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INDUSTRIAL AND MINING INVESTIGATIONS PTY. LIMITED

Incorporated in the A.C.T.

EXPLORATION LICENCE E.L. 4/61

WEST COAST TASMANIA

QUARTERLY RESUME

23.8.83 to 22.11.83

1. SUMMARY

Field exploration staff were mobilised during the current period following the Winter break and field activities commenced.

During the quarter under review activities were concentrated on:-

- The commencement of field activities
- The reopening of access tracks
- The commencement of a heavy mineral sampling programme
- The commencement of an exploration programme on various magnetic anomalies on the eastern border of the license which are regarded as being prospective for tin.
- The statistical analysis of geochemical values obtained from stream sediment and soil samples
- The analysis of core from the magnesite deposit at Main Creek
- Further metallurgical research by the C.S.I.R.O.

2. EXPLORATION

A Winter recess ended in mid October. Initial work involved the reopening of access tracks in the Donaldson River and Main Creek areas which had been closed by fallen timber. New access to areas south of Savage was gained by renovating existing tracks and the Whyte River gauging station track, and extensions are planned. A prolonged wet spell during early November hampered activities making the high priority targets east of the Whyte River inaccessible.

Examination of heavy minerals and silts commenced on areas which include Tertiary gravels plus some control streams, in the plateau area of the Whyte/Savage divide. Indications are that the Tertiary paleodrainage was directed outwards from the Meredith Range massif, and that the existing Whyte River drainage did not exist at the time. This point was understood by Twelvetrees in 1903 from the occurrence of "granite wash at Big Creek" which is considered to be the Alfords Creek of modern maps. At this point the Whyte and Hazelwood gorges lie between the deposit and the Meredith Granite.

The placer deposits examined so far do not appear to have commercial prospects as they do not have sufficient volume. There does not appear to be a gravel in the area with potential for a platinum group metals placer, as only the fringe of the Bald Hills Serpentinite is included in the Alfords Creek paleodrainage, and further north it appears that the gravels are not preserved. Better prospects are likely in the south of the area.

A series of magnetic anomalies in the Mount Meredith area are considered prospective for tin. There is also a mention of "tin ore being discovered in the foothills of Mt. Meredith some years ago" in an unpublished Mines Department report (Scott 1926). Access to this area was cut off by high levels in the Whyte River until recently. Two kilometres of an access/soil sampling line were cut.

A statistical study of geochemical sampling on E.L. 4/61 was conducted during the period under review and is annexed as Appendix 1.

3. MAIN CREEK MAGNESITE

A series of magnesite samples were sent to Analabs at Burnie for analysis. Analab´s Analytical Report No. 236.1.08.2226 as annotated is attached as Appendix 2.

4. C.S.I.R.O. METTALURGICAL RESEARCH

The research programme on magnesite from Main Creek continued during the period under review.

Progress Report No. 11: Continuous Pilot Plant Test, received from the C.S.I.R.O. during the quarter under review is attached as Appendix 3.

APPENDIX 1.

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GEOPLAN Resource Planning
6 Jefferson Avenue, St Ives, N.S.W. 2075 Telephone (02) 440 8003

STATISTICAL STUDY OF GEOCHEMICAL SAMPLING IN I.M.I.'s EL 4/61 TASMANIA

D.L. HAWLEY

23 OCTOBER 1983

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not included here

Summary

Over 1700 soil and stream sediment samples were subdivided into 12 field identified rock type sub-division from the northern part of Industrial and Mining Investigation's EL 4/61 in northwest Tasmania. Classical statistical analysis included calculation of population means, variances, standard deviations and correlation matrices. Histograms were plotted and determination of anomolous values used a Lepeltier's comulative frequency graph (applied inversely) technique to determine population threshold/background limits. The data was transformed into log normal value, but the transformation did not improve definition of anomolous areas because of the high proportion of background (low) geochemical values. This was confirmed by the poor correlation co-efficients between copper, lead and zinc, away from definite anomalous areas.

The anomalous area's precise locations were plotted using the front-end of the geostatistically powerful Bluepack-3D software. Some observations on how the geochemical anomalies relate to the geology from this preliminary analysis are given.

Recommendations

First, additional soil line sampling is necessary over the top seven anomalous areas to determine the limits of the geochemical anomalies, which are still not known.

Second, a more advanced geostatistical treatment of the data is recommended with the new data on anomalous areas to greatly assist the project geologist in defining drill sites or rating areas for future drilling.

Third, it would be advisable to determine the gold and silver contents, from the "eyes" of the top three base metal anomalies, to determine the potential for precious metals.

Fourth, after collection of necessary in-fill grid soil samples from the northern area to rate targets, consideration could be given to stream sediment sampling the southern half of the tenement.

Comment on Statistics and Significant Sample Values

1. Comparing stream sediment to soil sample geochemical values for all populations gave mixed results dependent upon the size of the tributary or physical verses chemical transport of mineral concentrations (Horton number). In the smaller tributaries:
   (i) Zinc has the highest dispersion rate of the three elements, i.e. it is the most mobile element under northwest Tasmanian climatic conditions;
   (ii) lead has the least dispersion rate, meaning lead in stream sediments is generally lower than lead in the soil;
   (iii) copper appears to have a medium dispersion or movement away from an anomaly. The exceptions are the volcanic breccia/tuff horizons where copper has moved more readily into solution making anomaly localisation difficult (see later).

   Although it was considered to subdivide the stream and soil samples into two sub-populations, this was thought unscientific. The geochemical measurements are of the rock type population, and NOT the dispersion paths in streams or soil. The differences in mean values for elements from stream and soil diminished with the greater sample number, and with anomalous values no clear pattern emerged.

2. The stronger anomalies had statistically significant correlations for each element when considering the areal extensions of the higher geochemical values. They also exhibited log-normal or linear exponential distributions of data away from the 'eye' of the anomaly. This log normal distribution may be an indication, in those anomalous areas marked 'high', that sulphide mineralisation could be present. Additional soil sampling is strongly recommended to delineate the geochemical extent of the high corresponding copper, lead, and zinc values, and nearby

isolated high values should be infill gridded (see computer print out in Bluepack 3D).

3. The Correlation Co-efficients in Table 5 are a measure of the unity of the population. Unfortunately the larger sample populations have poor correlation co-efficients between the three elements measured. This could be a function of variable surficial cover such as Tertiary gravels, laterite, clay, transported material (alluvium, eluvium, glacial outwash, etc.), but is more likely to be a function of additional rock type horizons in the named population, with different geochemical responses. This variability was observed around anomalies where detailed line soil sampling had been completed.

4. After the limits of geochemical anomalies have been delineated with further sampling then more advanced statistics could be applied to assist the project geologist in siting a geophysical or drilling program.

Comment on the High and Medium Geochemical Anomalies Relative to the Geology

1. HIGH PRIORITY IN UPPER GREENSCHIST*
JUST NORTH OF LITTLE DONALDSON RIVER
The strike of the Precambrian Upper Greenschist to the west of the down faulted block of Permian Tillite is mapped as north-south. However the geochemical response on the north-south ridge sampled is oriented northeast-southwest. There appears to be a cross-cutting structural control to high geochemical values on this ridge as all element anomalous values have a similar orientation (refer to print-out in Bluepack 3D).

2. HIGH PRIORITY IN LOWER GREENSCHIST*
SPECIMAN CREEK LOCALITY
This area to the east of the down faulted block of Permian Tillite, has too few samples, at this stage, to make an accurate assessment as to the cause of the strong anomoly. In-fill sampling is a top priority along east-west lines both to the north and south of the Speciman Creek Highs. Preliminary inspection of the Geology Interpretation Plan, orientation of the high geochemical values plus the tributary stream directions, ridge orientations, the magnetic high and low anomalies of Slade (1983) in the Arthur Lineament and the orientation of the down faulted wedge of Permian tillite 200 metres to the west all appear to indicate sympathetic parallel fracturing within the Lower Greenschist anomoly area. However the real possibility that the anomaly is stratigraphically controlled cannot be ruled out, as 2 lines, 5,000 metres north in the Lower Greenschist indicate the anomaly could still be present along the same strike. Infill sampling is a top priority, as is further sampling in the anomaly area to the east of the Savage River Pipeline road.

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* The subdivision of the Greenschist population into upper and lower units either side of a down faulted block of Permian tillite was indicated with reference to Tables 3 and 4. The composition of the greenschist geochemistry infers 2 separate rock type populations.

3. HIGH TO MEDIUM PRIORITY McAULIFFE CREEK HEADWATERS ANOMOLY IN BLACK AND GREY SLATE, GREEN GREY SHALE, GREEN CLEAVED TUFF AND TUFF AND VOLCANIC BRECCIA

Because of the thin (150 to 350 metre wide) nature of the above units they are combined into the one anomalous area. In all cases there appears to be a strong stratigraphic control relative to I.M.I.'s interpreted geological boundaries. The interrelationship of these four interpreted rock types and the geochemical anomalies need more sample lines and perhaps mapping rock exposures in cross-cutting streams before a target is localised.

Table 1 - Summary of Sampling Data in the Northern Half of EL461 Tasmania

ROCK TYPE POPULATION (Symbol) and Age	AREA km²	SAMPLE NUMBER (STREAM,SOIL)	SAMPLE DENSITY /km²	GEOCHEMICAL PRIORITY	ALTITUDE RANGE(m)/ ANOMALY	HORTON STREAM NO.NEAR ANOMALY	SLADE'S MAGNETIC PROVINCE	SAMPLE POP./TOTAL POP.%	ADDITIONAL SAMPLING?
Tertiary Basalt (TB)	13	82(14,68)	6.3	MEDIUM	350to 500 mm	1,2	Arthur Lineament Rocky Cape	4.6	yes
Permian Tillite (PT)	4	32(11,22)	8.0	LOW	300 to 400 m	2,3	Arthur Lineament	1.8	limited
Upper Slate & Phyllite (USP)	20.0	68(68,0)	3.4	LOW	200 to 300 m	2,3,4	Rocky Cape	3.8	selective
Conglomerate & Sandstone (CCS)	4	18(18,0)	4.5	LOW	200 to 350 m	2,3	Rocky Cape	1.0	limited
Lower Slate & Phyllite (LSP)	5	32(32,0)	6.4	LOW	200 to 300 m	2,3,4	E-M Conductive Zone	1.8	around anomaly
Dolomite and Sandstone (DSS)	5	6(6,0)	1.2	LOW	200 to 300 m	3,4	Rocky Cape	0.3	yes
Black & Grey Slate (BGS)	12	181(27,154)	15.1	HIGH	250 to 400 m	2,3,4	Rocky Cape	10.1	around anomaly
Green Cleaved Tuff (GCT)	4	79(6,73)	19.7	MEDIUM	300 to 400 m	3,4	Arthur Lineament	4.5	around anomaly

TABLE 1 - continued

ROCK TYPE POPULATION (Symbol) and Age	AREA km²	SAMPLE NUMBER (STREAM,SOIL)	SAMPLE DENSITY /km²	GEOCHEMICAL PRIORITY	ALTITUDE RANGE(m)/ ANOMALY	HORTON STREAM NO.NEAR ANOMALY	SLADE'S MAGNETIC PRIVINCE	SAMPLE POP. / TOTAL POP.%	ADDITIONAL SAMPLING?
Tuff Volcanic Breccia (TVB)	4	91(4,87)	22.7	MEDIUM	250 to 350 m	2,4	Arthur Lineament	5.1	around anomaly
Green Grey Shale (GGS)	5	175(10,165)	35.0	MEDIUM	200 to 300 m	2,3,4	Arthur Lineament	9.8	around anomaly
Upper Greenschist (UGS)	13	724(76,648)	55.6	HIGH	200 to 300 m	2,3	Arthur Lineament	40.6	around anomaly
Lower Greenschist (LGS)	15	295(85,210)	19.6	HIGH	500 to 700 m	1,2	Arthur Lineament	16.6	yes
Last 10 populations are Precambrian (unsubdivided) in age.									

Table 2 - Priority of Additional Sampling in Anomalous Areas

PRIORITY (Geographic locat.)	ROCK TYPE POPULATION	AREA OF ANOMALY NxE in metres	TOTAL NUMBER OF SAMPLES	NUMBER OF ANOMALOUS VALUES Copper/ Zinc/Lead	SAMPLING INTERVAL (metres)	STRUCTURAL ORIENTATION OF ANOMALY	Cu-Pb-Zn RELATION-SHIP	GRID LOCATION MID POINT N. E.
HIGH just north of Little Donaldson River	Upper Greenschist (UGS)	1600 m x 1000 m	128	29Cu, 42Pb, 312Zn	100x25	045°	well correlated	4950-1400
HIGH Speciman Creek	Lower Greenschist (LGS)	1200 m x 800 m	118	8Cu 8Pb 8Zn	25x500	015°	well correlated	5150-1090
HIGH McAuliffe Creek Headwaters	Black and Grey Slate (GGS)	5000 m x 500 m	60	13Cu 15Pb 19Zn	25 x 50	340°	moderate correlation	4850-1050
MEDIUM McAuliffe to Donaldson River	Green-Grey Shale (GGS)	7000 m x 500 m	53	11Cu 10Pb 10Zn	50 x 200	360°	weak correlation	4900-1400
MEDIUM IMI Access Road	Green Cleaved Tuff (GCT)	4000 m x 500 m	38	5Cu 6Pb 6Zn	25 x 1000	010°	weak correlation	4850-1200

TABLE 2 - continued

PRIORITY (Geographic locat.)	ROCK TYPE POPULATION	AREA OF ANOMALY NxE in metres	TOTAL NUMBER OF SAMPLES	NUMBER OF ANOMALOUS VALUES Copper/ Lead/Zinc	SAMPLING INTERVAL (metres)	STRUCTURAL ORIENTATION OF ANOMALY	Cu-Pb-Zn RELATION-SHIP	GRID LOCATION MID POINT N. E.
MEDIUM Pineapple Creek Headwaters	Tertiary Basalt (TB)	1800m x 700 m	45	5Cu 14Pb 3Zn	25 x 1000	090°	poor correlation	5220-1670
MEDIUM McAuliffe Creek Headwaters	Tuff-Volcanic Breccia (TVB)	1500m x 500 m	6	4Cu 3Pb 4Zn	25 x 500	010°	well correlated	4880-1000
LOW Donaldson River North Headwaters	Lower Slate & Phyllite (LS)	500 m x 500 m	28	4Cu 4Pb 3Zn	along stream 50 m	010°	some correlation	4640-1400
LOW Donaldson River	Upper Slate & Phyllite (USP)	4000m x 1000 m	59	5Cu 4Pb 7Zn	along stream 50-100 m	005°	little correlation	4400-1450
LOW Broberick Creek	Permian Tillite (PT)	1400m x 600 m	20	2Cu 2Pb 2Zn	25+ stream	090°	good correlation	5050-1100

TABLE 2 - continued

PRIORITY (Geographic locat.)	ROCK TYPE POPULATION	AREA OF ANOMALY NxE in metres	TOTAL NUMBER OF SAMPLES	NUMBER OF ANOMALOUS VALUES Copper/ Lead/Zinc	SAMPLING INTERVAL (metres)	STRUCTURAL ORIENTATION OF ANOMALY	Cu-Pb-Zn RELATION-SHIP	GRID LOCATION MID POINT N. E.
LOW Little Donaldson River	Dolomite & Sandstone (DSS)	1000m x 500 m	6	1Cu 1Pb 0Zn	along river	040°	good correlation	4780-1580
LOW South West Corner	Conglo-merate & Sandstone (CSS)	1000m x 500 m	15	2Cu 2Pb 2Zn	along stream	random	poor correlation	4485-0550

Table 3 - Anomalous Values

ROCK TYPE POPULATIONS	SAMPLE NUMBER	ANOMALOUS VALUES FROM UPPER 10% QUARTILE. SIGNIFICANT VALUES (% OF POPULATION)			% TOTAL
Tertiary Basalt (TB)	82	111(8.5%)	25(9.8%)	173(8.5%)	4.6
Permian Tillite (PT)	32	113(9.4%)	51(6.2%)	174(12.5%)	1.8
Upper Slate & Phyllite (USP)	68	17(10.3%)	26(7.3%)	5(10.3%)	3.8
Conglomerate & Sandstone (CCS)	18	16(11.1%)	27(11.1%)	5(11.1%)	1.0
Lower Slate & Phyllite (LSP)	32	19(12.5%)	50(12.5%)	2(9.4%)±	1.8
Dolomite & Sandstone (DSS)	6	28(16.7%)	64(16.7%)	5(33.3%)	0.3
Black and Grey Slate (BGS)	181	125(9.4%)	51(10.5%)	120(9.4%)	10.1
Green Cleaved Tuff (GCT)	79	148(10.1%)	30(7.6%)	140(8.9%)	4.5
Tuff/Volcanic Breccia (TVB)	91	234(9.9%)	31(7.7%)	150(7.7%)	5.1
Green Grey Shale (GGS)	175	308(9.1%)	32(6.3%)	156(6.9%)	9.8
Upper Green-schist (UGS)	724	327(8.7%)	33(7.5%)	151(10.2%)	40.6
Lower Green-schist (LGS)	295	139(9.5%)	23(9.5%)	147(10.2%)	16.6
TOTAL	1783				100

Table 4 - Summary of Statistics

ROCK TYPE POPULATIONS	SAMPLE NUMBER	MEAN AND (STANDARD) DEVIATIONS) FOR: COPPER	LEAD	ZINC	% OF TOTAL SAMPLE
Tertiary Basalt (TB)	82	72(12)	14(20)	93(20)	4.6
Permian Tillite (PT)	32	52(20)	24(25)	68(25)	1.8
Upper Slate & Phyllite (USP)	68	8(9)	15(7)	4(3)	3.8
Conglomerate & Sandstone (CSS)	18	7(9)	13(16)	26(3)	1.0
Lower Slate & Phyllite (LSP)	32	13(10)	21(8)	1(1)	1.8
Dolomite & Sandstone (DSS)	6	42(6)	62(11)	2(2)	0.3
Black & Grey Slate (BGS)	181	72(50)	23(27)	68(40)	10.1
Green Cleaved Tuff (GCT)	79	90(18)	19(17)	92(13)	4.5
Tuff/Volcanic Breccia (TVB)	91	130(25)	20(23)	87(17)	5.1
Grey Green Shale (GGS)	175	163(11)	19(33)	89(15)	9.8
Upper Green-schist (UGS)	724	139(41)	12(20)	79(17)	40.6
Lower Green-schist (LGS)	295	56(19)	9(13)	78(34)	16.6
TOTAL	1783	103	15	74	100.0
	TOTAL WEIGHTED AVERAGES				

Table 5 - Normal Correlation Co-efficients (Log-Normal) Between the Three Base Elements Cu, Pb and Zn

ROCK TYPE POPULATIONS	SAMPLE NUMBER	Cu/Pb	Cu/Zn	Pb/Zn	% OF TOTAL POPUL-ATIONS
Tertiary Basalt (TB)	82	-0.38(-0.32)	0.66(0.81)	-0.50(-----)	4.5
Permian Tillite (PT)	32	-0.50(-0.03)	0.13(0.71)	0.10(0.24)	1.8
Upper Slate & Phyllite (USP)	68	0.47(0.52)	0.04(0.14)	0.20(0.29)	3.8
Conglomerate & Sandstone (CSS)	18	0.67(0.77)	0.38(0.40)	0.50(0.38)	1.0
Lower Slate & Phyllite (LSP)	32	0.76(0.73)	0.06(0.33)	0.41(0.42)	1.8
Dolemite & Sandstone (DSS)	6	0.95(0.90)	-0.28(-0.13)	-0.19(-0.05)	0.3
Black & Grey Slate (BGS)	181	-0.17(-0.17)	0.32(0.48)	-0.47(-0.47)	10.1
Green Cleaved Tuff (GCT)	79	-0.24(-0.26)	0.06(0.42)	-0.38(-0.28)	4.5
Tuff/Volcanic Breccia (TVB)	91	-0.09(-0.24)	0.22(0.36)	-0.31(-)	5.1
Green Grey Shale (GGS)	175	-0.13(-0.09)	0.23(0.24)	-0.20(-)	9.8
Upper Green-schist (UGS)	724	-0.09(0.02)	0.42(0.54)	-0.19(-0.22)	40.6
Lower Green-schist (LGS)	295	0.04(0.13)	0.16(0.52)	0.16(0.37)	16.6

SIGNIFICANT CORRELATIONS ARE UNDERLINED

APPENDIX 2.

472022

52 Murray Road ... W.A. 6155

ANALYTICAL REPORT No. 236.1 [illegible]

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

RECEIVED -3 JAN 1984 Ans'd..................

ORDER No. | PROJECT

Industrial & Mining Investigations
Suite 3709
Australia Square
Sydney NSW 2000

DATE RECEIVED	RESULTS REQUIRED
14.11.83	

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
		3	41

STATE OF SAMPLES		PRE-TREATMENT							ANALYSIS		
REFER BELOW	SAMPLE NUMBERS	DRY	CRUSH	SPLIT	PUL-VERISE	SIEVE	OTHER SEE REMARKS	NONE	REFER TO ANALYSIS SECTION	PREPARATION	METHOD
RO	MC27 (S1-S24)								MgO CaO Fe2O3		40
	MC28 (S1-S15)								SiO2 LOI		40
									S		40
PC	HM1 HM2	1							Sem Scan		

RESULTS TO

As above

RESULTS TO

REMARKS

STATE OF SAMPLES		ANALYSIS — PREPARATION				ANALYSIS — METHOD	
whole core	WC	perchloric acid	A1	cold acid	CA	atomic absorbtion	AAS
split core	SC	hydrochloric acid	A2	specific sulphide	SS	x-ray fluorescence	XRF
cutting	CU	nitric acid	A3	other mixed acids	Mo	spectrophotometry	SPEC
rock	Ro	aqua regia	A4	alkaline attack	AA	colorimetry	COL
soil	SO	nitric-perchloric	A5	volatilization	VO	chromatography	CHR
pulp	PU	HF mixture	A6	ignition	IG	titration	TTN
water	WA	HF under pressure	A7	pressed powder (XRF)	PP	other chemicals means	CHEM
tissue	TI	fusion	A8	glass fusion (XRF)	GF	miscellaneous	MISC
stream sediment	SS					fluorescence	FLUOR
heavy mineral	HM					inductively coupled plasma	ICP

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472023

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	236.1 08 2226	8.12.83		1 OF

TUBE No.	SAMPLE No	MGO	CAO	FE2O3	SIO2	LIO	Depth	Box		
1	MC27 S1	44.8	1.55	2.65	0.55	50.4	33.80	1		
2	MC27 S2	44.7	2.05	2.70	0.20	50.4	42.60	2		
3	MC27 S3	43.2	3.75	2.10	0.25	50.6	44.10	3		
4	MC27 S4	43.0	3.80	2.50	0.20	50.4	58.95	4		
5	MC27 S5	41.8	4.00	2.90	1.45	48.9	61.35	5		
6	MC27 S6	45.6	1.30	2.25	0.10	51.0	65.80	6		
7	MC27 S7	42.0	3.70	3.05	1.50	49.0	74.35	7		
8	MC27 S8	42.4	4.10	2.75	0.15	50.6	113.65	13		
9	MC27 S9	45.0	0.70	2.70	0.45	50.7	118.40	14		
10	MC27 S10	44.1	1.80	2.65	0.25	50.8	131.80	16		
11	MC27 S11	42.8	4.05	2.25	0.20	50.7	133.50	17		
12	MC27 S12	21.0	26.8	3.00	2.30	45.5	144.40	18	Dolomite	
13	MC27 S13	26.8	21.6	2.50	0.85	47.2	149.90	19		
14	MC27 S14	44.9	1.15	2.45	0.35	50.9	158.30	20		
15	MC27 S15	44.6	2.40	2.20	0.30	50.8	159.30	21		
16	MC27 S16	35.9	11.8	2.40	0.15	49.4	169.45	22	dolomitic	
17	MC27 S17	42.4	3.90	2.90	0.15	50.1	172.45	23		
18	MC27 S18	43.0	4.15	2.25	0.37	50.0	183.70	24		
19	MC27 S19	43.0	1.40	5.50	0.55	49.6	188.70	25		
20	MC27 S20	45.1	2.05	1.30	0.15	51.0	279.50	38		
21	MC27 S21	44.0	3.50	1.40	0.55	50.6	283.00	39	white magnesite low Fe.	
22	MC27 S22	42.6	5.30	1.20	0.35	50.5	289.70	40		
23	MC27 S23	45.7	1.80	1.30	0.10	51.1	317.40	43		
24	MC27 S24	46.2	1.10	0.80	0.30	51.3	322.45	44		
25	MC28 S1	41.8	2.00	2.60	5.00	48.1	55.00	2		

Results in ppm unless otherwise specified
T = element present; but concentration too low to measure
X = element concentration is below detection limit
— = element not determined

AUTHORISED OFFICER [signature]

472024

ANALABS

A division of McDonald Hamilton & Co. Pty. Ltd

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	236.1 08 2226	8.12.83		2 OF

LINE No.	SAMPLE No.	MGO	CAO	FE2O3	SIO2	LIO	Depth	Box		
1	MC28 S2	34.3	9.50	3.30	6.70	45.7	59.40	3		
2	MC28 S3	34.4	6.30	6.40	9.70	43.0	68.50	4		
3	MC28 S4	21.5	27.9	1.20	2.20	46.0	72.50	5		
4	MC28 S5	21.3	28.0	0.90	2.10	46.1	80.10	6		
5	MC28 S6	35.1	8.80	2.70	10.2	42.5	86.40	7		
6	MC28 S7	31.9	6.10	1.30	38.6	21.7	88.40	8		
7	MC28 S8	29.6	15.8	2.70	6.65	44.8	94.50	9		
8	MC28 S9	31.5	10.6	2.10	11.0	44.0	108.80	11		
9	MC28 S10	21.0	29.4	1.35	1.25	46.6	113.10	12		
10	MC28 S11	41.2	3.40	4.60	1.30	49.1	139.10	14		
11	MC28 S12	43.9	2.50	3.30	0.45	50.3	144.65	15		
12	MC28 S13	43.6	0.80	3.40	2.00	49.7	151.60	16		
13	MC28 S14	36.5	7.60	4.60	2.80	47.7	159.00	17		
14	MC28 S15	39.8	5.10	3.90	1.30	49.0	162.65	18		
15										
16										
17										
18	Note;	All results in percentage.								
19		Results based on as received samples								
20										
21										
22										
23	DETECTION	0.1	0.01	0.01	0.05	0.1				
24	DIGESTION									
25	METHOD	408	408	408	408	408				

Results in ppm unless otherwise specified
T = element present, but concentration too low to measure
X = element concentration is below detection limit
— = element not determined

AUTHORISED OFFICER [signature]

APPENDIX 3.

APPENDIX 3
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Institute of Energy and Earth Resources

Division of Mineral Chemistry

PRODUCTION OF MAGNESIA FROM SAVAGE RIVER MAGNESITE

(Progress Report No. 11: Continuous Pilot Plant Test)

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CONTENTS

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(Progress Report No. 11: Continuous Pilot Plant Test)

INTRODUCTION

In previous reports [1,2] the results of modifications to the pilot-scale autoclaves and of a series of batch leaching tests were detailed. Some of the modifications were necessitated by a number of problems that arose in the first of a proposed series of continuous leaching tests. Although it was planned to carry out further continuous leaching tests, IMI requested that we continue with laboratory-scale tests aimed at producing a high-grade magnesia containing $< 0.05\%$ Fe_2O_3 [3,4].

At the present stage it is not anticipated that the continuous leaching programme will be completed in the near future, so that it was considered appropriate that the results of the continuous test that had been carried out should be reported now.

EXPERIMENTAL

Prior to the commencement of the planned 24 h test, several 2-3 h mini tests were carried out in order to establish suitable operating procedures. These can be summarized as follows.

- 40 separate samples of bulk calcine [1,2], each weighing 0.75 kg, were prepared and stored in suitable containers placed on the upper platform of the test rig (see Fig. 6 in Ref. 1).
- The cooling system (stirrer glands and internal cooling coils) was activated.
- The turbine impellers were turned on.
- Valves on the transfer lines between each pair of autoclaves were shut.
- The indicating temperature controllers were switched on and set at the required temperatures (35.0°C in each case).
- The voltage regulators for the heating coils were set at the required values as appropriate to the operating temperature. The heater switches were in the off position.

- The autoclaves, sampling ports and drain lines were purged with high pressure carbon dioxide to ensure that they were open and free from liquor.
- After shutting the sampling ports and drain line valves, the autoclaves were pressurized with carbon dioxide at the required value (50 psig). The carbon dioxide delivery line valves were all preset at the same pressure.
- 25 ℓ tap water was added to the slurry mixing vessel and agitation of the latter commenced.
- The slurry pump was set at the required rate (equivalent to a flowrate of approximately 0.65 ℓ/min.).
- The first of the 0.75 kg samples of calcine was added to the slurry mixing vessel and the slurry pump started.
- Record each autoclave temperature at suitable intervals.
- After about 20 ℓ slurry had been pumped into No. 1 autoclave, the inlet valve was turned off, the pump stopped, and the remaining slurry removed from the mixing vessel.
- No. 1 autoclave heater turned on.
- 25 ℓ tap water plus the second 0.75 kg calcine sample added to the slurry mixing vessel and pumping recommended. Proceed as with first sample.
- Valves between each pair of autoclaves opened as soon as the overflow alarms sound.
- Turn on the heating coils of autoclaves 2 and 3 as soon as these contain a minimum of 10 ℓ pulp.
- Remove 10-20 ℓ (measured) reacted pulp from No. 4 autoclave as soon as the overflow alarm of this autoclave sounded. This necessitated stopping the agitation system for a short period. Repeat as required.
- Collect bleed and analytical samples from each autoclave as required. The sampling lines were purged before and after sample collection with high pressure carbon dioxide.
- Alter the operating temperatures and carbon dioxide pressure as required.

During and after the leach test, which was shortened to 23 h, several operating problems were encountered. These related to blockage of the inlet line, excessive leaking around the slurry pump gland housing, inadequate temperature control in Nos. 2 and 3 autoclaves*, and blockage of Nos. 2 and 3 autoclave drain lines. Despite these problems, it was felt that the first of the planned series of continuous tests had been successfully carried out.

RESULTS AND DISCUSSION

Table 1 is the operating log of the continuous leach test. The fixed operating conditions were initially set as follows.

50 psig carbon dioxide
3% solids pulp density
35°C (Nos. 1-3 autoclaves)

As noted in the log, both the carbon dioxide pressure and leach temperature were altered during the second half of the test.

Table 2 and Figs. 1 and 2 give the analytical data as a function of time for samples recovered from each autoclave. The following points are to be noted.

- There is a much greater variation in magnesium and iron concentration as a function time in No. 1 autoclave compared with No. 4 autoclave.
- The magnesium content of the leach slurry increases as the slurry passes from No. 1 through to No. 4 autoclave.
- The iron content of the leach slurry decreases as the slurry passes from No. 1 through to No. 4 autoclave.
- The variation of the magnesium content of the leach slurry as a function of time in each autoclave is at least partly related to the variation in the composition of the crude calcine.
- Variation of the leaching conditions in general had little apparent effect on the rate and degree of magnesium oxide dissolution. This is not totally unexpected since > 60% of the dissolution takes place in No. 1 autoclave, and with the exception of the operating carbon dioxide pressure, the operating parameters of this autoclave were not altered.

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*It was later found that the solenoid valves operating the cooling circuits were incorrectly installed. Much better control could be expected with the values in the correct position.

- Although "complete" dissolution of the magnesium oxide component of the crude calcine takes place before the slurry enters No. 4 autoclave, suggesting a shortened retention time could be used, such a move is a disadvantage in that it does not allow further reduction of the iron concentration as the slurry passes through all four autoclaves.
- The data are consistent with the results of the batch-scale leach tests reported previously [2].

CONCLUSIONS

Despite the fact that the test was not carried out under conditions that we now believe to be those necessary to reduce undesirable iron dissolution [4], the results of this single test do show that the proposed leaching process can be carried out on a continuous basis without the need to radically alter processing conditions and procedures.

If further continuous leach tests are to be carried out, then these will be performed under more appropriate conditions.

REFERENCES

1. J.H. Canterford and C. Moorrees, Production of magnesia from Savage River magnesite, CSIRO Division of Mineral Chemistry Report MCC 302 (1981).
2. J.H. Canterford and C. Moorrees, Production of magnesia from Savage River magnesite, CSIRO Division of Mineral Chemistry Report MCC 391 (1982).
3. J.H. Canterford and C. Moorrees, Production of magnesia from Savage River magnesite, CSIRO Division of Mineral Chemistry Report MCC 450 (1982).
4. J.H. Canterford and C. Moorrees, Production of magnesia from Savage River magnesite, CSIRO Division of Mineral Chemistry Report MCC 499 (1983).

Table 1. Continuous pilot plant leach test — operating log.

Time		Feed addition	Autoclave temperature (°C)				Autoclave sampled				Vol. slurry removed from No. 4 autoclave (ℓ)	Comment
Actual	Elapsed (min)		1	2	3	4	1	2	3	4		
0830												Activated control systems
0855	0	x	18.3	14.2	14.3	14.5						Feed slurry pump turned on
0913	18		20.6	15.2	14.8	15.4						
0915	20						x					
0916	21	x										No. 1 autoclave heater turned on (240 V)
0925	30		23.5	16.0	15.3	16.3						
0930	35											Valve between Nos. 1 and 2 autoclaves opened
0940	45		26.4	18.2	15.6	17.2	x					
0944	49											No. 2 autoclave heater turned on (240 V)
0950	55		28.1	21.8	16.0	18.1		x				Valve between Nos. 2 and 3 autoclaves opened
1000	65		30.1	24.9	19.9	18.8						
1004	69	x							x			
1007	72											No. 3 autoclave heater turned on (240 V)
1015	80		32.5	27.8	28.5	20.5						Valve between Nos. 3 and 4 autoclaves opened
1025	90		34.0	29.5	35.0	24.4						
1030	95									x		
1040	105	x	35.5	32.5	35.0	27.5	x				9.2	Voltage on Nos. 1 and 3 heaters reduced to 180 V
1055	120		35.0	34.0	35.2	28.5					12.4	
1107	132		35.0	34.5	35.0	29.0				x		
1115	140	x										
1120	145		35.2	34.5	35.0	28.5		x				
1130	155		35.2	34.4	35.2	29.0				x	12.5	
1140	165		35.2	34.2	35.2	30.0			x			
1148	173									x	4.3	
1154	179	x	35.5	34.3	35.2	29.8						
1158	183						x				15.1	
1208	193		35.0	34.5	35.2	28.5				x		
1212	197										12.0	
1220	205		34.8	34.7	35.0	29.3						
1233	218	x						x			10.4	
1252	237		35.3	34.5	35.0	30.1				x	14.6	
1306	251	x										
1316	261										15.1	
1330	275		35.2	35.2	35.3	29.5						
1335	280								x		16.0	
1342	287	x										
1357	302									x	14.0	
1405	310		34.9	35.0	35.2	29.4						
1418	323	x					x				15.1	
1435	340		35.0	34.0	35.0	29.0						
1441	346									x	14.4	
1455	360											Valve on slurry inlet side of pump blocked. Switched off for 10 min which cleared
1505	370		35.0	34.8	35.1	28.8						Recommenced pumping
1520	385							x			13.1	
1535	400									x	15.8	

Table 1 (continued).

Time: Actual	Time: Elapsed (min)	Feed addition	Autoclave temperature (°C): 1	2	3	4	Autoclave sampled: 1	2	3	4	Vol. slurry removed from No. 4 autoclave (ℓ)	Comment
1547	412	x										
1556	421		34.9	34.6	35.0	29.4						
1600	425								x		16.0	
1615	440		35.0	34.6	35.2	29.3						
1623	448	x								x	15.5	
1642	467						x				13.0	
1657	482	x										
1700	485									x	19.0	
1710	495		34.8	34.6	35.0	29.3						
1725	510							x			14.2	
1733	518	x										
1746	531									x	16.1	
1750	535		35.3	34.2	35.0	29.8						
1810	555	x							x		17.3	
1820	565		35.0	34.4	35.1	30.2						
1835	580									x	18.6	
1848	593	x										
1900	605										15.2	
1905	610		35.0	34.5	35.1	29.8						
1922	627	x					x				14.9	
1942	647		35.0	34.0	35.0	28.7						
1946	651									x	18.0	
1957	662	x										
2014	679							x			11.0	
2029	694	x	35.1	34.2	35.3	29.2						
2035	700									x	14.2	
2055	720								x		14.4	
2105	730	x	34.9	33.5	35.2	28.6						
2125	750									x	24.0	
2143	768	x										
2155	780						x				19.2	
2203	788		34.2	33.7	35.2	28.0						Temperature controller on No. 3 autoclave reset at 40.0°C
2217	802	x	35.0	33.0	39.0	29.5				x	17.0	
2224	819		34.8	33.3	40.1	29.4						
2245	830							x			16.0	
2256	841	x										
2300	845		35.0	33.5	40.3	29.0						
2312	857									x	16.2	
2330	875	x	34.7	33.5	39.9	30.6			x		17.0	
2358	903									x	15.2	
0005	910	x	35.1	33.5	40.0	29.7						
0027	932								x		16.2	
0035	940		35.1	33.6	40.1	30.5						
0045	950	x									16.1	Temperature controller on No. 3 autoclave reset at 35.0°C
0051	956		35.1	33.6	35.0	28.5						
0116	981	x						x			16.8	
0127	992		35.4	32.9	35.0	28.5						
0133	998									x	18.0	
0150	1015		35.0	32.5	34.9	27.4						
0158	1023	x										

Table 1 (continued).

Time			Autoclave temperature (°C)				Autoclave sampled				Vol. slurry removed from No. 4 autoclave (ℓ)	
Actual	Elapsed (min)	Feed addition	1	2	3	4	1	2	3	4		Comment
0203	1028								x		17.8	
0230	1055	x	34.9	32.3	35.1	27.8				x	17.2	Temperature controller on No. 3 autoclave reset at 25.0°C
0243	1068		35.2	33.2	30.0	27.9						
0250	1075		34.6	33.0	28.9	27.5			x		15.6	
0306	1091	x										
0310	1095		35.0	32.9	27.2	26.0						
0317	1102									x		
0345	1130	x	34.8	32.2	26.5	26.2			x		18.0	
0411	1156	x								x		Temperature controller on No. 3 autoclave reset at 35.0°C
0415	1160		34.8	31.6	28.5	26.2					18.5	
0427	1172		34.7	32.0	35.0	25.9						
0438	1183						x				16.0	Pressure reduced to 20 psig
0459	1204	x	35.3	32.2	35.0	28.2	x				19.4	
0515	1220		34.3	32.5	35.0	26.3						
0530	1235	x						x			19.0	
0552	1257		35.0	32.2	35.3	25.6						
0559	1264						x				17.0	
0602	1267	x										
0625	1290		35.5	32.5	35.0	28.0		x			16.0	
0645	1310	x							x		16.3	
0710	1335		36.5	32.2	34.6	26.5						
0715	1340	x								x		
0745	1370						x				14.2	
0755	1380									x		Shutdown commenced
0855	1440											Shutdown completed. Commenced cleaning out rig.
1055	1560											Clean up completed.

Table 2. Continuous pilot plant leach test — analytical data (g/ℓ).

Time		No. 1 autoclave		No. 2 autoclave		No. 3 autoclave		No. 4 autoclave	
Actual	Elapsed (min)	Mg	Fe	Mg	Fe	Mg	Fe	Mg	Fe
0915	20	5.82	0.053						
0940	45	5.77	0.055						
0950	55			6.24	0.060				
1004	69					6.68	0.053		
1030	95							7.27	0.040
1040	105	6.08	0.050						
1107	132							7.34	0.027
1120	145			6.97	0.043				
1130	155							7.52	0.029
1140	165					7.52	0.037		
1148	173							8.00	0.028
1158	183	7.40	0.058						
1208	193							8.19	0.030
1233	218			7.48	0.050				
1252	237							7.81	0.033
1335	280					7.81	0.044		
1357	302							8.19	0.039
1418	323	6.51	0.059						
1441	346							7.81	0.038
1520	385			7.67	0.049				
1535	400							8.37	0.037
1600	425					8.08	0.047		
1623	448							8.24	0.041
1642	467	8.15	0.073						
1700	485							8.37	0.042
1725	510			8.19	0.063				
1746	531							8.38	0.042
1810	555					8.05	0.049		
1835	580							8.19	0.042
1922	627	7.54	0.073						

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Table 2 (continued).

Time		No. 1 autoclave		No. 2 autoclave		No. 3 autoclave		No. 4 autoclave	
Actual	Elapsed (min)	Mg	Fe	Mg	Fe	Mg	Fe	Mg	Fe
1946	651							8.03	0.039
2014	679			7.63	0.055				
2035	700							8.05	0.039
2055	720					80.5	0.044		
2125	750							8.06	0.039
2155	780	7.33	0.067						
2217	802							8.19	0.042
2245	830			7.62	0.058				
2312	857							8.23	0.036
2330	875					8.03	0.045		
2358	903							8.17	0.036
0027	932					7.65	0.042		
0045	950							8.02	0.040
0116	981			7.48	0.053				
0133	998							8.14	0.042
0203	1028					7.65	0.046		
0230	1055							8.34	0.041
0250	1075					7.83	0.047		
0317	1102							8.36	0.048
0345	1130					8.18	0.053		
0411	1156							8.08	0.051
0438	1183	7.22	0.079						
0459	1204	6.78	0.067						
0530	1235			8.25	0.061				
0559	1264	7.83	0.067						
0625	1290			8.02	0.061				
0645	1310					7.95	0.053		
0715	1340							8.07	0.043
0745	1370	7.43	0.068						
0755	1380							8.04	0.044

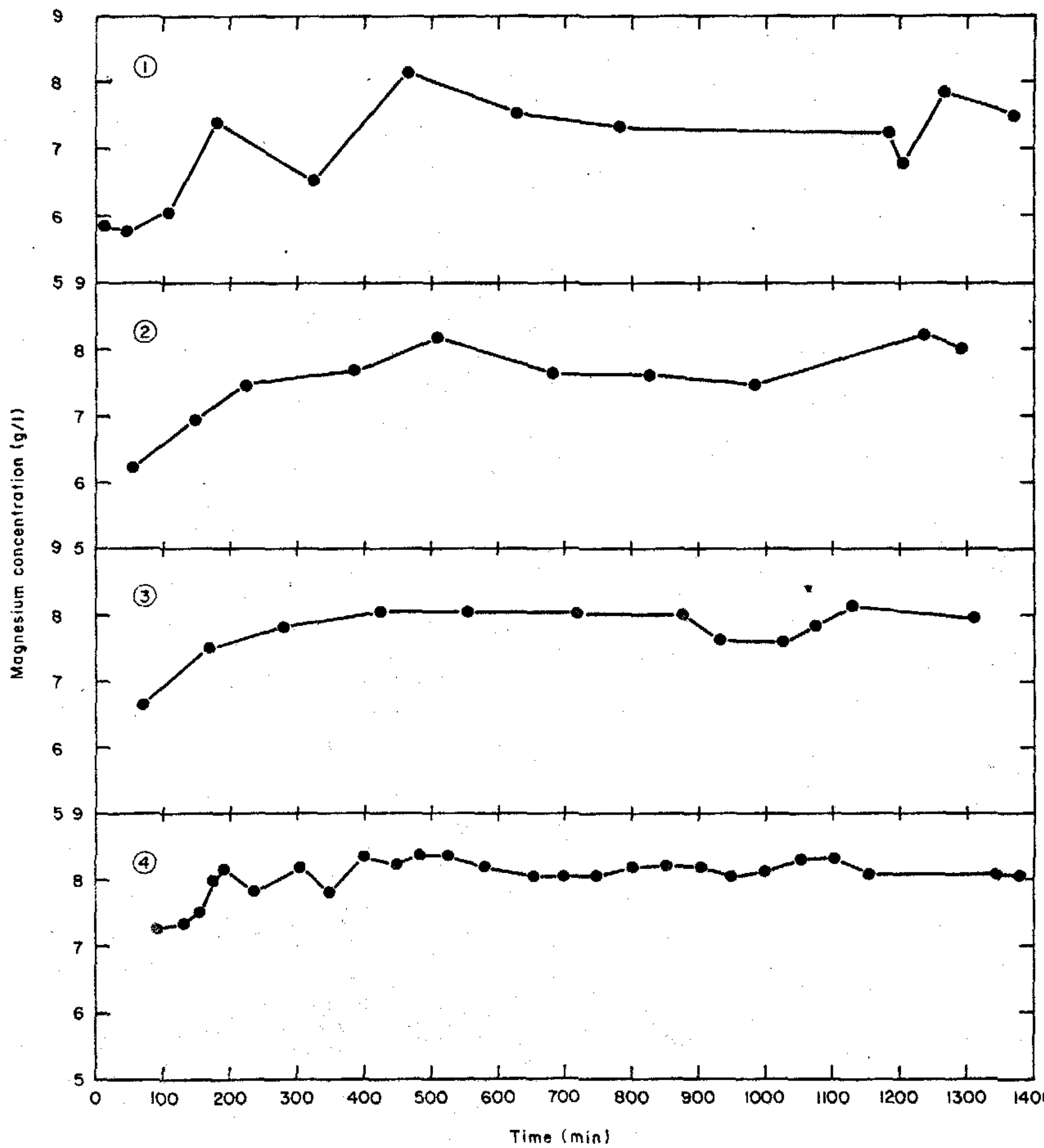

Fig. 1. Magnesium concentration of leach slurry as a function of time for each autoclave.

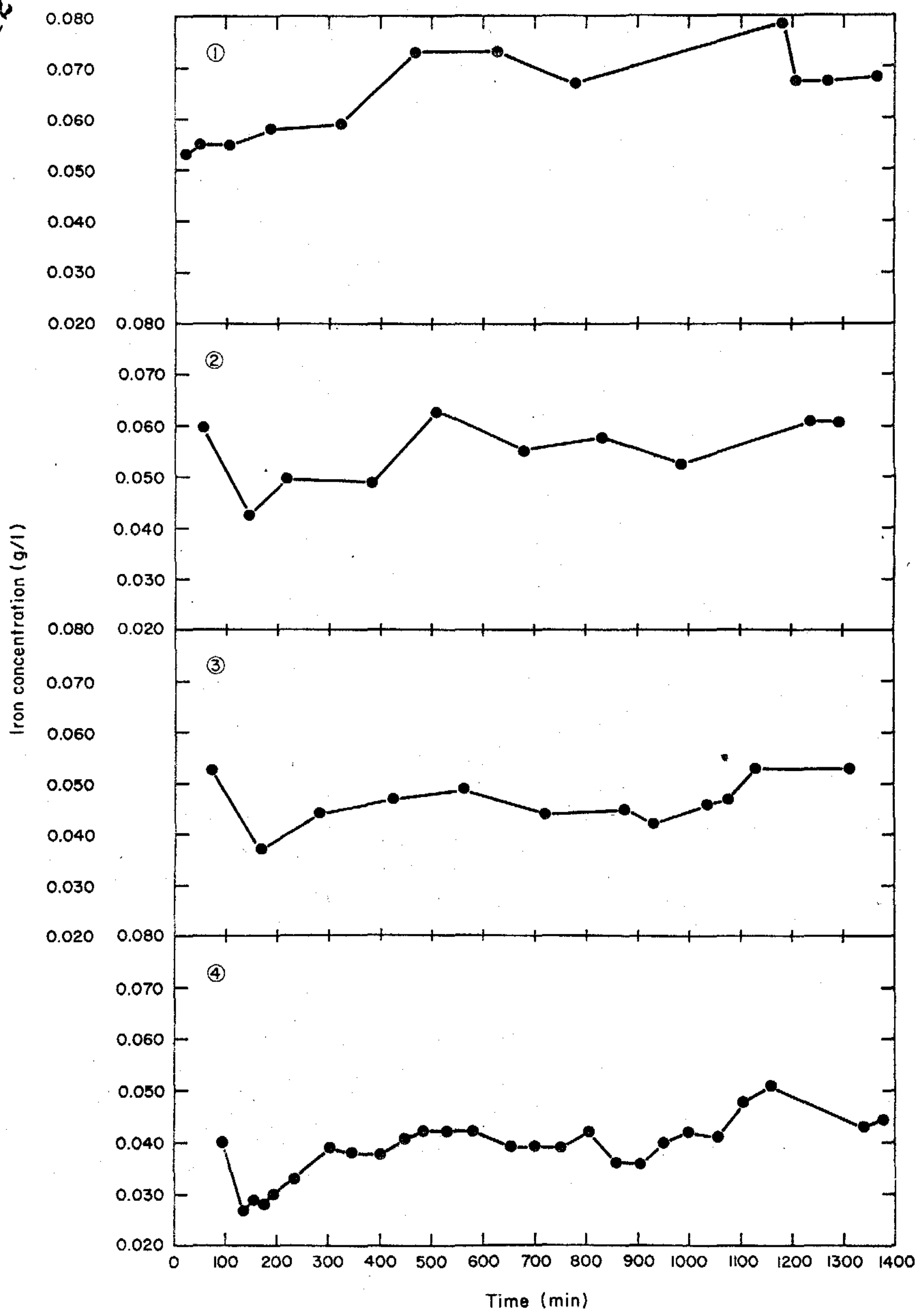

Fig. 2. Iron concentration of leach slurry as a function of time for each autoclave.