Syndicate

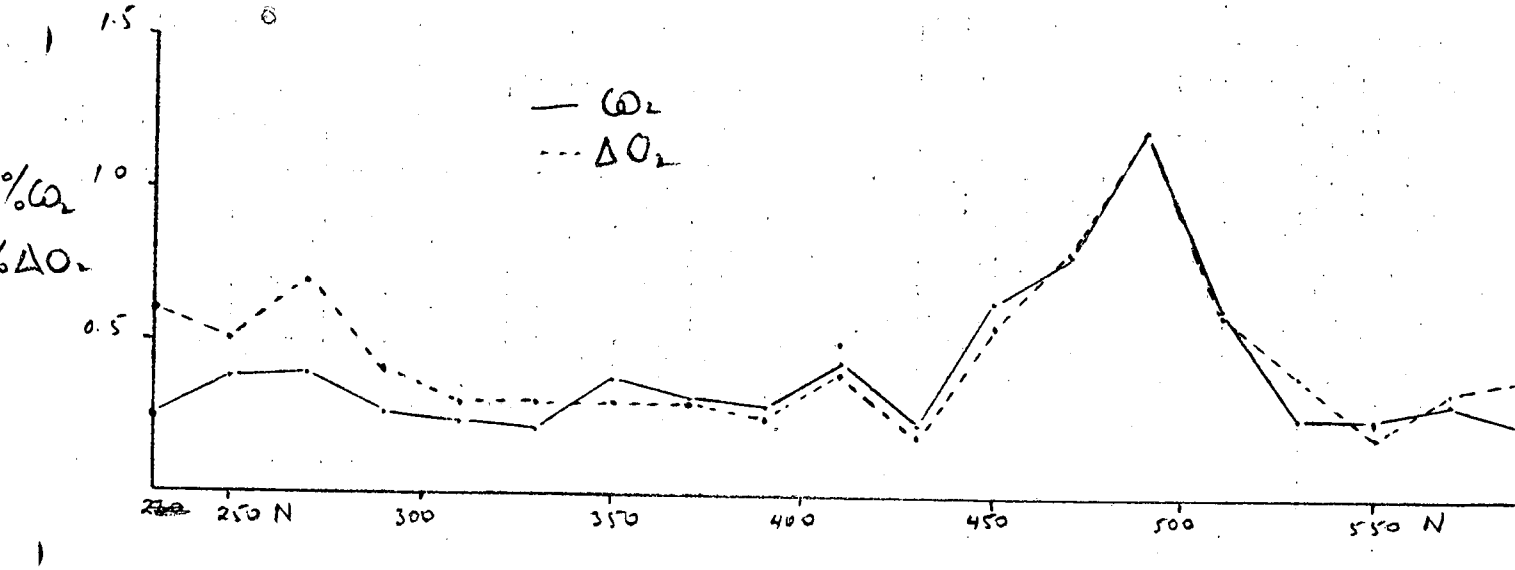
GRID Sandy Flat COORDINATES Grid line 38340E

BEARING DISTANCE DATE 16-6-92

COORDINATES	CO_2	O_2	Depth(cm)	Comments: Vegetation, Profile
36230 N	0·25	20·3	70	Half dried Spew + other gross + ironwood, tetradonta 3m
250	0·38	20·4	55	" Widely spaced
270	0·39	20·2	55	" ironwood, tetradonta
290	0·27	20·5	60	"
310	0·24	20·6	75	"
330	0·22	20·6	63	"
350	0·38	20·6	75	"
370	0·32	20·6	75	" 3m from Tall high ironwood
390	0·29	20·65	72	" 4m from Ironwood
410	0·44	20·5	74	"
430	0·23	20·7	65	" + tetradonta 10m high
450	0·63	20·3	75	Bare ground
470	0·79	20·1	65	" + tetradonta 10m
490	1·20	19·7	75	" + " "
510	0·62	20·3	63	clump tetradonta holes
530	0·27	20·5	70	⇦ Grass only
550	0·26	20·7	75	Grass (bottom) + tetradonta cluster to 10m
570	0·32	20·6	75	" + ironwood
590 N	0·24	20·5	75	
Profiles				
350N	0·12	20·5	25	
"	0·22	20·4	50	
"	0·35	20·3	75	
"	0·46	20·2	100	
468N	0·27	20·3	25	
"	0·50	20·3	40	

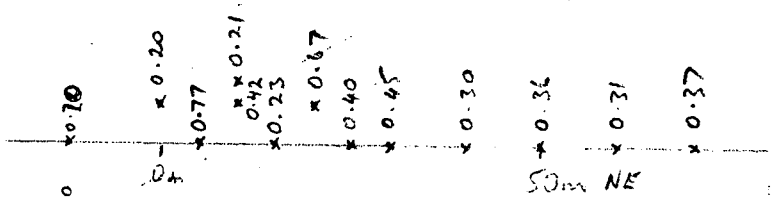
O_2 air reading = 20·9%

Sandy Flat 38340E line



ΔO_2 = Air reading (20.9%) − Soil atmosphere reading.

Sandy Flat West CO_2 %



APPENDIX 2

DEPARTMENT OF MINES AND ENERGY

GEOLOGICAL SURVEY

SOUTH AUSTRALIA

REPORT BOOK 92/60

SOIL AIR CO_2/O_2 PROJECT PROGRESS REPORT II, MOONTA DISTRICT

Dr I G WATMUFF
CONSULTANT

AND

B J MORRIS
SENIOR GEOLOGIST
MINERAL RESOURCES BRANCH

OCTOBER 1992

DME 179/91

CONTENTS PAGE

TABLES

FIGURES PLAN NO.

+ 1 Plate

DEPARTMENT OF MINES AND ENERGY
GEOLOGICAL SURVEY
SOUTH AUSTRALIA

REPORT BOOK 92/60 DME 179/91

Soil Air CO_2/ O_2 Project Progress Report II, Moonta District

DR I G WATMUFF
B J MORRIS

INTRODUCTION

Soil air carbon dioxide (CO_2) and oxygen (O_2) measurements as a guide to oxidising sulphide have been assessed by several researchers and government geological surveys in the United States, Ireland, Africa and Saudi Arabia (Lovell et al 1983; Hinkle and Dilbert, 1984; Reid and Rasmussen, 1990; Ball et al, 1990 and McCarthy Jr and Bigelow, 1990). The rationale is that sulphide oxidation in the presence of water and oxygen will produce sulphuric acid which in turn will attack any carbonates present to produce CO_2. Oxygen is consumed in the process. Both CO_2 and O_2 are easily measured to an acceptable accuracy in the field with portable equipment.

The soil air CO_2/O_2 project is being conducted jointly between the author (consultant) and the South Australian Department of Mines and Energy (SADME). The aim of the project is to test the technique over areas of known mineralisation in a variety of geological and geographical settings. Progress Report I detailed testing in the Mount Lofty Ranges (Watmuff, 1992) and this report details trials in the Moonta area.

The cooperation of Moonta Mining NL in allowing access to mineralised areas is greatly appreciated.

CASE HISTORY

Moonta Area

Copper was mined from the Moonta area from the 1860s to 1923. The ore occurred in sub-parallel NW-SE trending fracture zones, hosted by Moonta porphyry and contained within an area of several tens of square kilometres. Twenty seven years of exploration by Western Mining Corporation and North Broken Hill led to a new copper discovery in 1987. This work is reported in SADME Envs 6999, 7001 and 8368.

Modern open-cut mining commenced in 1988 on an extension to the old Poona lode containing an insitu undiluted ore reserve of about 180,000 tonnes averaging 7.1% copper and 2.0 grams per

tonne gold above a cut-off grade of 2% copper (1987 estimate). A second open cut operation was also developed on the Wheal Hughes lode 1.6 km to the south. Primary Poona lode ore consisted of a coarse grained chalcopyrite - pyrite assemblage in quartz - tourmaline - chlorite - feldspar(minor) gangue. Supergene sulphides were chalcocite and covellite.

Four traverse locations were chosen over the Poona, Wheal Hughes, Paramatta and Mid Moonta lodes in the Moonta area for soil $CO_2/\Delta O_2$ and a fifth over the Alford prospect a few kilometres NE of Kadina (figures 1 & 2). All traverses were within cereal paddocks or cleared land. Vegetation comprised dried grass and/or stubble with minor fresh autumn germination following recent rain.

Wheal Hughes

Traverses were made across the SW extension of the current Wheal Hughes pit along mine grid line 9960N in March and July 1992. Seven drill holes provide good subsurface mineralisation control (figure 3) and pit exposure 30 m away to grid north provides detailed overburden and weathered profile information (figure 4).

The $CO_2/\Delta O_2$ data are plotted in figure 3 and tabulated in tables 1 & 2. The March values show excellent correlation with sub-surface mineralisation. Soil air over footwall rocks measures between 0.25% and 0.35% for CO_2 and 0.1% to 0.3% for ΔO_2. Passing over the ore horizon and then the hanging wall, there is a sharp, three to four fold increase in both CO_2 and ΔO_2 which fades away to background as the ore horizon dips deeper to the northwest.

The winter measurements followed above average seasonal rains in late autumn and early winter. Grasses, broadleaf plants and legumes were thick and lush over the footwall rocks, some of the ore zone and to a lesser extent the hanging wall. Background values were typically double those of March but the main anomaly peak was also significantly enhanced. Two relatively high values over footwall rocks at 2040 and 2050mE may be due to biological activity or may reflect another pathway of CO_2 gas escape from known or unknown mineralisation. The lowest background values coincided with bare ground or relatively little surface vegetation at the far western end of the traverse. The oxygen deficit may deviate significantly from its corresponding CO_2 value in contrast to the March results.

No carbonate has been described within the Moonta porphyry or the ore gangue. If indeed there is no carbonate, alternative explanations for the existence of the anomaly must be considered. Possibilities include:

a) migration of SO_2 into the calcrete layer where gas sampling took place; or
b) bacterial activity in the oxidising sulphide ore.

Paramatta Lode

A traverse was made approximately normal to strike across the main Paramatta lode (Fig 2), a site

undisturbed since early mining in the Moonta area, and 500 metres north of Wheal Hughes. Percussion drilling by the WMC-NBH Moonta Wallaroo joint venture partners on a small unmined shoot about 150 m south of the main lode gave two intersections (in separate holes - MP683 and MP684) which averaged approximately 1.9 m @ 20% pyrite and 0.65% copper as chalcopyrite and 1.9m @ 9% pyrite and 0.95% copper as chalcopyrite, at depths below surface of 68 m and 26 m respectively. A third hole (MP601), in a separate traverse of six percussion holes across the main lode, intersected massive gossan containing quartz but no sulphide between 10 m and 14 m below surface. Only rare to trace pyrite and chalcopyrite was reported sporadically through Moonta porphyry in most of the other holes (SADME Env 8368).

The upper part of the weathered profile comprises a few centimetres of loam overlying 2 m to 3 m of nodular calcrete grading downwards to red-brown and sometimes pale clay which persists to a depth of 6 m to 12 m. Below this, red-brown oxidised Moonta porphyry grades down to a fresh grey colour.

The soil air traverse passes a few metres east of the Main Shaft (No 3) and west of No 4 shaft, intersecting the line of shafts at 7mS along the traverse. It is sub-parallel to the linear traverse of six percussion holes (MP602 to MP597) 15 m to 25 m to the northeast. The gas data and relevant strike projected drillhole data are plotted in figure 5 and tabulated in table 3. Soil CO_2 values are only 1½ to 2½ times background over the ore zone. The oxygen deficit shows general correlation with CO_2, but the higher values over the ore zone do not give an anomaly as broad as CO_2. The lower anomaly/background contrast compared to Wheal Hughes probably reflects the weakness of the remaining mineralisation at Paramatta lode.

A short traverse across the small ore shoot intersected by holes MP683 and MP684 in winter (July 1992) did not give a clear anomaly response. Winter grass growth was lush and background CO_2 values relatively high and more variable than in autumn. The data are given in table 4.

Mid Moonta Lode

Mid Moonta was a small lode about 1 kilometre due east of Wheal Hughes (Fig 2). A soil gas traverse across strike between the third and fourth shaft going NE along strike yielded no anomalous values (table 5). Subsequent drilling intersected only about 1 m of 1% copper. The CO_2 values were remarkably stable - 0.22% to 0.25% over a distance of 90 m with the exception of one value of 0.31. The oxygen deficit was consistently 0.2%.

Poona Lode

The Poona open cut mine has been exhausted of mineable ore so this lode could not be tested. A soil air traverse was made at the western end of the Poona pit along the old north-south railway line cutting to intersect the approximate centre point of the old Poona lode, mined out in earlier times (Fig 2). The railway rails and ballast had been removed and replaced with a thin veneer of lime (calcrete) rich material. Extreme difficulty was encountered

in driving the probes to 75 cm and this depth was not always attained. The sample horizon appeared to be the red-brown clay below the calcrete horizon. The traverse surface was about 2½ metres below the original ground surface.

The data are plotted in figure 6 and tabulated in table 6. No clear anomalous response was recognised. The mineralisation below the traverse line is probably very weak.

Alford Prospect

Alford prospect occurs in a wheat paddock about 10 km north of Kadina. A soil gas traverse was made north-south across an east-west trending (approximately) line of mineralisation in the vicinity of DDH132 and DDH136 (WMC+NBH Moonta-Wallaroo joint venture 1961-1988, SADME Env 8368).

The primary sulphide mineralisation is both disseminated and in quartz veins. It comprises mainly pyrite (2-3%) with minor molybdenite and chalcopyrite, and is associated with argillic and propylitic alteration in the apical portion of a porphyritic diorite and in metasedimentary roof rocks (figure 7). The propylitic alteration appears to have been overlaped by the argillic alteration in parts. Carbonate occurs throughout the argillic alteration.

Sulphide oxidation is complete to about 110 m below surface and locally extends downward at least 230 m below surface (figure 7). A supergene chalcocite blanket up to 4 m thick with associated pyrite is developed at about 110 m. The deeper oxidation in DDH132 is characterised by native copper and an absence of pyrite.

Percussion drilling and shallow auger drilling in the area by the WMC+NBH Moonta-Wallaroo joint venture partners indicates a near surface profile similar to that in the Moonta area to the south. The calcrete horizon however appears to be more massive rather than nodular and limited probe penetration to 50 cm or less. Top soil is a grey-brown calcareous sand. Weathered bedrock occurs at a depth of 5 m to 7 m below surface.

The soil gas data are plotted in figure 7 and tabulated in table 7. Unfortunately, an accurate location for the drillholes could not be established on the ground at the time of CO_2/O_2 measurement and the traverse was actually made about 50 m west of the collars of DDH132 and DDH136. The interpretive geological section based on the drillhole logs and also aligned north-south is correlated with the gas traverse by making their respective intersections with the approximately east-west trending surface line of mineralisation common. An uncertainty of up to 30 m north or south still exists in the correlation due to the lack of geographical control.

Carbon dioxide in soil air over the prospect area yielded a steady background range of 0.14% to 0.18%. Anomalous values extended up to 0.40% and showed reasonable spatial correlation with the sulphide in the uppermost portion of the redox surface. The oxygen deficit correlates closely with the CO_2 values, but is usually slightly higher.

REFERENCES

Ball, T K, Crow, M J, Laffoley, N, Piper, D and Ridgway, J, 1990. Application of soil-gas geochemistry to mineral exploration in Africa. In: S E Kesler (Ed) Soil and Rock Gas Geochemistry. J Geochem Explor, 38:103-115.

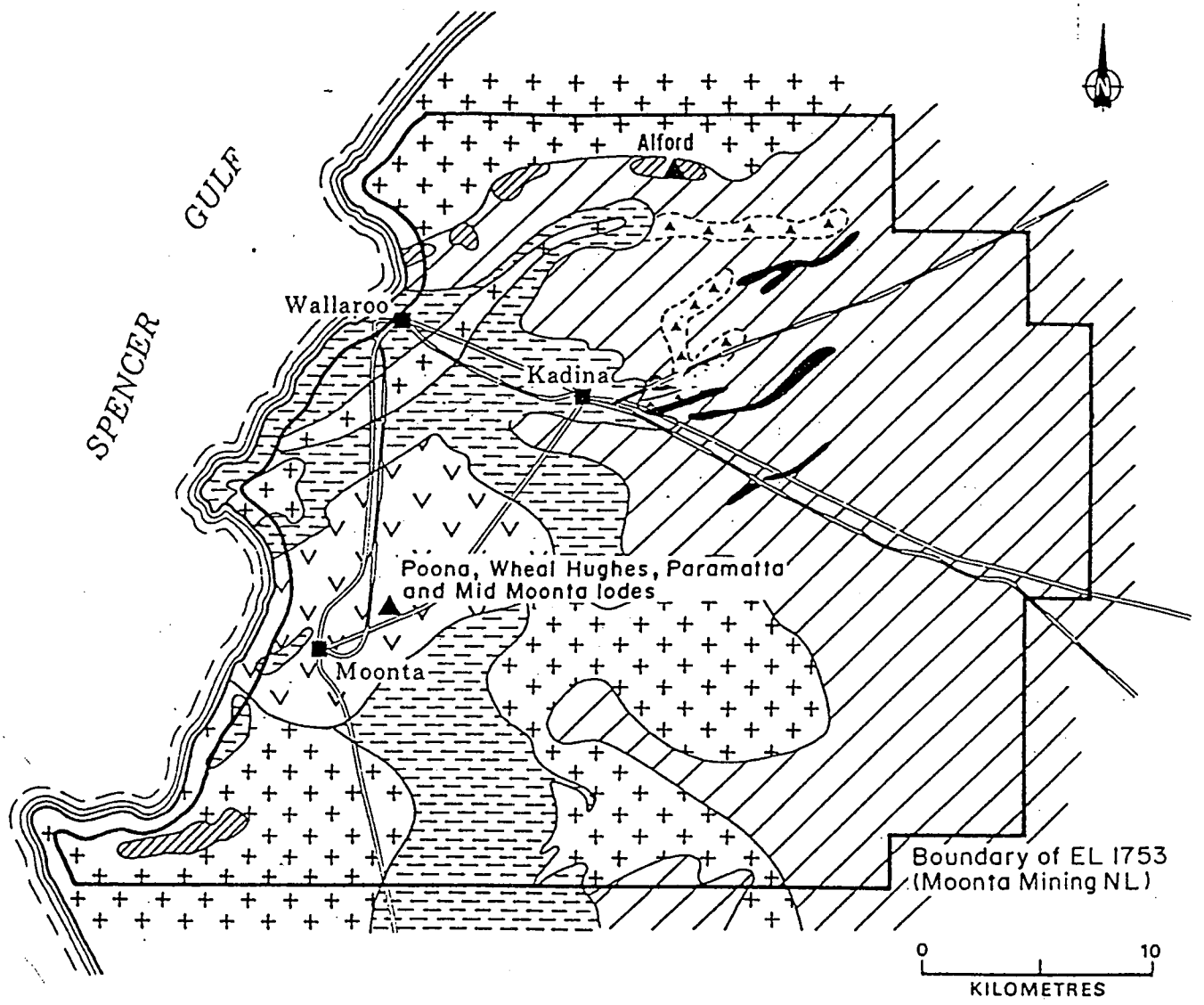
Lovell, J S, Hale, M and Webb, J S, 1983. Soil air carbon dioxide and oxygen measurements as a guide to concealed mineralisation in semi-arid and arid regions. In: G R Parslow (Ed), Geochemical Exploration 1982. J Geochem Explor, 19:305-317.

McCarthy, Jr J H and Bigelow, R C, 1990. Multiple gas analyses using a mobile spectrometer. In: S E Kesler (Ed), Soil and Rock Gas Geochemistry. J Geochem Explor, 38:233-245.

Reid, A R and Rasmussen, J D, 1990. The use of soil-gas CO_2 in the exploration for sulphide-bearing breccia pipes in northern Arizona. In: S E Kesler (Ed), Soil and Rock Gas Geochemistry. J Geochem Explor 38:87-101.

Hinkle, M E and Dilbert, G A, 1984. Gases and trace elements in soils at the North Silver Bell deposit, Pima County, Arizona. J Geochem Explor, 20:323-336.

Watmuff, I G, 1992. Soil Air CO_2/O_2 Project, Progress Report I, Mount Lofty Ranges. South Australian Department of Mines and Energy report 92/50 (unpubl).



SOIL AIR CO_2 and O_2 PROJECT

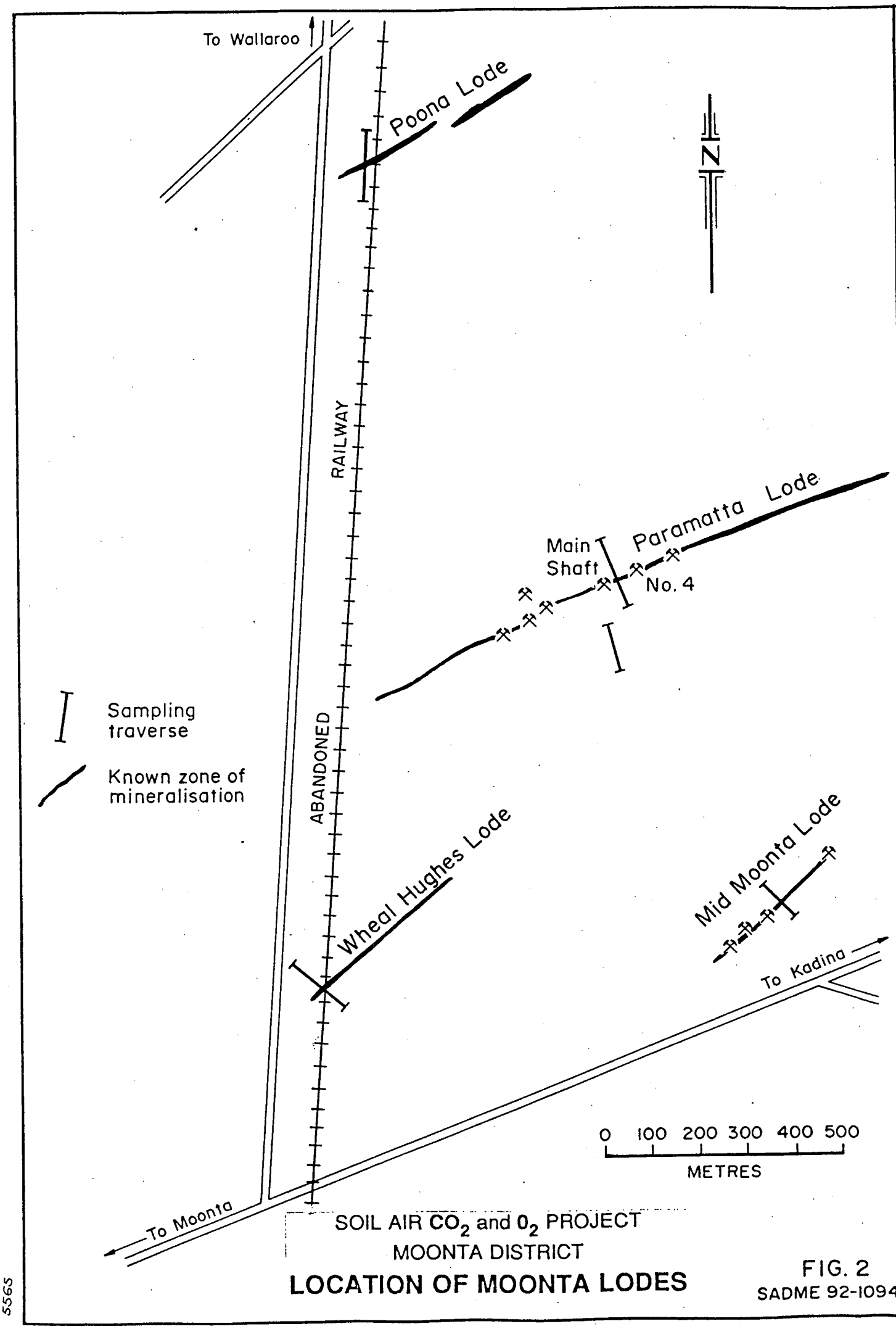
MOONTA DISTRICT

REGIONAL LOCALITY AND GEOLOGICAL PLAN

5565

FIG. 1

SADME 92-1093



SOIL AIR CO_2 and 0_2 PROJECT

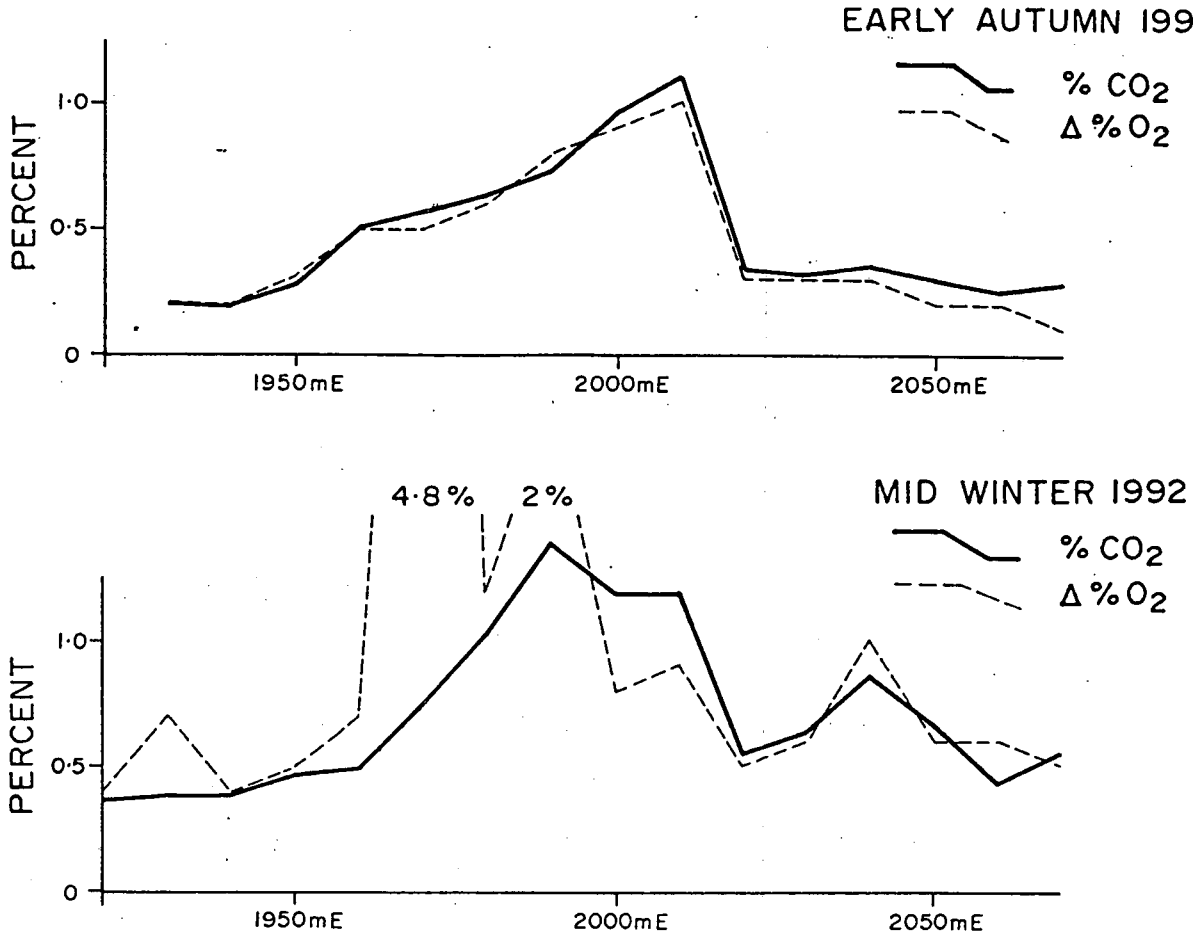
MOONTA DISTRICT

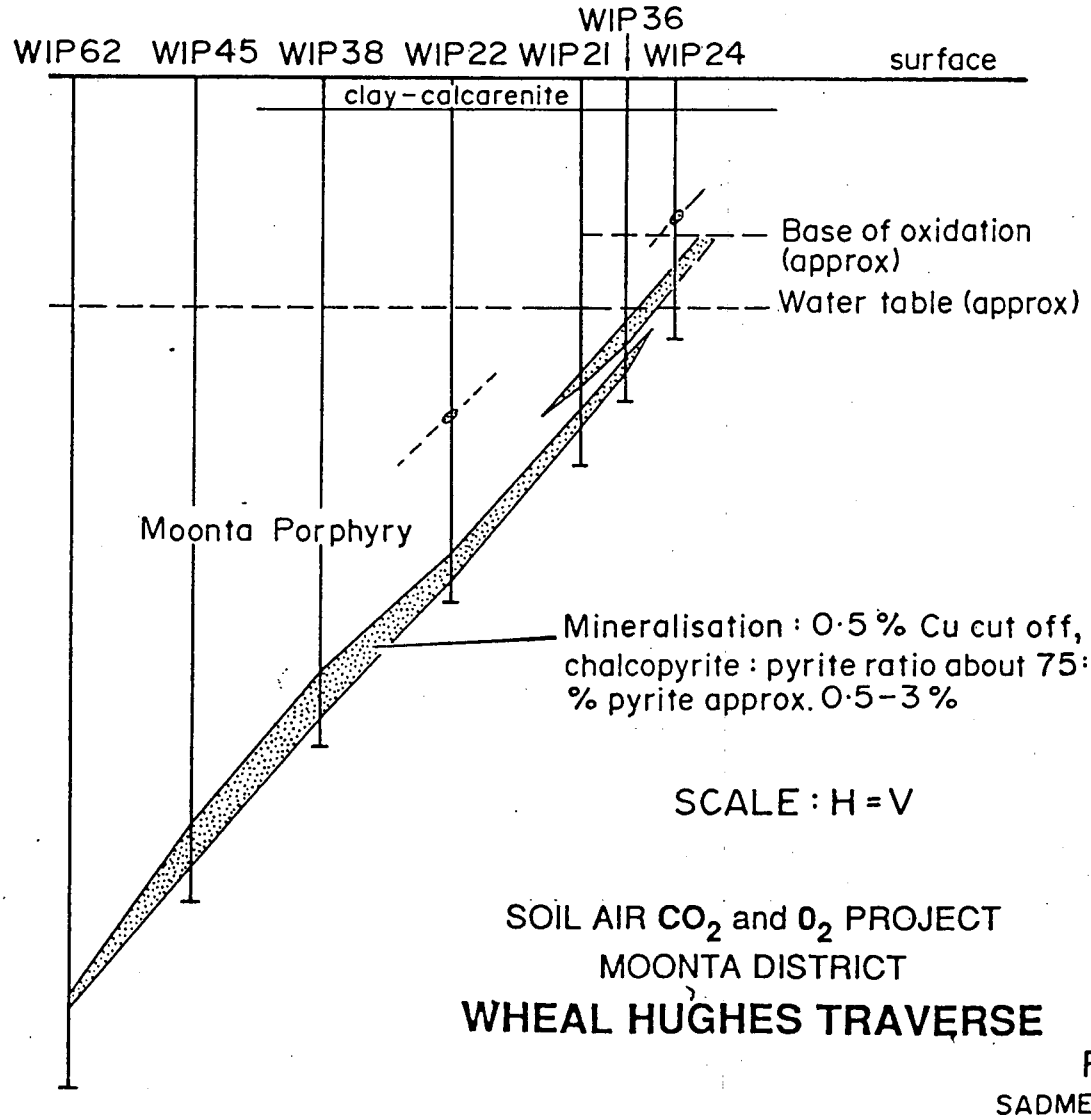
LOCATION OF MOONTA LODES

FIG. 2

SADME 92-1094

5563





SOIL AIR CO_2 and O_2 PROJECT

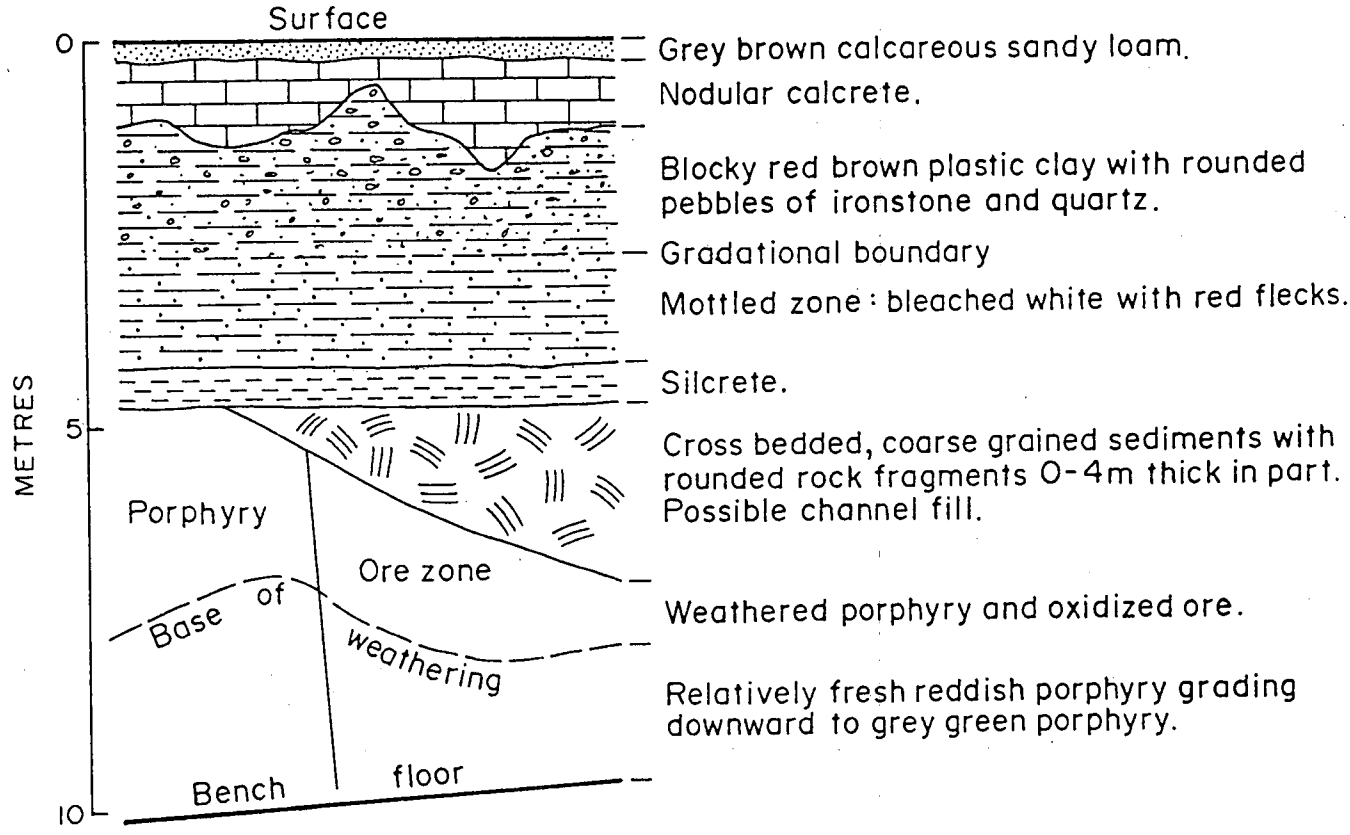
MOONTA DISTRICT

WHEAL HUGHES TRAVERSE

FIG. 3

SADME 92-1095

5565



NOTE: Surface to base of weathering generally 12-15m in rest of pit

SOIL AIR CO_2 and O_2 PROJECT

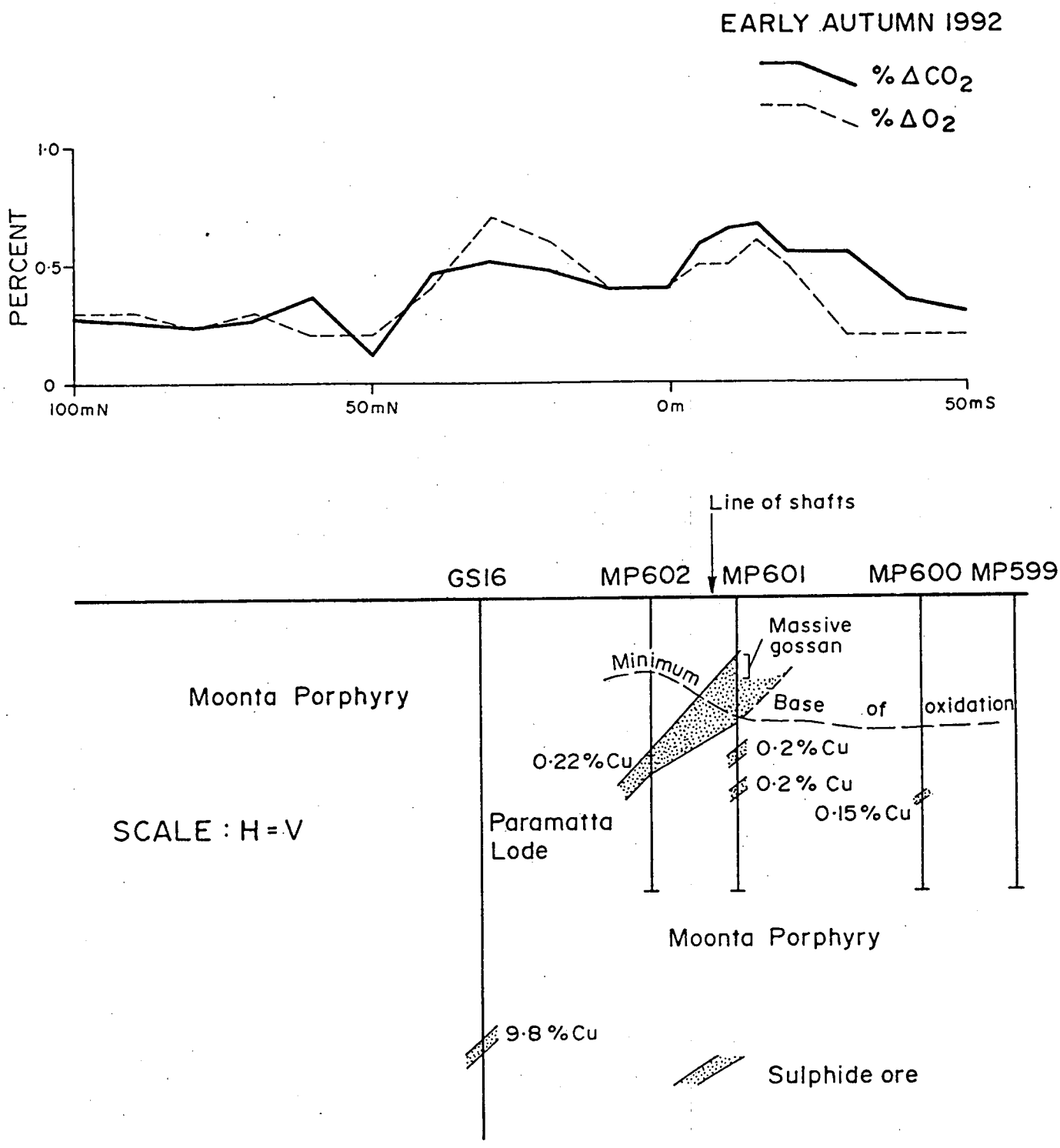
MOONTA DISTRICT

WHEAL HUGHES PIT, GEOLOGICAL PROFILE

FIG. 4

SADME 92-1096

5565



SOIL AIR CO_2 and O_2 PROJECT

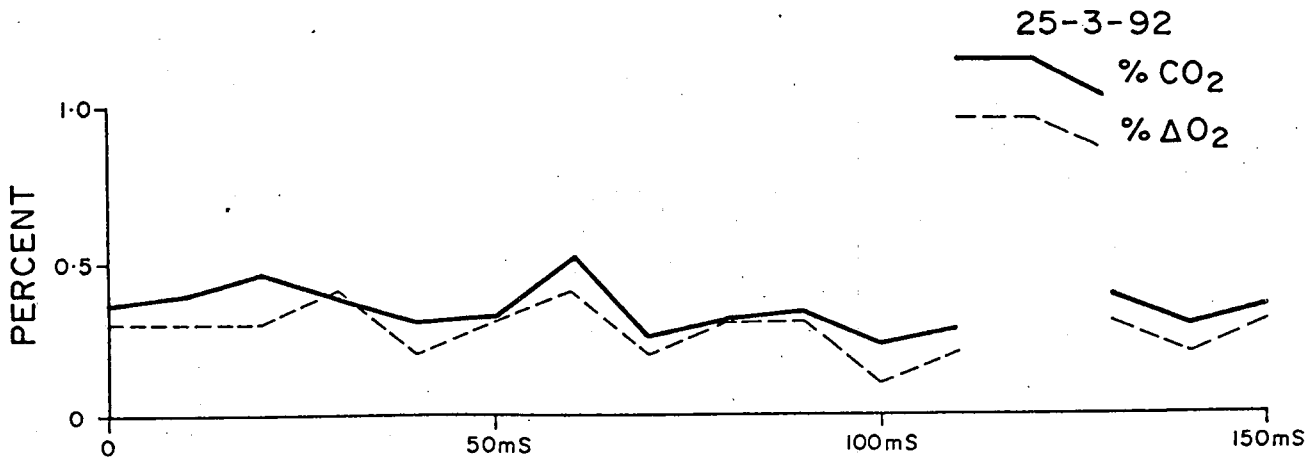
MOONTA DISTRICT

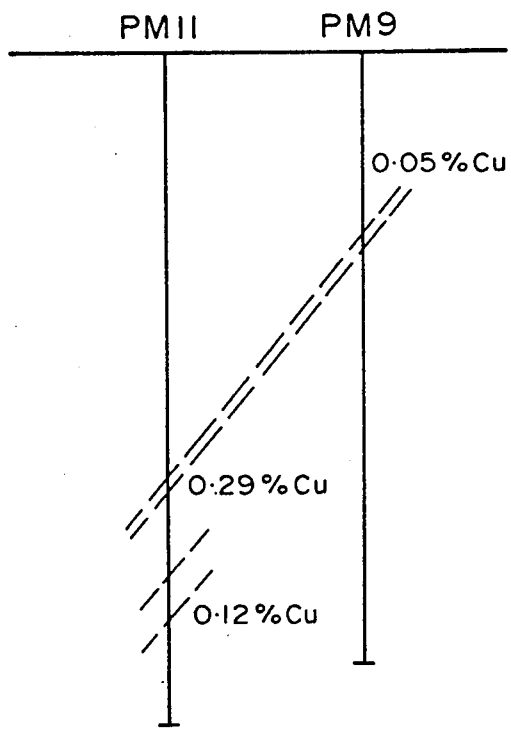
PARAMATTA LODE TRAVERSE

FIG. 5

SADME 92-1097

5563





Drillhole section parallel to and 15m east of above traverse line

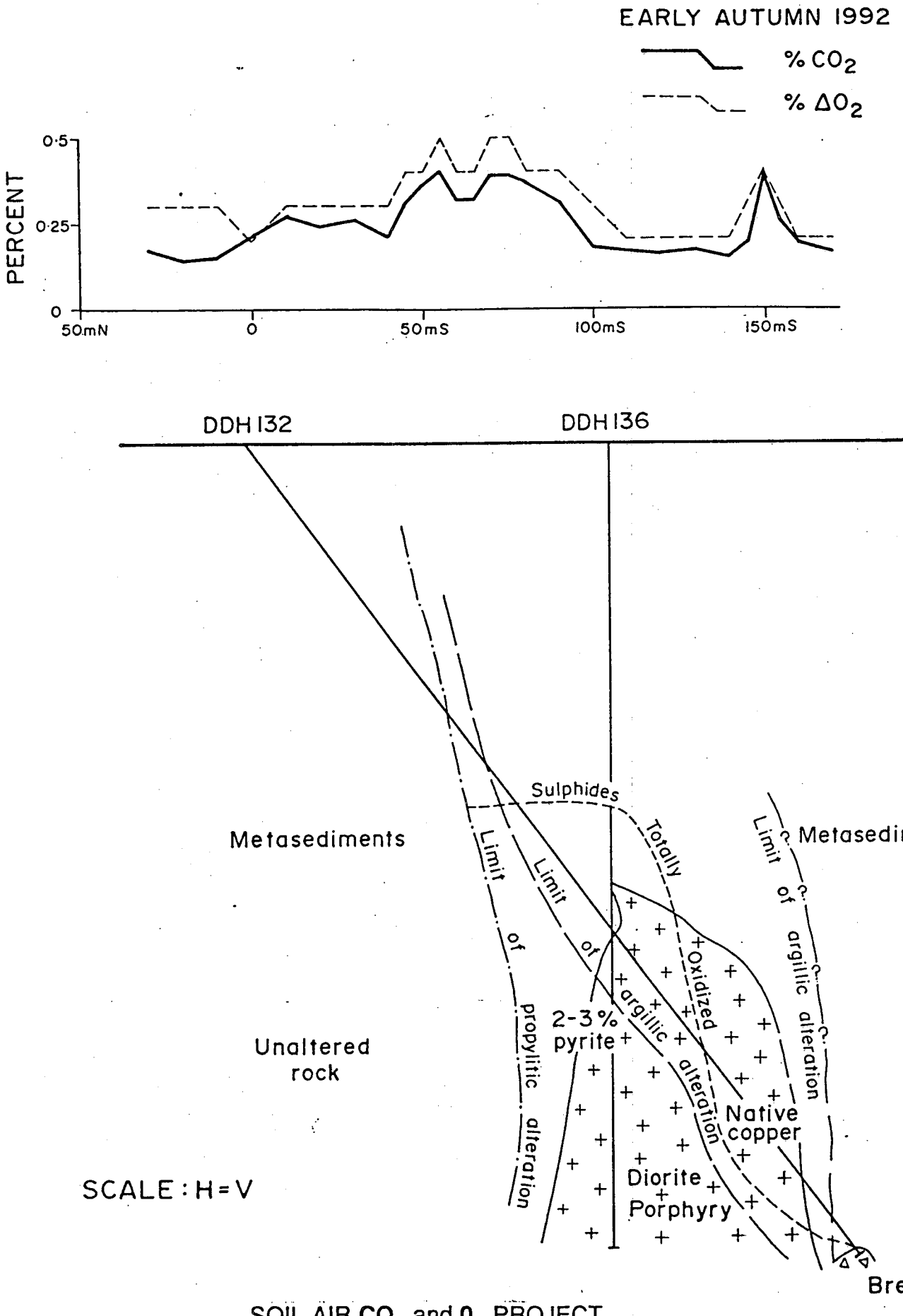
Chalcopyrite:pyrite ratio approx. 75:25

SOIL AIR CO_2 and O_2 PROJECT
MOONTA DISTRICT

POONA LODE TRAVERSE

FIG. 6
SADME 92-1098

5564



SOIL AIR CO_2 and O_2 PROJECT

MOONTA DISTRICT

ALFORD PROSPECT TRAVERSE

FIG. 7

SADME 92-1099

5565

CR93/051

REDBANK COPPER PTY LTD.

SANDY FLAT

SOIL GAS CO_2/O_2

LINE 38340E

Soil gas Analysis: Dr G Watmuff
Geology: J Cooke (Compiler)
Survey Date: June 1992

Plate 1