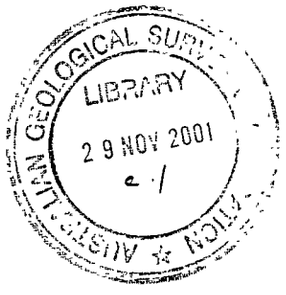

DEPARTMENT OF SUPPLY & DEVELOPMENT

COMMONWEALTH COPPER & BAUXITE COMMITTEE

2ND. REPORT

Interim Report on Copper Resources

TELEPHONE M 3901.

COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF SUPPLY AND DEVELOPMENT,

"~~WESTERN HOUSE~~", Century Building,
~~83 WILLIAM STREET~~, Swanston Street,
MELBOURNE, C.1.

In reply quote No.

4th August, 1941.

Senator the Hon. George McLeay,
Minister for Supply and Development,
MELBOURNE. C.1.

Dear Sir,

INTERIM REPORT ON COPPER RESOURCES.

Presented following 3rd Meeting of Committee held at Sydney, 1st August, 1941.

(a) INTRODUCTION.

1. The Copper and Bauxite Committee, at its initial meeting, saw the need for the coordination of the mass of reports already in existence throughout Australia in Government and private hands, and obtained the services of Mr. M.A. Mawby, Mining Engineer, as Technical Secretary to assemble them.

2. This he has now done, and his report, which fulfils item (a) of the Committee's terms of reference in respect to Copper, is attached as Appendix "A".

3. At the last meeting of the Committee, held on 1st August 1941 in Sydney, a review was made of this report, together with relevant other information supplied by Committee members.

(b) COPPER REQUIREMENTS.

4. For your information, the Committee presents the following:-

Australian Copper Tonnage Requirements

	Tons	
Defence	36000	
Commercial	22000	
	58000	Authority - Controller of Materials Supply.
Estimated Australian production 1941	22000	
Copper to be imported	36000	

Present Australian Yearly Refinery Capacity	Tons.	
Electrolytic Refining and Smelting Coy.	15,000	Authority -
Mt. Lyell Mining Pty. Co. Ltd.	14,000	Companies concerned.
	29,000	

Present prices of Copper.

Imported refined £480
Australian(old) £486/10/-
" (new) £92/-/-

5. From Mr. Hanby's report, the Committee has selected what it considers to be the best sources of Copper, in the order of their possible development, with estimates of potential tonnage.

6. In considering these, it must be realised that there are a number of intangibles that have yet to be investigated, and that also in respect to these, the Dept. of Supply and Development will be called upon to make certain decisions respecting financial assistance, and the basis for same, before they can be developed.

7. It will also be quickly seen that under present conditions, namely, present prices, operating and transport conditions, even if all of these main properties realise the estimated tonnage, many more new sources of Copper in Australia will have to be developed, or old properties exploited if it is the intention of the Government to be self contained in respect to its Copper supply during the war period.

8. Having these figures in mind, the Committee would be materially assisted in its presentations, if the Minister could instruct the Committee as to whether that is the intention, or whether the Government desires only to obtain the greatest amount of possible Copper under present conditions.

(c) INCREASED PRODUCTION.

9. A study of Mr. Hanby's report, and interim reports by Messrs. Ranst and Hanby, in respect to Laloki Mine and Mt. Chalmer's Mine, together with the following tabulation, indicate the potential Copper expansion :

Possible sources / ....

x Appendices "B", "C" and "D".

Possible Sources	Tons of New Copper per Year	Interval of Time to when this production can be reached.
Laloki G.M.	1000	6 - 9 mos.
Mt. Chalmers	1500	18 mos. Depending on underground conditions ascertained following dewatering.
Mt Lyell	500	
Lake George (from Lead concentrate)	850	Depends on Smelting capacity.
Mt. Isa (new Copper ore)	2500 5000	Depends on Mt. Isa intentions.
Mt. Isa (dross)	360	Depends on Smelting capacity.
Whim Creek	6000 1000 with 100 T today plant	Depends on solution of metallurgical problem - doubtful if under 2 yrs.
	12210	
Other reasonable sources are:		
Mt. Oxide Qld.	?	Depends on plant and rebuilding road to Dobbyn.
Trekelano Qld.	?	Depends on accelerated development.
90-Mile, Qld.	?	" "
Redbank N.T.	300	Depends on shipping.
Gouger Ore	?	Depends on higher prices and man power available.

10. The present position, and action taken by the Committee in respect to these properties is:-

(i) Laloki, Papua:

This Company has already had £10,000 from the Department of Supply and Development, and has made application for a further £2500. The Committee has arranged for a capable Mining Engineer to immediately visit the property and report to the Committee on the state of the property, its present management and possibilities of producing the estimated Copper output, and at what price. This should be completed within a month. This report will govern the Committee's recommendation.

(ii) Mt. Chalmers, Q.

The attached reports by Messrs. Keast and Mawby suggest that the Mine should be dewatered and milling tests carried out following which, if successful, recommendations will be made as to the method of putting the property into production. The Committee is in accord with the recommendations contained in the reports of Messrs. Keast and Mawby in reference to dewatering and obtaining samples at an estimated cost of £10,000. At today's meeting, Mr. Newman, on behalf of Mt. Morgan Co., stated that this Company would be prepared to supervise dewatering at Government cost and this company is submitting a proposal to then investigate the possibility of operating the property, which if feasible, it would undertake on some agreement satisfactory to the Government, the present owners and itself.

This proposal will be submitted for consideration at the next meeting of the Committee, tentatively fixed for the 14th August, at Brisbane.

(iii) Lake George, N.S.W.

The Lake George people are willing to establish flotation units at their plant, to produce a Copper Lead concentrate, if arrangements can be made to smelt it in Australia. This would add 850 tons per year to present production. The Committee is making inquiries of Electrolytic Refining and Smelting Company and Mt. Lyell Company to ascertain whether they could treat this product.

(iv) Mt. Isa, Q.

It has been reported that Mt. Isa has discovered a substantial Copper lode paralleling its Lead lode, and it is the intention of the Committee to meet the principal officers of the Company in Brisbane to discuss this new phase of their operations; also to ascertain if possible, its value in terms of new Copper, and if any, when production can and will be undertaken.

(v) Whim Creek, W.A.

The Committee has been informed that this property is under option to the de Bernales' group.

All reports indicate a very substantial tonnage of medium grade ore, but the solution of the metallurgical problem is still uncertain. The Committee is arranging for the Council for Scientific and Industrial Research in West Australia to test a parcel of representative ore to check the metallurgical premises of the present owners.

It should be realised that at the best, this property would take considerable time to bring into production, and that living conditions are rigorous to say the least.

(vi) Mt. Oxide, Q.

This property has an estimated tonnage of considerable proportions of good grade. Its location is such that during the wet season of several months, the present road is impassable. At the next meeting of the Committee in Brisbane, its potentialities will be discussed with Mr. Noland Blanchard, Geologist of Mt. Isa, who has studied it exhaustively.

(viii) Trekelano, N.T. The Committee has been informed that this most interesting, good grade and one of the deepest known Copper deposits in the Cloncurry District, is being worked at a minimum rate.

From reports received, it is possible that with accelerated development, the ore reserves and tonnage produced, could be materially and quickly increased. It is considered that, in view of the shortage of Copper, a closer investigation of ways and means to obtain this acceleration should be made by the proper Government officials.

(viii) 90-Mile, N.T. From information received, this is being developed rather slowly as is the case of Trekelano, and the Committee considers that possibly the same means should be taken to accelerate production as is indicated above for Trekelano.

(ix) Redbank, N.T. This property has considerable easily mined and high grade ore on the surface, but shipping space is needed.

It would be possible immediately to mine say two thousand tons if labor is available and stack same at the coast 40 miles away if a lighter and the necessary shipping could ultimately be obtained. The average estimated grade before sorting is around 15% and with sorting between 20% and 30%.

(x) Gouger Ore.

This is equally a difficult tonnage to forecast and the Committee is of the opinion that there is at all times a direct ratio between the price of copper and the tonnage obtained from this source. There have been indications during the past few months of a slight increase of production but nothing of real importance.

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10. In addition to all of the above, there are many old copper fields in Australia from which the oxidized ore was mined prior to present day metallurgical achievements which have not since been explored, and on which useful prospecting by geophysical methods and diamond drilling could be done with reasonable chances of proving additional copper ore. Instances of these are the Moonta Wallaroo fields, the Burra Copper Mine, the Blinman Copper Mine, the Bremer Mine, Mt. Hope and the Cloncurry field.

11. Whether the Committee should present a case for each or any ~~mx~~ of these, depends on the direction asked for above respecting the necessity or otherwise of obtaining all Australia's Copper requirements in Australia.

Yours faithfully,

(Sgd.) H. C. Raggatt, Deputy Chairman.

A. J. Keast)
J. M. Newman)
M. J. Martin) Members.
J. Horsburgh)
Commonwealth Copper & Bauxite Committee.

(Sgd.) A. C. Smith,
Secretary.

LC

(C O P Y)

THE ZINC CORPORATION LIMITED

BROKEN HILL, N.S.W.

July 22, 1941.

A.C. Smith, Esq.,
Secretary, Copper & Bauxite Committee,
Department of Supply and Development,
CANBERRA. A.C.T.

Dear Sir,

Enclosed are copies for all members of the Copper and Bauxite Committee of Mr. Mawby's report which represents a great deal of combing and summarising of a mass of reports and detail.

If you could have these distributed by the next airmail on receipt I think that there would be an opportunity for the Committee to meet next week to discuss our next action.

If the Committee members could be asked to telegraph their agreement to this, and to Mr. Mawby's suggestion to have Messrs. Kruttschnitt, Blanchard, and Blackett present it would then be in your hands to arrange the meeting. Any day but Monday or Tuesday would suit me.

Yours faithfully,

(Sgd.) A.J. KEAST.

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LC

THE ZINC CORPORATION LIMITED

BROKEN HILL, N.S.W.

July 21, 1941.

A.C. Smith, Esq.,
Secretary,
Copper & Bauxite Committee,
Department of Supply & Development,
CANBERRA. A.C.T.

Dear Sir,

The duty of your Committee was defined by the Minister for Supply and Development and Munitions on 21st May, 1941, as follows:-

"1. To inquire into the resources available in Australia for the production of copper and bauxite, and to advise in particular on the following questions in relation to any unused resources which the Committee may consider should be utilised for war purposes.-

(a) the qualities and quantities of ore available at particular sites

(b) the treatment required to produce material suitable for use in War production,

(c) the transport required in relation to the production of ore and of its treatment to the point of use in War production,

(d) the labour, materials and equipment required to establish particular new production,

(e) the time required to establish such production, and

2. To advise on any Commonwealth assistance or other action which, in the Committee's opinion, would be necessary or desirable to ensure production from any resources which it considers should be utilised for War purposes."

As technical secretary to your Committee I have realised that before any detailed investigation could take place for an increase in copper production, Clause (a) of the above required amplification, and I have written the attached notes on "the qualities and quantities of ore available at particular sites." The notes have been compiled from the various reports of the Departments of Mines and private investigations. I have attempted to epitomise all available information on the more important copper deposits of Australia.

Already the Mt. Chalmers Mine, Queensland, and the Laloki Mine, Papua, have been closely investigated and recommendations made; but before any further detailed investigations are commenced a statement of the real position of the Australian copper demand is necessary. This must be considered in relation to the possibility of obtaining copper supplies from overseas, as the whole economics of increased copper production are involved. Copper is indispensable to many war industries but how far may we proceed before the production cost of copper assumes major importance?

Many applications for consideration of certain mines are being received from members of Parliament, civic bodies, etc. Only mines with known reserves or deposits from which high grade ores can readily be obtained should be considered at this stage; but a following policy of exploration work, particularly drilling, of the more promising mines should be instituted in collaboration with the State Mining Departments.

The management and technical organisation of any proposed programme is of vital importance and for this reason any operating companies who are interested in, or in the neighbourhood of, potential copper producers should be approached. The Mt. Isa Company can materially contribute to an increase from their own leases and the Cloncurry field; the New Occidental Gold Mines Limited may assist in the Cobar area, and other large companies such as Burma-Malay Limited, who are engaged in copper prospecting activities, may provide useful services with the purpose of speeding up our work. I would propose that representatives of the Mt. Isa Company (preferably Messrs. Kruttschnitt and Blanchard), and of the New Occidental Gold Mines Limited be invited to attend the next meeting of the Copper Committee.

Yours faithfully,

(Sgd.) M. MAWBY..

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LC

INTERIM REPORT ON POSSIBILITY OF INCREASED COPPER PRODUCTION IN AUSTRALIA

At the second meeting of the Copper and Bauxite Committee held in Sydney on 12th and 13th June, 1941, I submitted the following programme of investigation, which was approved:-

1. Possibility of increased production from Mt. Lyell, Mt. Morgan, New Occidental, and present producing mines. Ascertain "bottleneck" in each case.

2. Possibility of production from non-producing or small producing areas such as -

   (a) Mt. Chalmers, Queensland
   (b) Cloncurry district, Queensland
   (c) Whim Creek, Western Australia
   (d) Cobar Shield, N.S.W.
   (e) South Australian fields
   (f) West Australian fields
   (g) Other known cupriferous areas.

3. Possibility of production from -

   (a) B.H. Associated Smelters - Mt. Gunson siliceous copper ore.
   (b) Lake George lead concentrate (1,000 tons copper per annum)
   (c) Copper ore bodies in hanging wall of Black Star and Black Rock ore bodies, Mt. Isa, Queensland.

4. Reliability of supplies from overseas.

1. Present Producers - Ascertain full capacity limits and any reasons why production cannot be increased. Information from head offices of companies and possible visit to each operation.

2. Potential Producers - Collection of information proceeding in Mt. Chalmers, Cloncurry district, Mt. Oxide, Whim Creek, Redbank (N.T.) and South Australian occurrences.

3. Production as Bye-Product Lead Producers - Pt. Pirie taking maximum amount Mt. Gunson ore replacing barren siliceous flux.

   Lake George position requires experimental tests and company data.

   Mt. Isa to supply outline of possibility.

4. Overseas Supplies - Dependent upon war and shipping conditions.

The most important consideration in all of this work is the assessment of the urgency and tonnage of copper required for Australian industry above that produced from present operating mines. It is also assumed that Rhodesian blister copper is available from the port of Beira in Portuguese East Africa; and the relative economics of importing copper even under the present difficult shipping position should be examined. I have no knowledge of the above - but such knowledge must be available to the members of the Committee before any recommendations are made for large appropriations of Commonwealth money to present and potential copper producers for increase of output.

At present the chief producers of copper in Australia are

Mt. Lyell Mining and Railway Co. Ltd., Tasmania
Mt. Morgan Ltd., Queensland
Chillagoe State Smelters, Queensland
New Occidental Gold Mines, Cobar, N.S.W.
Electrolytic Refining and Smelting Co., Pt. Kembla, N.S.W.
Broken Hill Associated Smelters, Pt. Pirie, South Australia.

Mt. Lyell Mining and Railway Co. Ltd.

The current copper output of the company is at the rate of 12,000 tons per annum.

Expansion of copper production has been the aim of the Directors and General Manager for a long while past and orders for additional equipment were placed in Australia and England over twelve months ago. Delivery of these orders is now in progress. The labour position, both as regards skilled and unskilled labour, is an important consideration in this field and apart from the installation of the additional plant an adequate supply of labour will be necessary before increased copper production can be expected.

There is no doubt that this progressive company will force copper production to the limit of their capacity.

Mount Morgan Limited

Present production is now about 100 tons per week of copper. This company is handling a large tonnage of low grade copper ore by open cut operations, involving the removal of much overburden. The treatment plant has been extended to increase copper production which is dependent upon rate of removal of overburden allowing the mining of the deeper higher grade copper ore.

The company reports that "owing to the limited supply of water, the throughput of our treatment mills are at present somewhat handicapped." Preliminary surveys have been made by the Government Engineer and the company is anxious for commencement of the improved water supply.

The Secretary of the Copper and Bauxite Committee - Mr. A. C. Smith - has written the Under Secretary, Department of Mines, Brisbane, drawing attention to the urgent necessity for the required water supply which will become more urgent as the tonnage of sulphide ore increases.

Chillagoe State Smelters

At this State operated plant one water-jacketed blast furnace measuring about 14' x 4' at the tuyeres is in use and handles about 100 tons of ore and fluxes per day, excepting week ends when it is banked down for 36 hours. The smelting duty is about 3.6 tons per square foot of the area at tuyeres, a smelting rate which could be increased some 50% if ore was available. Generally about 80% of the ore tonnage is derived from the Cloncurry field. High grade siliceous gold ores are also smelted. A garnetiferous flux averaging about 1% copper, 1 dwt gold is quarried about 2 miles from the Smelters The plant is efficiently operated and adapted for considerable expansion if the outlook for ore supplies provides warranty.

There is no doubt that the policy of the Queensland Government is to keep this smelter in operation even though working losses are sustained. It appears uneconomical to have the smelter at Chillagoe when most of the ore is hauled from mines 830 to 1000 miles distant in the Cloncurry mineral field. The smelter officials however are optimistic and hope that the increased copper price will result in increase of copper ore from nearer mines, and also that the prospecting operations of the Burma-Malay group in the new Mitchell River copper area will result in a new source of copper ore for the smelters

Increased production from this source is thus dependent upon the production from gougers and small syndicates operating in Central and Northern Queensland. As an indication of production :

Year	Ore treated tons	Copper tons	Gold Fine oz.
1930	13,888	2,280	583
1931	24,097	2,534	1,216
1932	29,666	2,871	2,034
1933	25,427	2,844	5,642
1934	23,023	2,192	5,352
1935	16,094	1,645	6,187
1936	20,862	1,962	8,704
1937	25,185	2,487	13,771
1938	24,833	2,136	16,687
1939	27,368	2,185	19,545
1940	22,398	2,183	17,106

Note: Smelters did not operate March, April and May, 1940, on account of dislocation of rail traffic due to excessive wet season, and general coal strike.

New Occidental Gold Mines N.L.

At present operating the New Occidental and New Cobar Mines. The New Occidental ore is direct cyanided for the recovery of gold, but the New Cobar ore is treated by flotation for the recovery of a copper-gold concentrate.

The present production of refined copper is 584 tons per annum compared with 500 tons per annum for the previous two years. Increased copper production can be obtained from -

(1) Jubilee orebody - New Cobar Mine
(2) Gladstone Mine
(3) Chesney Mine

The Jubilee orebody is to be tested by driving 200 feet north of present New Cobar workings, and at 20/6/41, 63 feet had already been driven. If anticipated results are fulfilled the copper production of the company will be increased by about 200 tons per annum; commencing within the next two or three months.

The lease of the old Gladstone Mine was the subject of a complaint of non-fulfilment of labour conditions by the company but the Warden's decision to cancel the lease was disregarded by the Minister of Mines "in order to allow the Lessee a period of two months in which to comply with the labour conditions". It is the company's intention to carry out exploratory diamond drilling and other work if this lease is obtained. This work would take from six to nine months.

The Chesney Mine is reputed to have ore reserves of 614,000 tons assaying 2.5% copper, 0.9 dwts. gold per ton. Shaft sunk to 950 feet and no plant available. Matter of unwatering and sampling this mine is now being considered by the management. It is probable that one to two years would be necessary to place this mine on a producing basis.

The Board of Directors of this Company have advised that a full report on their position has been forwarded to the Committee on 14th July, 1941.

Broken Hill Associated Smelters

The following information relating to the production of copper in recoverable form is supplied by the company:

"(1) Copper content of Broken Hill ores 1675 tons
(2) Miscellaneous 100 "

(Note: (1) and (2) on the basis of present scale of lead smelting operations and grade of material)

(3) Mount Gunson copper ore = say 800 "

(Note: On basis of 350 tons ore per week containing 4.5% copper)

Estimated copper input per annum

2575 tons

Recovery in saleable product = say 91%

Equals 2343 tons of copper in copper matte and speiss

The ratio of speiss to matte is 1 to 5
therefore the above copper would be produced

(a)	in matte	1953	tons	per annum
(b)	in speiss	390	"	" "
		2343	"	" "

The production of copper matte is forwarded to the Electrolytic Refining and Smelting Co., Pt. Kembla for the recovery of the copper Technical difficulties prevent the recovery of the copper content of the speiss which is at present being held here pending the discovery of a market.

The matte grade is :

45% copper
16% lead
17 ozsssilver per ton

The Broken Hill output will remain practically constant. The Mount Gunson ore carrying about 80% silica has replaced the barren siliceous flux used in the smelting operations; and the 350 tons per week is the limiting tonnage that can be smelted. The ore reserves and grade of the Mount Gunson deposit are unknown and the above mentioned grade of 4.5% may be decreased to from 3.5% to 4.0%.

Mt. Isa Mines Ltd.

The Manager, Mr. C.R. Hilton, advises:

"Copper does occur in both of these sections (Black Star and Black Rock) of our mine and the possibility of production has had our attention for several years. To this date there is not sufficient data to prove or disprove the existence of any extensive deposit.

In the Black Rock section the deposit occurs as oxide and carbonate copper together with more or less native copper in a silicified brecciated zone. Considerable work was done towards the exploration of this deposit several years ago and the conclusion was reached that it consisted of a small lens of no great depth. Being a silicious ore without sulphur it was refused by Chillagoe State Smelters although one Tributer was able to dispose of a small tonnage of sorted ore to that smelter. It was decided to defer further extraction, as the selective mining was wasteful, and to conserve the entire deposit for use as silicious flux if the sulphide copper occurrences, which had been indicated by the deeper diamond drilling, were extensive enough to warrant the installation of milling and smelting plant.

In the Black Star section the deposits appear to be erratic both as to location and grade of ore. They occur in dolomite some distance from the lead mineralization. Early day diamond drilling disclosed occurrences of sulphide copper in the deeper holes, the upper limit being slightly above the elevation of the present No. 7 level (875 feet below the surface). In 1939 a series of horizontal drill holes was put out from No. 7 level drive into the promising area, but the results were disappointing. During the past year development of the lead orebodies has proceeded to No. 8 and No. 9 levels and diamond drill exploration of the dolomite areas for copper occurrences has been carried on continually as lateral

development has proceeded. The work to date does not indicate continuity in the copper mineralization, although several plums of fair size and grade have been intersected. Exploration will be continued and will be followed by development if considered feasible and within the financial resources of the company.

Our milling staff has already made flotation tests upon drill core samples and we have given considerable thought to the subject of ways and means of concentrating the ore and smelting the concentrates.

We should like to assure your Committee that it is our wish to co-operate to the fullest extent toward the expansion of copper production and will treat the matter as one of importance and urgency".

Under present operating conditions 2,000 tons of lead-copper dross assaying 62% lead, 54 ozs. silver per ton and 18% copper is produced annually.

Arrangements have been made to have 1,900 tons of this material treated abroad, leaving about 1,000 tons on hand. It is probable that a dross smelting furnace will be erected at the mine.

Recent drilling on the No. 8 level of the Black Star lode has been encouraging, but the copper ore bodies appear to be isolated masses occurring in the dolomite hanging wall. No attempt can be made at an estimation of ore reserves until further exploratory work is undertaken to delineate the boundaries of the copper ore occurrences.

Lake George Mines Ltd.

This company is mining and milling a complex, fine grained lead-silver-zinc-copper-gold ore producing a lead-silver-copper concentrate zinc concentrate and a pyrite concentrate for acid manufacture.

The Managing Director advises "that it is feasible to separate from our lead concentrate a copper concentrate having the following approximate analysis:

	%
Copper	18
Lead	7
Zinc	7
Iron	22
Sulphur	30
Insolubles	5
Soluble gangues	11

The tonnage of the above concentrate should amount to 400 tons per month. We have attempted to sell this product to the Electrolytic Refining and Smelting Co. at Port Kembla, but have been advised that, because of the high lead and zinc contents of material received from Pt. Pirie, it is unable to accept our concentrate. Recently, we have been informed that, after certain additions are made to the plant which will take about four months, it is expected that a certain part of the tonnage can be accepted."

This mine can therefore produce about 850 tons copper per annum for Australian requirements providing a treatment for this copper-lead product is available in Australia.

Read-Roseberry Mines, Tasmania

These mines operated by Electrolytic Zinc Co. produce some 33 tons lead concentrate per day containing 3% copper. Owing to the fine microscopic association of the copper and lead minerals, the separation of an enriched copper product from the lead concentrate is not deemed possible. The lead concentrate is despatched overseas and the copper content of approximately 350 tons per annum is not available for Australian consumption.

Electrolytic Refining and Smelting Co. of Australia.

The following table shows the receipts of paid for copper at Port Kembla:

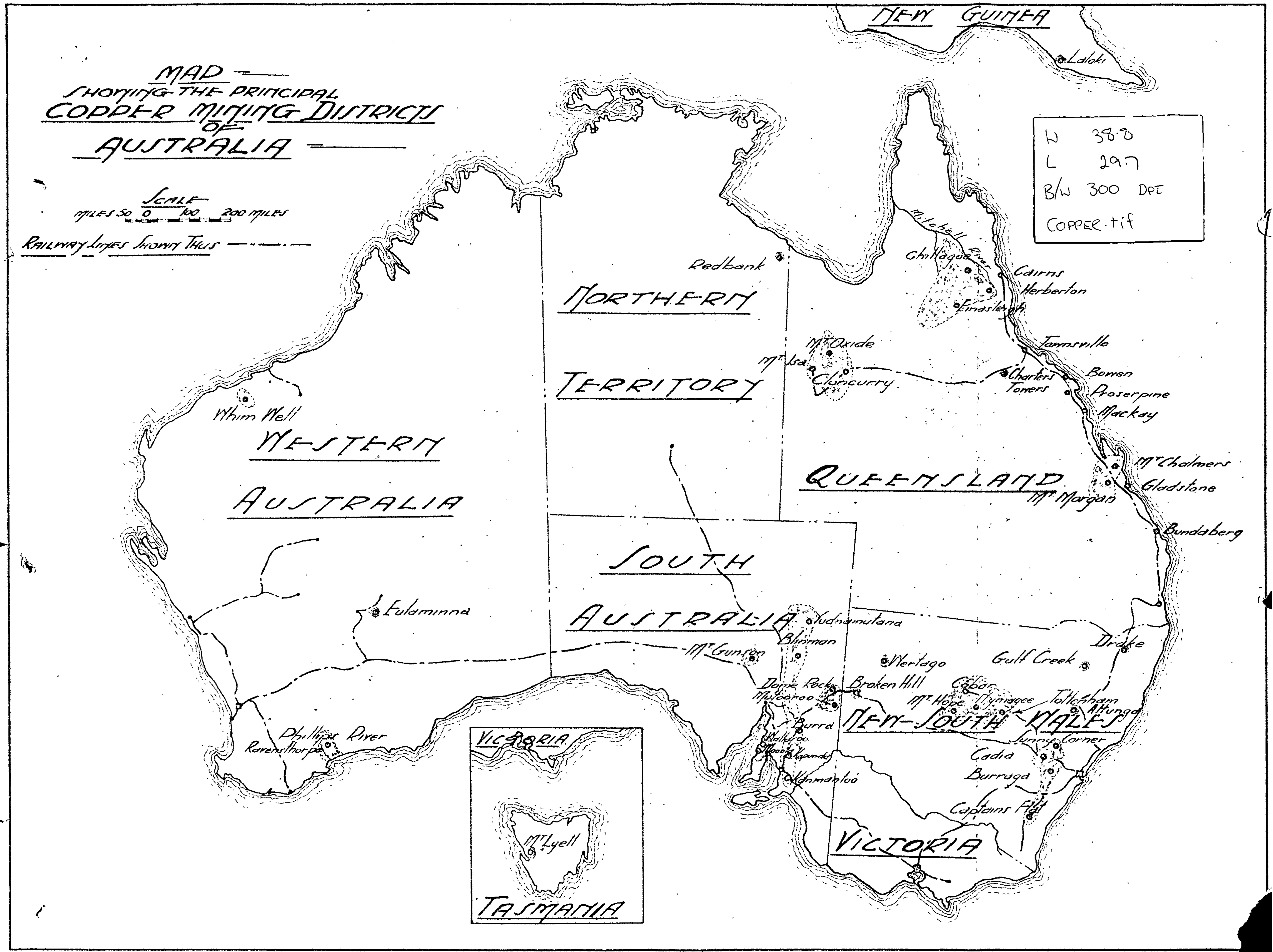
Vendor	Year ended 31/12/40 Tons	Six months ended 30/6/41 Tons
Mt. Morgan Limited	4,465	2,420
Mt. Lyell M. & R. Co. Ltd.	10,400	5,337
New Occidental Gold Mines, N.L.	520	319
Broken Hill Assoc. Smelters Pty. Ltd.	944	1,260
Chillagoe State Smelters	2,435	760
Electrolytic Zinc Co. of A/asia. Ltd.	247	24
Mandated Alluvials, N.L.	83	10
Moonta Copper Recovery Ltd.	76	60
Sundry Gougers	93	42
TOTALS =	19,263	10,232

SUMMARY OF PRODUCTION - PRESENT LARGE PRODUCERS AND LEAD MINES

Present Producers	Position	Present Production Rate
Mt. Lyell	Additional plant and equipment on order and being installed - subject to deliveries and satisfactory labour supply production will be increased gradually.	12,000 tons p.a.
Mt. Morgan	Increased production dependent upon quick rate of overburden removal and installation of additional water supply	4,800 " "
New Occidental	Increasing production steadily with probable acceleration of productions by working of Gladstone lease and Chesney Mine	584 " "
Chillagoe	State smelters dependent upon gouger and small syndicate operations	2,200 " "

Lead Producers	Product	Copper Contents p.a.	Realisation
Broken Hill Associated Smelters, Pt. Pirie	Copper matte	1,953	Port Kembla
	Copper speiss	390	Overseas
Lake George Mines Ltd., Captains Flat, N.S.W.	Copper-lead concentrate	864	Overseas
Electrolytic Zinc Co., Read-Roseberry, Tasmania.	Lead concentrate	350	Overseas
Mt. Isa Mines Ltd.Mount Isa ✗	Copper-lead dross	360	Overseas
		3,917 tons of which 49.8% is at present recovered in Australia	

✗ Copper orebodies being explored. Copper-lead dross figures apply to smelting of lead concentrate.



MAP
SHOWING THE PRINCIPAL
COPPER MINING DISTRICTS
OF
AUSTRALIA
SCALE
MILES 50 0 100 200 MILES
RAILWAY LINES SHOWN THUS
W 38.8
L 29.7
B/W 300 DPI
COPPER.tif
NEW GUINEA
Laloki
WESTERN AUSTRALIA
NORTHERN TERRITORY
QUEENSLAND
SOUTH AUSTRALIA
NEW-SOUTH WALES
VICTORIA
TASMANIA
Whim Well
Eulaminna
Phillips River
Ravensthorpe
Redbank
Mitchell River
Chillagoe
Cairns
Herberton
Einasleigh
Townsville
Mt. Oxide
Mt. Isa
Cloncurry
Charters Towers
Bowen
Proserpine
Mackay
Mt. Chalmers
Gladstone
Mt. Morgan
Bundaberg
Yudnamutana
Blinman
Mt. Gunson
Dome Rock
Mutooroo
Burra
Wallaroo
Moonta
Kapunda
Wertago
Broken Hill
Cobar
Mt. Hope
Nymagee
Tottenham
Gulf Creek
Drake
Attunga
Sunny Corner
Cadia
Burraga
Captains Flat
Mt. Lyell

CLONCURRY FIELD

The Cloncurry mineral field consists of an area about 200 miles by 130 miles in which there are many outcrops of copper ore. Very few of the copper lodes have been tested to appreciable depths and many of the operations have been of the "gouger" type, wherein the richer lenses of ore only have been mined; and the ore hand-picked prior to disposal to the Chillagoe State Smelters. Plants have operated on some of the larger mines e.g. Mt. Elliott, Hampden and Hampden Consols, Mt.Cuthbert etc., but in most cases operations were suspended on account of the low and fluctuating price of copper and the decrease in the copper content of the ores below water level.

In some areas such as Mt. Oxide and other mines particularly in the northern portion of this mineral field several adverse factors have prevented continuous working operations. The mines are often remote from towns offering the amenities of community life, and the wet season of four months - December to March - with tropical climate and the cessation of usual transport facilities do not encourage a stable labour force.

Several relatively small companies have been interested in the field but their operations have been confined to selective mining. The richer mixed oxidised-sulphide ores from the zone of secondary enrichment, in many instances, well repaid expenditure; but no one has exercised sufficient initiative to test the behaviour of the lodes at depth. In 1926, an American H. S. MacKay, reporting on the Mt. Elliott properties elaborated on the existence of considerable areas of "porphyry copper" - a term which was associated with successful large, low-grade American copper mines - and he recommended certain expenditures both in drilling operations and plant, all of which were doomed to failure by his "wrong diagnosis."

Sir Herbert Gepp in 1933 had reported against the provision of a smelter in the Cloncurry district. He considered that the easily obtained richer ore was mined prior to 1920, and that despite the expenditure of thousands of pounds in exploration and development, there was a steady diminution in ore reserves of profitable ore and developments at depth were disappointing.

Mr. A. F. McAskill in 1937 examined the potentialities of the field and suggested the erection of small reverberatory smelting plants at key localities throughout the field to operate as subsidiaries to the Chillagoe State Smelters. The initiation of a smelting campaign required that the ore reserve position of each mine and the fluxing qualities of the different ore types were known. This examination has only partially been carried out in the Kajabbi area; wherein the grade and tonnage of primary sulphide ores has never been tested.

Since 1935, the Aerial, Geological and Geographical Survey of Northern Australia have examined several areas within the Cloncurry field. During 1936, Mt. Oxide and Mt. Freda deposits were examined. The gold-copper ratios of the copper ores of Cloncurry field received attention in 1937, and it was found that the average ratio was 1 dwt. gold per 10% copper. The Lochness area, 75 miles north west Cloncurry received attention during 1938, The Survey was disbanded in 1940, but at the present time a general report on the Cloncurry district with map is in the hands of the Commonwealth Printer.

Following such a long period of stagnation the Cloncurry field has been practically condemned as a copper producer. The general opinions of -

(1) Narrowing of lodes at depth
(2) Impoverishment of copper values in the primary ore zone.

(3) Isolation with attendant high freight costs
(4) Climate disadvantages
(5) Troublesome labour forces
(6) Uncertain price of copper

have always been associated with this field.

But are they real? Underground developments at Trekelano have proved that in this mine the grade and tonnage of ore per vertical foot of depth have been generally maintained. Few, if any, of the mines have been tested at depth by a vigorous drilling and developmental campaign. It is very doubtful whether anywhere in the world there exists such a large number of copper lodes untested at depth as in this field.

Isolation, climatic disadvantages and troublesome labour soon disappear with the establishment of permanent industry and the present settled state of the Mt.Isa community proves that such operating disadvantages are inevitably connected with only the pioneering stage of mine exploration and development. The term "low grade ore" in this field is generally applied to one with maximum content of 5% copper, but such ore cannot be regarded as low grade on world standards.

The fluctuating price of copper is certainly a real deterrent in exploration of copper resources, particularly in view of the large, rich deposits of North Rhodesia and the Congo - the total production of which is exported. Our fortunate geographical position in relation to shipping port of Beira, from which Rhodesian copper is exported, helps to make copper mining a speculative enterprise in normal times when shipping is available.

The Queensland Government has given every assistance to prospectors and gougers in the way of machinery and developmental grants, reduced railway freights to Chillagoe Smelters and technical advice. A special freight rate of £1.1s.6d. per ton of ore from Cloncurry to Chillagoe is now in force and attached Table 'A' shows the amount payable for varying grades of copper ore delivered at Chillagoe State Smelters, while Table 'B' summarises the annual copper production from the Cloncurry field with annual average copper prices.

Present Position:

The approximate weekly despatches of ore from the Cloncurry district are about 70 tons semi-oxidised ores from Mt. Oxide, 140 tons sulphide ore from Trekelano (lately reduced) and 40 tons from other sources, chiefly oxidised ores. The average grade is about 14% copper.

At the Trekelano Mine there has been no real policy of development, the ore being obtained by stope development rather than actual stoping. The private holding syndicate is loath to spend money in development of an exploratory nature. The ore with its iron and sulphur content plus a carbonate gangue is valuable to the Chillagoe Smelters, who have built up several months' stocks of this ore for fluxing purposes.

At Mt. Oxide the mining operations are those of selectively mining the richer portions of the orebody by tributing parties. Operations of this type may produce copper, but will never test the possibilities of this lode as a large copper producer.

General gouging operations on the many small mines have not been materially increased with the added incentive of higher copper prices Owing to the war and general increase in employment throughout the country, there is not available sufficient unemployed, experienced men with mining experience to work the more promising mines. Syndicates and companies are not attracted by the increased price due to the possible fall, when shipping becomes normalised after cessation of the war.

The larger mines of the field are held by Mt. Elliott Limited. This company has in recent years lost money in Victorian deep lead mining - Talbot Alluvials Limited - and their financial position is not strong. They have evidently fulfilled labour conditions, but for many years have been content to let their mines on tribute, rather than carry out any developmental or operating policy.

The attached Table 'C' shows the ore possibilities of the larger mines of the Cloncurry field practically all of which are held by the Mt. Elliott Company. Brief resumes of the more important mines are also attached. Information has been obtained from the following sources -

1. Lionel C. Ball. "Cloncurry Copper Mining District," Queensland Geological Survey. Pub.No.215, Parts 1 and 2, 1908.

2. Edwin S. Berry. Report on Mt. Elliott, Queensland, Australia. (for Hayden, Stone & Co., New York) March,1920.

3. C. G. Gibson. Report on Mining Properties of the Hampden-Cloncurry Copper Mines Limited in the Cloncurry District, North Queensland, 22:8:17.

4. H. S. Mackay. "Report on the Mines owned by Mt. Elliott Limited, in the Cloncurry District, Queensland, Australia.

5. Dr. J. Gustafson. "Notes on Copper Mines of Mt. Elliott Limited, Cloncurry District, Queensland, 31:1:38.

   "Mount Oxide and Orphan Copper Mines, Cloncurry District, Queensland" 14:1:38.

6. G. A. More. "Investigations of the Production of Copper Ores in the Cloncurry District, Queensland." 21:11:40.

7. References in Queensland Government Mining Journal.

8. References in publications of Aerial, Geological & Geophysical Survey of Northern Australia.

9. Conversations with officials of Queensland Mines Department, June, 1941.

As mentioned earlier, the Mt. Isa Company have distinct possibilities of discovering economic copper lodes in the hanging wall of two of the lead-silver-zinc orebodies. They also have a lead-copper dross problem capable of solution by the erection of copper smelting plant. A sound, technical organisation is existent and may be made available for the general development of the Cloncurry field.

The Hampden Consols Mine has reputed ore reserves of at least 330,000 tons sulphide copper ore averaging 4% copper, which should be amenable to flotation concentration. The ore reserves can probably be reached by drives from the Hampden Shaft and the effect of the fire in the underground workings of the Hampden Consols also needs investigation.

At Ballara a 42" x 72" water jacketed blast furnace is available, and it is believed that copper converters are available at Mt. Cuthbert. These may well be utilised in any future smelting campaign.

Recommendations:

(1) The potentialities of the Cloncurry mineral field should be immediately assessed by the Mt. Isa organisation with the assistance of the staff of the Queensland Mines Department. Technical and efficient organisationis absolutely essential for the success of any undertaking for the production of copper.

(2) Providing the above investigation is favourable, Government financial assistance would probably be required for -

(a) exploration of the Mt. Isa copper deposits.
(b) establishment of copper smelting plant at Mt. Isa.
(c) establishment of concentrating plant at a convenient site to serve the sulphide ore producers of the field. Hampden Consols appears the best locality. The lease title to be subject of negotiation, but may be judiciously handled with Government assistance. Concentrates to be smelted at Mt. Isa.
(d) initiation of vigorous developmental and drilling campaign at Trekelano. This is important as the ore is rich and has valuable fluxing qualities.

(e) The erection of small smelting furnace at Mt. Oxide or Kajabbi area; in the latter case to be preceded by drilling of the more favourable prospects e.g. Crusader, Dobbyn, Orphan, Warwick Castle.
(f) Gougers to be given every assistance by loan of compressors, equipment, free assays, etc. with an ultimate view of building up this source of oxidised and siliceous ore for the Mt. Isa copper smelter.
(g) improvement of Mt. Oxide-Dobbyn road.

(3) A responsible executive officer of the Mt. Isa Company and possibly a technical representative of the Queensland Government should be present at the next Committee meeting to enable a general policy of attack to be formulated.

TABLE A

CHILLAGOE STATE SMELTERS

COPPER TARIFF - ORES DELIVERED CHILLAGOE

Grade of Ore	Amount payable up to 5:5:1941	Amount payable from and including 6:5:1941
%	£ s d	£ s d
7	1 16 6	2 11 0
8	2 7 0	3 3 6
9	2 17 6	3 16 0
10	3 8 0	4 8 6
11	3 18 6	5 1 0
12	4 9 0	5 13 6
13	4 19 6	6 6 0
14	5 7 5	6 15 11
15	5 14 11	7 5 5
16	6 1 9	7 14 8
17	6 8 10	8 3 5
18	6 15 3	8 11 11
19	7 1 4	9 0 0
20	7 10 8	9 11 5
	Plus 9s.5d. for each further unit and less 10s.6d. for each unit under 7%	Plus 11s.5d. for each further unit and less 12s.6d. for each unit under 7%

TABLE B

PRODUCTION OF COPPER - CLONCURRY DISTRICT

1911 - 1940

Year	Tons Copper	Average Copper Price £ s d
1911	8,510¾	56 10 0
1912	10,435	73 9 1
1913	9,771½	70 3 8
1914	8,215	60 13 7
1915	9,880	72 10 4
1916	9,908	116 1 3
1917	10,189¼	115 16 10
1918	11,625	110 0 1
1919	4,346	95, 5 7
1920	7,672	97 12 7
1921	89	69 8 5
1922	325	62 19 11
1923	518½	72 16 5
1924	261	68 11 0
1925	982	67 4 0
1926	1,098¼	65 18 8
1927	2,905	62 9 6
1928	2,339	69 13 6
1929	3,377¼	85 17 8
1930	2,169	66 0 3
1931	2,316½	53 6 6
1932	2,597	45 9 5
1933	2,087¾	45 17 8
1934	1,878	41 19 4
1935	1,417½	44 12 6
1936	1,862	53 12 1
1937	2,720	75 2 0
1938	1,562	57 5 11
1939	2,083½	62 6 0
1940	1,687½	75 4 6

TABLE C

ORE RESERVE ESTIMATES OF THE PRINCIPAL MINES OF THE CLONCURRY FIELD.

	Production			Ore Reserves			Approx. Av. tons per ft. stoped ore plus reserves.	Further Ore Possibilities. Oxidised and Secondary.		Primary Ore.		Remarks.
	Tons	% Cu	dwts Au	Tons	Grade %	Authority		Tons	Grade %	Tons/Ft.	Grade %	
Mt. Elliott	264,007	9.23	3.0x	600,000 O &S 4,000 S.	3 10	Mt. Elliott Co.	1,730			1,600	1-3	Mt. Elliott reports 60,000 tons at 16% top levels inaccessible owing to collapse of workings. Ore has given 4.2 dwts gold.
Hampden Consols	21,165	8.8	1.8x	33,000 S. 120,000 O.	4	do.	982	2,000,000?	2?	1,500	3+ ?	High sulphur content of ore caused fire 1918. Shaft retimbered 1922 when fire extinct. Dr. Gustafson considers distinct possibility of open cutting gossan outcrop.
Hampden	171,689	6.73	1.25x	Unknown			562+	150,000?	3½+?	300-400	3½ - 4	Incompletely stoped.
Great Australia	32,936	7.75	0.3 x	110,000 S. 93,000 O.	2.5 Mt. ElliottCo. 4.0 Mt. ElliottCo.		787			1,800	2½	Drilled in depth. Low grade orebody. May be longer.
Dobbyn	16,506	16.98	1.0x	33,000 S.	5.0	do.	210±	50,000	5.0	210±	4	Fair chance of new ore shoot.
Crusader	742	17.5	1.2x	50,000 O	5.0	do.	1,200	10,000	5.0	1,200	3	Can be open cutted, possibility of increasing tonnage.
Kalkadoon East L.)	45,887	10.8	0.3x	Unknown			26	17,000	4	400+	1½	Poor prospecting
Kalkadoon West L.)							71					Might double low grade ore.
Mt. Cuthbert	57,931	6.9	0.03x	"			250?	30,000	6	1,600± or 300	1-2 2-3	Further ore possibilities is Mt.Elliott estimate. Poor prospecting (Dr. Gustafson)
Orphan	22,549	11.58	0.91	31,000 O &S.	9.2	Dr.Gustafson	130			230	1-6	Remote chance of new deposits in district. Possibility of obtaining several thousand tons 12% ore below 100 ft. north level.
Mt. Oxide	31,083	30.0x		236,800 O&S.	7.9	do.	80	280,000	7.9			Reasonable possibilities of large orebodies 4 to 5% copper near mines guessed at 500 to 2,000 tons per foot depth (Dr. Gustafson). Poor chance of rich secondary copper zone beneath hematite outcrop (R.L.Blanchard).
Paddock	Unknown							Less than 1% Cu (Gustafson)				H.S Mackay (1936) reported this as large "porphyry deposit." Testing unsatisfactory.
Argylla				200,000 O.	4.0	Mt.Elliott						Imposing outcrop 150 ft. wide. Average grade unpayable. Lenses high grade ore.
Trekelano	137,000	12,0x	1.5x			Q.Mines Dept.	200+			200+	10	Values and size of orebody being maintained at depth. Practically no outcrop. Structural control of orebodies within shear zone established. Shear prominent and not fully explored.

S. = Sulphide ore
O. = Oxidised ore
x = approximate

MOUNT ELLIOTT

Location: Selwyn, terminus of branch line of railway from Cloncurry, 73 miles south of Cloncurry.

Past Production: 264,007 tons - 9.23% copper, about 3.0 dwts.gold. Average production rate during 68 months of smelter operation 3,880 tons per month with maximum production of 9,218 tons for April, 1918.

Geology. Surface geology obscured. Ore occurs on east limb of large north pitching anticline in sheared and folded slates. Orebody at surface 90 ft. long and 60 ft. wide, dipped N.E. at 65° and pitched north at 50°. Shape and dimensions alter on successive levels downwards.

Outcrop siliceous and limonitic gossan with oxidised copper minerals. Grade fell off very rapidly in depth and shows about -

Surface		15-18% copper
125 ft.	level	15% "
285 ft.	"	12-14% "
400 ft.	"	4-5% "
500 ft.	"	2-3½% "

Size of Orebody: Most of the lode appears to have been mined. The tonnage per vertical foot depth judged from mine level maps are -

Surface		400
125 ft.	level	970
185 ft.	"	840
285 ft.	"	1,530
400 ft.	"	2,460
500 ft.	"	1,700

Ore Possibilities: Mt. Elliott ore reserve figures -

600,000	tons	oxidised and sulphide	3% copper
4,000	"	sulphide	10% "
60,000	"	oxidised	16% "

(in top levels inaccessible on account of collapse workings).

The 500 ft. level plan shows two low grade orebodies whose upward extensions have not been adequately tested. Other possibilities slight.

HAMPDEN MINE

Location: Kuridala on Cloncurry-Selwyn railway, 20 miles north of Selwyn and 53 miles south of Cloncurry.

History: Pegged about 1884. Opencutting and prospecting 1898-1906. In 1906 Hampden Cloncurry Mines, Ltd., formed and erected smelters in 1911 operating until 1921. Company paid £437,000 in dividends (other mines also operated). Property acquired by Mt. Elliott Ltd. in recent years but not worked.

Past Production: 171,689 tons ore 6.73% copper, about 1.25 dwts gold. Average production during time smelters operated 8,960 tons per half-year with maximum rate of 13,652 tons in half year ended 28/2/15.

Geology: Lodes occur in long, wide crush zone in black slates. Shear zone occupied by the lodes and marked on surface by strong siliceous and ferruginous gossan. Grade fell off rapidly at depth. Oxidised ore averaged 9% copper, 1.5 dwts. gold; whilst lower level ores average 3-4% copper, 0.6 dwts.gold.

Ore Reserves: No ore reserves published by Mt. Elliott Co. From study of mine plans it would appear reasonable that 150,000 tons of low grade ore, say 3%, is partially developed on upper levels.

HAMPDEN CONSOLS MINE

Location: Kuridala, on the Cloncurry-Selwyn railway, 20 miles north of Selwyn and 53 miles south of Cloncurry. Property adjoins Hampden Mine.

History: Mining started 1908 and main shaft sunk 250 ft. followed by development at this depth. In 1911, Mt. Elliott Ltd. acquired the property and a new shaft commenced south of No. 1, in 1915 this was 500 ft. deep. In 1917, development had reached 400 ft. level and reserves estimated at 400,000 tons of 4% ore. The high sulphur content caused a fire by spontaneous combustion early in 1918 and work ceased. Shaft re-opened and retimbered in 1922, but although the fire was extinct, the market price of copper caused another shut down and the mine has remained closed since.

Production: 21,165 tons - 8.78% copper, about 1.9 dwts gold.

Geology: Same as the adjoining mine (Hampden); but lode is apparently wider.

Size of Orebody: Variously described as having the following dimensions

Mt. Elliott Co.	-	600 ft. long, 30 ft. wide or 1,440 tons/ft
Berry	-	400 ft. long, 50 ft. wide or 1,600 tons/ft

By taking ore mined plus published reserves and dividing by 400 (480' deepest level less 80' barren capping), a figure of 982 tons/ft is obtained.

Ore Possibilities: Mt. Elliott ore reserve figure 450,000 tons of oxidised and sulphide ore averaging 4% copper, probable 0.5 dwts gold.

Possibilities in depth appear to be about, 1,500 tons per ft. at 3½% copper.

Tributors in recent years have been mining high grade ore 17-24% copper from new pits and open cuts in the outcrop. This outcrop of gossan is from 20 to 250 ft. wide and nearly 1½ miles long and represents a large tonnage of lode material. Dr. Gustafson believes that there is a distinct possibility that great portions of it might average 2-3% copper. This lode could be open-cutted. He recommends detailed mapping of gossan using leached outcrop-technique as developed by R. Blanchard, geologist of Mt. Isa Mines Ltd.

TREKELANO MINE

Location: 9 miles S.S.E. Duchess to which it is connected by rail.

Production: To end of 1940 about 137,000 tons averaging 12% copper, 1-1½ dwts gold. Present average grade of ore despatched 10 per cent copper, 1½ dwts gold per ton.

The chief gangue mineral is calcite which makes this ore most valuable to the Chillagoe Smelters for its fluxing qualities.

Ore Reserves: Proved ore reserves practically nil as production has been obtained by stope development methods. Unknown tonnage in pillars.

The recent work by Geologist S.R.L. Shepherd has established a possible structural control of ore deposition; the ore shoots being associated with oblique fissures traversing a well defined shear zone. He refers to three ore shoots, 'A', 'B' and 'C', the existence of which was not realised.

Recommendation: A vigorous prospecting campaign should be carried out on the levels as indicated by Mr. Shepherd and the possibility of

(1) further orebodies along the shear zone
(2) persistence of the known shoots to depth

should be vigorously undertaken.

This property is important because

(1) it is the only known example of persistence of copper values below water level in the Cloncurry field.
(2) the calcitic gangue is a valuable smelter flux
(3) apparently a structural control of the orebodies has been recognised.

GREAT AUSTRALIA.

Location: ½ mile from Cloncurry township.

Production: 32,936 tons averaging 7.75% copper, about 0.3 dwts.gold.

Geology: Deposit occurs in broad belt of limestone intruded by fine grained basic rock. Geology obscure on surface.

Size of Lode: Approximately 790 tons per foot. Plans indicate 1,800 tons per foot on lower levels of very low grade ore. (Note: the term very low grade ore is applied to 2½% ore).

Ore Possibilities: Mt. Elliott Co. 93,000 tons oxidised ore 4% copper
110,000 " sulphide "2.5% "

There may be 1,800 tons per foot of primary ore averaging 2-2½% copper

MT. CUTHBERT MINE

Location: At Mt. Cuthbert the terminus of a branch railway from the Clnncurry-Dobbyn line and 63 miles from Cloncurry.

History: Acquired by Mt. Elliott Co., about 1923. Originally pegged about 1907 and smelting operations were carried on at Mt. Cuthbert from 1917 to 1920.

Past Production: 57,931 tons 6.9% copper, about 0.03 dwts gold.

Size of Orebody; Mr. Powell, manager, Mt. Elliott Co. estimates 30,000 tons above 350 ft. level; which would give the average tonnage per foot of depth as approximately 250.

Ore Possibilities: Maximum about 30,000 tons 6% copper. Possibilities in depth probably limited to material averaging less than 3% copper.

KALKABOON MINE

Location: One half mile from Mt. Cuthbert mine.

History: Controlled by Mt. Cuthbert Co. until 1923, when it passed into the hands of the Mount Elliott Co.

Production: 45,887 tons averaging 10.82% copper; about 0.3 dwts.gold

Size of Orebody: In the east lode, one very rich shoot - 120 ft. by 3 ft. - averaged about 35 copper down to 100 ft. level. At 150 ft., grade was 10-15% and fell off steadily until at 350 ft. it was 2-3%.

In the parallel west lode an orebody 340 ft. by 25 ft. averaged 12% dow to 150 ft. level. Below this level it averaged 2-2½% with limestone gangue.

In the primary zone, according to Mr.Powell (manager, Mt. Elliott Co.) there might be 400 tons per foot depth, grade 1½% copper.

Ore Possibilities: There might be 17,000 tons 4% ore in east lode down to 350 ft. level. Grade below this level probably 1½%.

DOBBYN MINE.

Location: Dobbyn at terminus Cloncurry-Dobbyn railway, 72 miles N.N.W. Cloncurry by air; railway siding at mine.

History: Discovered at beginning of century. Production appears to have commenced in 1909. Now owned by Mt. Elliott Co., who ceased production from lower levels about 1932. Since that time small parcels selected by tributors from open cut and old workings. Depth 330 ft.

Production: (31/1/38) Total tons ore 16,506 Average grade:
Total tons copper 2,810 Copper 16.98%
Total ozs.gold * 375.37 Gold say 1 dwt
* 7,940 tons with recorded gold contained 0.964 dwt gold and 16.2% copper.

Ore Reserves: Mt. Elliott estimate (1938) 33,000 tons 5% copper (sulphide ore) Cannot be checked as water is now within 38 ft. of surface.

Prospects of Increasing Ore Reserves:

Dr. J. K. Gustafson (1938) estimates lode shows 210 tons per foot depth. In addition to above reserves he guesses at 210 tons per ft. depth 4% copper ore below 330 ft. level.

Possibility of one or more additional ore shoots in the half mile of partially explored lode channel. Shaft in fair order and equipped with steel headframe. Worthy of dewatering and underground examinatio in view of known occurrence of primary sulphides.

MOUNT OXIDE

Location: 90 miles north Mt. Isa. 112 miles N.W. Cloncurry. 90 mile by road (45 miles by air) from Dobbyn, nearest railhead. Can only be reached on horseback in rainy season - December to March. No possible landing field anywhere near the mine. Permanent water Gunpowder Creek, 9-10 miles distant.

Production: To end of 1940 -

31,083 tons averaging about 30% copper.

Lease Holder: Mount Elliott Co. At present under tribute.

Ore Reserves: Reasonable expectancy of 236,800 tons, 7.9% copper with clearly indicated possibility of further 280,000 of same grade.

Total - 517,700 tons, 7.9% copper containing 40,898 tons copper.

Ore Possibilities: Reasonable possibilities of large bodies containir 4 to 5% copper near mine guessed at, 500 to 2,000 tons per foot depth (Dr. J. Gustafson).

Possibility of enriched zone under massive hermatite mass considered by some engineers, but adversely regarded by R1 Blanchard, geologist, Mt. Isa Mines. Ltd.

Adverse Factors:
(1) Remoteness
(2) Climate
(3) Past record of troublesome labour
(4) Excessive freight costs to Chillagoe Smelters
(5) Mixed sulphide oxide ores not amenable to simple concentration methods.

ORPHAN MINE

Location: 2 miles N.E. Dobbyn to which it is connected by railroad.

Production: 23,764 tons ore averaging 12% copper, 0.91 dwts gold.

Lease Holder: Mt. Elliott Limited.

Ore Reserves: Possible 31,000 tons 9.2% copper.
Possible 38,900 " 9.9% "
Estimates by Dr. J. K. Gustafson (1938) based on incomplete plans of Mt. Elliott Ltd. and verbal data of Mr. Powell, Manager, Mt. Elliott Limited.

Prospects of Increasing Ore Reserves: Possibility that primary lodes will not contain more than 4% copper and will be encountered abruptly (by analogy with district lode characteristics - Dr. Gustafson).

Main shaft 300 ft. deep vertical in hanging wall said to be in good condition. Steel headframe.

There appears no attractive possibility of materially extending ore possibilities in the near vicinity of the mine. (Dr. Gustafson's opinion after examination and with knowledge of the geophysical survey by the North Australian Survey party).

Depth expectations cannot be safely measured at better than 230 tons per ft./depth assaying 1 to 5% copper.

Idle since 1937.

CRUSADER LODE

Location: 3 miles S.E. Dobbyn.

Production: 742 tons ore 17.5% copper, about 1.2 dwts gold.

Lease Holder: Mt. Elliott Limited.

Ore Reserves: Mt. Elliott Ltd. estimate

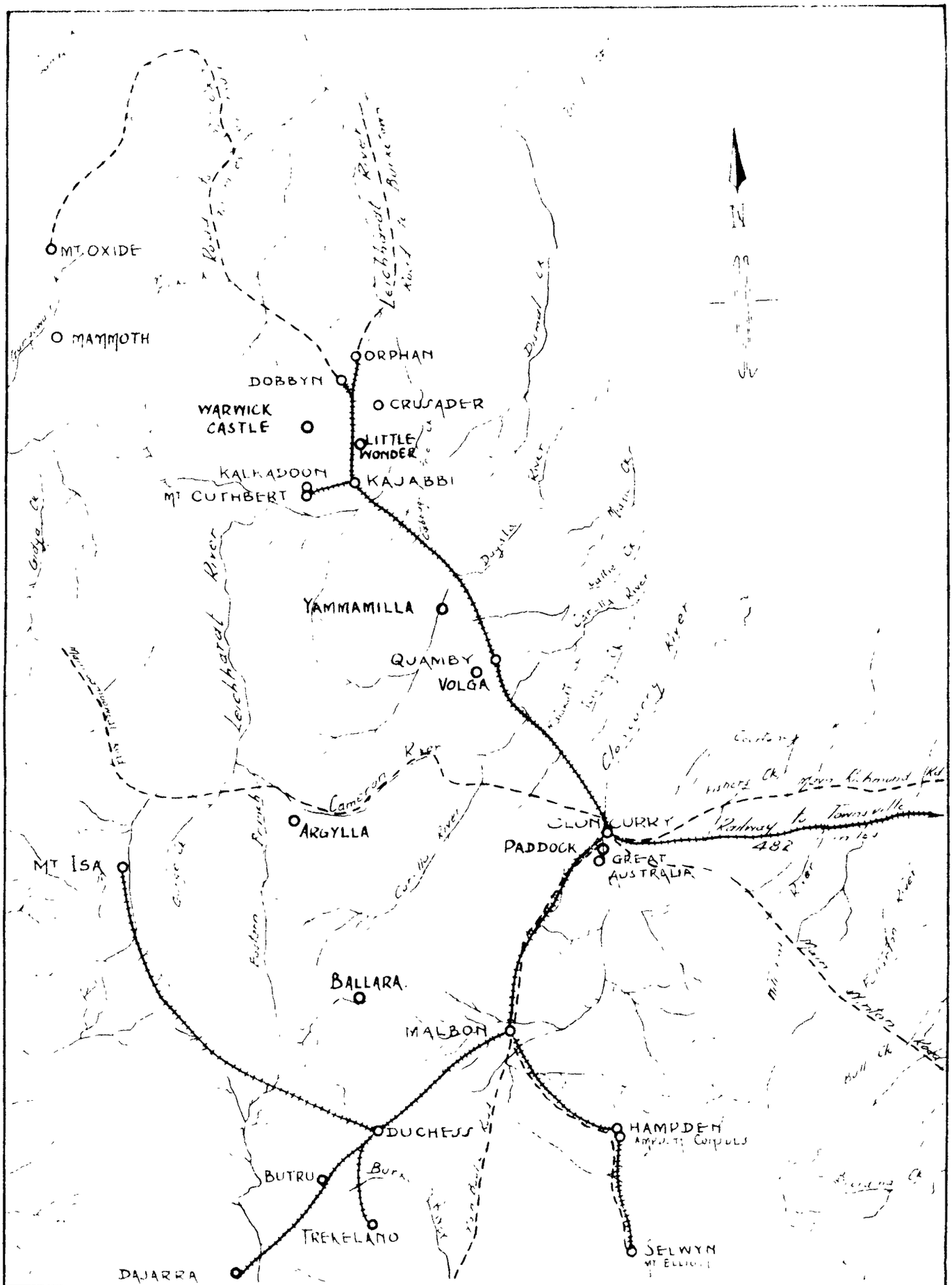
50,000 tons of 5% copper (unchecked).

Future Prospect: Six churn drill holes indicated that grade drops abruptly from around 5% in the oxidised zone to about 3% at water level.

Dr. Gustafson considers above estimate conservative. He considers that all of the ore reserves can be open cutted; which is an important costs consideration.

WARWICK CASTLE

Location: 14 miles from Dobbyn, 7 miles distant from railway.



LOCALITY PLAN

CLONCURRY DISTRICT

— QUEENSLAND —

SCALE 1" = 18 Miles

FIG I

OTHER QUEENSLAND COPPER AREAS

The attached table D shows that the annual production of Queensland from 1911-1940 and table E summarises the production of each mining district for the same years.

GLADSTONE DISTRICT

Reference to table E shows that production from this district has practically ceased. There are, however, several very large orebodies which may have possibilities as low-grade propositions.

The Many Peaks Mine 58 miles by rail from Gladstone has probable ore reserves of 700,000 tons and a recorded production of 508,491 tons averaging 1.6% copper; 0.18 dwts gold. The mine is developed to the 650 ft. level and continuation of the ore to 770 feet is proved by drilling. Operated by Mt. Morgan Co. from 1910 to 1918 as source of flux ore.

The Glassford Creek Mine 60 miles from Gladstone, 4 miles from rail produced 17,925 tons ore averaging 3.8% copper, 3.2 dwts gold per ton from 1903 to 1918. There is no basis for determination of sulphide ore reserves.

The Mount Cannindah Mine, about 63 miles from Gladstone, 2 miles from rail is a large brecciated slate formation and production has been confined to rich oxidised and secondarily enriched ore shoots. Primary ore where sampled in a crosscut in the 180 ft. level returned 2.2 - 2.5% copper, 0.4 dwts gold per ton. There is no basis for determination of sulphide ore reserves.

The Peak Downs lode near Clermont was a famour producer and from 1862 to 1878 produced 100,000 tons of 17% ore. The reason for suspension of operations cannot be determined.

HERBERTON FIELD

Copper bearing lodes usually with high silver values are well developed in several localities and several have been worked in the oxidised and secondarily enriched zones. Primary ores appear to be complex with zinc blende as an important associate.

The Mt. Molloy Mine has produced 42,000 tons of 8.5% ore. It is considered that the South end of the mine has possibilities and four men are engaged in mining a bunch of high grade secondary sulphide.

The Consolation Mine, 6 miles from Herberton supplies about 50 tons per week 4% copper ore for the Chillagoe State Smelters. It is used as a basic flux.

The Siberia lode at Emuford has produced less than 1,000 tons; three quarters of which was secondary ore containing 23% copper, and 6 - ozs silver per ton; the remainder being slightly enriched primary ore containing 5 - 6% copper and 5 - 9 ozs silver per ton. Prospects for future supplies of high grade ore are limited and further exploration is necessary to determine the value of the primary ore. A high arsenic and zinc content will penalise this ore.

At Mt. Garnet the sulphide orebody contains a high zinc content with little chalcopyrite. This mine can only be of interest if th production of zinc concentrate is warranted.

CHILLAGOE DISTRICT

This district was a large producer of copper in the past. A large number of copper-silver lodes have been worked as Muldiva, Calcifer

Production:	1917 - 162 tons)	grade unknown	
	1926 - 219 tons)		
	1927-1929	183 tons	17-19.7% copper

Small production and workings not extensive.

Remarks: Timbering of main shaft (175 ft. deep) has been burnt out.

Sampling of the lower levels justified as this orebody may develop into a large, low-grade producer.

LITTLE WONDER - TRUMP - MUSSOLINI LINE OF LODE

Location: Approximately 1 mile N.N.E. Mighty Atom railway siding.

Production: Lode has been worked over length 1900 feet and a branch lode an additional 500 feet.

Little Wonder	494 tons	10.85% copper	1-2 dwts gold
Mussolini	100 "	24% "	1-2 " "
Trump		Unknown	

Remarks: Systematic prospecting recommended both in depth and laterally. Present workings from surface 150 feet and the lode justifies investigation of primary sulphide orebodies.

YAMMAMILLA

Location: About 22 miles west of Quamby, 30 miles by road from Kajabbi.

Remarks: Prominent lode outcrop with strong silicification and orecciation recognised as a good prospecting indication in the Cloncurry district. Free-hold title. Reserves practically nil but the lode should be tested by drilling.

Zillmanton, Mungana, Redcap, Lady Jane, Girofla, Ruddygore and Tartana. The enriched surface ores have been mined and the only outcropping ores are large low-grade bodies, which are too low for profitable working, but some are useful for smelting fluxes.

The Lady Jane and Girofla mines, situated on the same line of lode at Mungana were important producers but contain lead and zinc as well as copper. The zinc content increases with depth and any future working policy must embrace recovery of zinc.

The Zillmanton lode has extensive surface workings but underground development was hampered by very heavy water and difficult mining conditions. Only scanty information is available.

The Redcap lodes have possiblities of large lenses of ore but a heavy water pumping cost would be incurred.

The Ruddygore orebody is a large disseminated deposit of secondary ore and grade would not average more than 1.5% copper.

The Tartana, Calcifer and Ti-Tree lodes are low grade bodies below payable grade but suitable for fluxing purposes.

The OK Mine between 190491909 produced 78,579 tons of ore which averaged just under 10% copper. A large body of dense sulphide ore averaging 2-3% copper is reputed to be left. There is a heavy water intake.

North of the Mitchell River the Burma Malay Ltd. are prospecting the Pinnacles area which is optimistically regarded as a potential source of copper by the officials of the State Smelters. The only information available is a report by Mr. H.H. Bieske of the Smelter staff. The results of the investigation by Burma Malay Ltd. will be awaited with interest.

CHARTERS TOWERS DISTRICT

Several scattered copper lodes in immediate district of Charters Towers - only the Carrington mine was a large producer. This mine was recently dewatered and inspected officially by an officer of the Mines Department, who considered that values in the bottom level were unpayable.

The Einasleigh Mine was a relatively large copper producer from 1901 to 1921 when the mine closed because of the low price of copper. It is developed to 580 ft. level and the ore reserves are unknown. This mine warrants further investigation.

The Ninety Mile Copper mine, about 85 miles east of Einasleigh and 22 miles from Cairns is a very promising lode. Proved reserves are about 1,000 tons of ore averaging 20% copper, 5 dwts gold. About 16 men are employed on this property which is producing about 50 tons ore per week. The mine is owned by Mr. J.H. Norcott, who has other interests and who is content tomine a small tonnage of highly profitable ore. The developments at the 90 ft. level have exceeded in size and value the expectations based on the original shallow developmental work - the original outcrop had been worked and abandoned before Norcott took possession. The lode is almost vertical and of considerable length. It is of distinct promise as a source of additional copper and should be vigorously developed.

OTHER COPPER AREAS

The gold-silver-copper ores of the Mt. Perry, near Bundaberg occur as narrow fissure veins. The Kennedy lode has been worked to 1200 ft. depth. The occurrences are best suited to small company operations and no great production of copper could be expected from this source.

At Mt. Kelsey, near Proserpine about 30 tons per week of ore averaging 2% copper and 6 ozs gold per ton is despatched to Chillagoe Smelters, but there is no likelihood of tonnage increase.

Near Mackay, the copper lodes of Mount Flora, Mount Grange and Mount Spencer have attracted attention. The Mount Flora lodes have distinct possibilities as there is good evidence of persistence along both their strike direction and in depth. At Mount Spencer the Pine Vale lode is half a mile long and contains lenses of copper ore separated by relatively large blanks; only high grade ores can profitably be mined on account of the narrow lodes and long road and rail transport to smelters. The areas are, however, worthy of detailed investigation.

Near Kilkivan there are several copper fields including the Black Snake, Munna, Mount Pudlo and Calgoa. The prospects of this area are not as promising as several others mentioned.

In the Stanthorpe district a number of arsenic, tin and copper lodes have been worked. The Silverspur mine produced copper, but the value of this property relies mainly on an increased price of silver.

Summary of Prospects of Queensland and Copper Areas.

The Mt. Chalmers mine has been the subject of a previous report and taking into account the known tonnage and value of ore reserves and the favourable location in relation to railway and treatment plant at Mt. Morgan, this property demands inspection. The only real problem is the mining of the orebody, as even under the best conditions of preservation of the old workings the mining of this orebody will demand close attention and skill. The future of this property cannot be assessed until the mine has been dewatered.

The Cloncurry field demands attention, more so, on account of the possibility of defining economic copper lodes in the Mt. Isa Mines. Should Mt. Isa Mines Ltd. decide to exploit the orebodies in their leases, a most fortunate position is created for the development of the Cloncurry field. We then have a large, technical and highly skilled organisation available for investigation of the mines of the Cloncurry area, and there is no doubt that any grants of Government monies will be wisely spent. Every assistance should be given for the development of this field by the Mt. Isa Co.

The mines of the Chillagoe and far northern areas are undoubtedly closely watched by Government officials as potential producers for the Chillagoe State Smelters. There is no doubt that with the combination of the higher copper price and the known sympathetic practical assistance of the Queensland Government that this area will receive assistance and attention from the State.

The 90-Mile Copper mine near Ingsleigh is definitely worthy of a vigorous drilling and developmental campaign; other promising areas should be considered after the above recommended mines have received attention.

QUEENSLAND COPPER PRODUCTION

Year	Copper tons	Average Price £ s d
1911	20,383	56 10 0
1912	23,120	73 9 1
1913	23,655	70 3 8
1914	18,435	60 13 7
1915	19,703	72 10 4
1916	19,519	116 1 3
1917	19,062	115 16 10
1918	18,979	110 0 1
1919	9,997	95 5 7
1920	15,897	97 12 7
1921	2,428	69 8 5
1922	5,104	62 19 11
1923	6,242	72 16 5
1924	5,630	68 11 0
1925	3,909	67 4 0
1926	1,216	65 18 8
1927	3,741	62 9 6
1928	2,786	69 13 6
1929	3,748	65 17 8
1930	2,930	66 0 3
1931	3,135	53 6 6
1932	3,136	45 9 5
1933	2,941	45 17 8
1934	2,906	41 19 4
1935	2,900	44 12 6
1936	3,828	53 12 1
1937	5,149	75 2 0
1938	4,458	57 5 11
1939	5,798	62 6 0
1940	6,907	75 4 6

For details of more important producing districts see Table E.

TABLE E (Page 1)

COPPER PRODUCTION OF DISTRICTS IN QUEENSLAND

Districts	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926
Charters Towers	30	26	26	1	28	54	49	19	1							
Chillagoe	789	417	630	175	592	94	204	61	1	218	101	60	651	355	185	89
Cloncurry	8510	10435	9771	8215	9880	9908	10189	11625	4346	7672	89	325	518	261	982	1098
Etheridge	1096	1241	1297	188	18	62	74	112	3	1139	814	172	23	5	1	
Gladstone	2013	1765	739	995	680	922	744	187	175	147	23	2	21	46	-	1
Herberton	154	189	163	44	192	566	565	206	94	409	98	40	155	83	91	21
Mount Morgan	5264	7068	7648	7796	8018	7646	6971	6655	5332	6263	1289	4483	4847	4865	2634	-
Mount Perry	562	443	1044	318	353	175	176	52	16	45	5	10	9	6	7	3
Rockhampton	1834	1345	2246	590	-	6	-	11	-	-	-	-	-	-	-	-
Others	128	189	89	111	39	85	89	50	28	3	7	10	15	7	6	2
	20383	23120	23655	18435	19703	19519	19062	18979	9997	15897	2428	5104	6242	5630	3909	1216

TABLE E (Page 2)

COPPER PRODUCTION OF DISTRICTS IN QUEENSLAND

Districts	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Bowen	-	-	-	-	-	-	-	-	-	10	19	33	33	28
Charters Towers	-	1½	4½	1	-	7	4¼	-	1	5	5¼	109¼	125	186¾
Chillagoe	8	3½	16¼	39¼	51	27½	17¾	23¼	149½	105½	93	78¾	78	79½
Cloncurry	2905	2339	3377¼	2169	2316½	2597	2087¾	1878	1417½	1862	2720	1562	2083½	1687½
Etheridge	-	-	6¾	4	5	2½	20¼	4	4½	5¾	157½*	4	4¾	3
Gladstone	-	1¼	64½	75¼	11½	52¾	16	21¾	6½	6¾	3¼	1½	2½	2½
Herberton	-	-	84¼	350½	596½	430½	359¾	212¾	147¾	132¾	146	169¼	133	169
Mount Morgan	812	430½	180	276	150½	14¼	423	756	1166	1675	1961¾	2488	3299½	4699
Mount Perry	13	10	6½	5¾	4	3¼	3	9¾	5	2½	8½	7¾	5	4½
Rockhampton	-	-	¼	-	-	-	-	-	-	-	18¼	-	-	1
Others	3	¼	8¾	9¼	-	1¼	9¼	½	2¼	22¾	16½	4½	34¼	46¼
	3741	2786	3748	2930	3135	3136	2941	2906	2900	3828	5149	4458	5798	6907

* Including Ninety Mile Mine (J.H.Norcott) previously included in Charters Towers in other years.

N.S.W. COPPER AREAS

COBRA AREA

The only important copper producer in N.S.W. is the New Occidental Gold Mines Limited from their New Cobar Mine. Their production may be increased from the adjoining Gladstone and Chesney leases.

It is believed that the Gladstone lease will ultimately be obtained by this Company.

Chesney Mine. Owned by New Occidental Gold Mines and adjoins the New Cobar Mine. Ore reserves are given as -

465,930 tons 2.44% copper, 0.9 dwts gold, 7.0 dwts silver
plus
probable 44,560 " of similar grade

510,490 "

Since 1904 when the mine was acquired by the Great Cobar Mining Syndicate, 307,000 tons of ore have been mined. A typical analysis of the ore shows about 12% iron and 65% silica with a mineralisation of chalcopyrite, pyrite and pyrrhotite. Average working costs for 1913, when last operated were -

	s	d
Mining & development	15	4
Milling	5	1
	20	5

on a 20,000 ton per week basis.

According to Geo. More, who was conversant with the last mine operations, the ore reserves are recoverable by the method of open stoping and filling. The length of ore of No. 4 level is about 800 feet and the lengths decrease uniformly at each succeeding level to 300 feet at No.8 level. Geo. More states "thus, the orebody appears to be 'carrotting-out' as the orebodies of the Great Cobar Mine also definitely tend to do." He estimates that the capital cost of re-opening the mine for production of 90,000 tons of ore per annum at £101,500. This ore tonnage will produce 8,334 tons 25% copper concentrate containing 2,083 tons copper and of a gross value of £220,850 at present metal prices.

However, this will probably be dealt with in the report of the New Occidental Board of Directors to the Committee.

Great Cobar Mine

It is estimated that there are 250,000 tons of ore containing 2.3% copper at the lowest level - 1,500 feet from the surface - of this old mine. Output has exceeded 4,000,000 tons of ore.

The production costs of copper during the last uninterrupted four-weekly run of this mine (February, 1919) were £113.1s.8d. per ton electrolytic copper. At the time the basic wage was 10s.6d. and 47.3% of the cost was for wages. Costs, under present operating conditions, would be in excess of the above figure.

It is not considered that this ore reserve should be considered at present on account of the depth and high capital cost of equipment.

Mount Hope

Discovered in 1878 and floated as New Mt. Hope Company in 1881. This Company sank a main shaft to 348 feet in depth and opened levels at 60, 100, 150, 270, and 340 feet, but most of the ore was obtained from an open cut. Operations of this company ceased in 1903. During 1906

to 1908 22,840 tons of ore were treated for 689 tons copper. The Mt. Hope Limited in 1913 introduced the Pechey leaching process. Total production of copper exceeds 5,700 tons.

The lode as at present developed appears in the form of a lenticular pipe. The limits of the orebody both longitudinally and vertically have not been defined. The present depth of 340 feet considering the dimensions of the lode, the water level and extent of secondary enrichment is insignificant. Ore reserves are 53,000 tons averaging 4.5% copper.

The ground is apparently strong enough for flat back open stoping with filling, and the orebody may yield 1,000 tons of 4% ore per foot depth.

This property is definitely one of the best 'bets' of the New South Wales copper mines.

Nymagee Copper Mine

Production - 24,408 tons copper from 422,630 tons ore from 1880 to 1916. A summary of ore tonnage above the 800 ft. level based on mine plans and sections from calculations by Mr. E.C. Andrews, Geological Surveyor (1916) shows -

144,500 tons assaying 3.4% copper
65,000 " " 3.0% "

The copper produced was well known for its purity and absence of deleterious metals. The mine was seriously hampered by the high cost of cartage to Hermidale.

Crowl Creek - Shuttleton Mine

Situated about 17 miles S.W. of Nymagee. First prospected in 1900. Main shaft 760 feet deep and the lowest level 730 feet from surface. 62,600 tons of ore have been smelted since the beginning of operations for a yield of 2,873 tons copper.

Summary of Cobar Area

The Cobar mining region includes within its limits the most important copper deposits yet developed in New South Wales and covers an area of 10,000 sq. miles. The chief mining districts and mines are:-

(1) Cobar district proper - (a) Great Cobar Mine
(b) Chesney Mine
(c) New Cobar Mine
(d) New Occidental Mine
(e) C.S.A. Mine
(f) Tinto Mine
(g) Cobar Gladstone Mine
(h) Queen Bee Mine
(2) Nymagee district - (a) Nymagee or Mouramba Mine
(b) Crowl Creek - Shuttleton Mine
(3) Mount Hope district - (a) Mount Hope
(4) Girilambone district -
(5) Hermidale district - (a) Budgerygar Mine
(b) Budgerygar North Mine
(c) Bonnie Dundee Mine
(6) Bobadah district -
(7) Tottenham district - (a) Mount Royal Mine
(b) Bogan River Mine
(c) Ace and Underlay mines
(d) Carolina Mine
(e) Albert Waterholes

At the present time only the New Occidental Gold Mines are operating in this whole area.

Other New South Wales Areas

Copper ores occur over widely separated areas in New South Wales. It is considered by the N.S.W. Mines Department officials that the two areas of Drake and Attunga are the most promising after the Cobar area.

At Drake the orebodies are small and the ore types often complex carrying lead, zinc, silver and gold, beside copper. Some of the mines have only a copper-gold association. The provision of a suitable customs concentrating plant in the locality would probably enhance production.

At Attunga the copper-gold lode occurs at contact of sediments and granite. Ore deposition is irregular and bunchy.

The N.S.W. Mines Department is not hopeful of any great increase in production of "gougers" ore by the increased price of copper and estimates that the total production from gougers, working parties, and small syndicates will not exceed 2,000 tons of 10% ore, or 200 tons copper, per annum.

Mount Hope and the larger abandoned mines of the Cobar Shield are considered by Government officials to offer the best bets, but then only if the economics of production are subjugated to the urgent national necessity for increased copper production.

NORTHERN TERRITORY

REDBANK OR WOLLOGORANG DEPOSITS

Locality: 15 miles west of Queensland border; 50 miles south of Gulf of Carpentaria.

Production: 695 tons 34.5% copper from 1916 to end of 1940.

Geology: Ore bearing rocks confined to volcanic flows interbedded with sediments. Surface outcrops masked by rock debris and laterite. Ore shoots variable in size, the largest (Red bank) being 200 ft. by 150 ft. maximum, with limits not fully defined.

Most of the ore has come from surface open cuts less than 25 feet deep No primary sulphides have been disclosed, but deepest shaft is only 76 feet deep.

Prospects: A legitimate field for prospecting. Requires costeaning and diamond drilling. Geophysical survey by Aerial, Geological & Geophysical Survey of Northern Australia recorded a number of scattered conductive zones but results generally were indecisive.

The area is poorly accessible. The nearest port is Massacre Inlet, 64 miles distant by road, on the Gulf of Carpentaria. During the wet season from December to April the road from Burketown, 174 miles distant, is impassable.

Only luggers drawing a maximum of 6'6" can operate at Massacre Inlet on spring tides. Lightering would be necessary with vessels of any size. The only service available to Massacre Inlet is the lugger "Leisha" of 90 tons freight capacity, which calls at Normanton, Burketown, Korumba, and Roper River five times per annum. The maximum number of trips which could be undertaken per annum would be ten, equivalent to 900 tons of ore. Freight rates approximate -

Massacre Inlet to Cairns	50s.9d.	plus 15%
Townsville	55s.9d.	" "
Brisbane	60s.9d.	" "
Sydney	80s.0d.	" "

The lugger "Leisha" would deliver the ore to Normanton which is served by the S.S. "Wandama" of the same shipping line, John Burke Limited. Luggers cannot be purchased today and Mr. Burke informed me that he would not be able to obtain additional shipping capacity. Hence freight rates would total -

	Per ton
Redbank to Massacre Inlet-motor truck	£6. 0. 0
Massacre Inlet to Sydney - ship	4. 0. 0
Sydney to Pt. Kembla - ship	10. 0
	£10.10. 0

The owner of the deposit - Mr. Masterton - has found it more profitable to sell the ore to the Electrolytic Refining & Smelting Company at Pt. Kembla rather than to the Chillagoe State Smelters. The above freight rate is equivalent to 11.8% copper, so that only very high grade ore can be realised with profit.

Summary: The Wollongorang deposit is a high grade surface copper deposit, the limits ofnwhich are not defined. The area is difficult of access and during the wet season from December to April is practically isolated for transport facilities. Shipping of ore from Massacre Inlet can only be undertaken by luggers, and if larger ships are used, lightering is necessary. High freight costs demand at least 25% ore despatches. The area is worthy of investigation by general prospecting methods with drilling into the sulphide zone.

WESTERN AUSTRALIA

WHIM CREEK

Location: About 50 miles from Roeburne and 14 miles south of Balla Balla on the coast; 2'-6" railway line Balla Balla to mine, 80-ton lighter can enter Balla Balla, but ocean-going boats within five miles.

History: 75,000 tons of average grade 31.2% copper hand-picked for overseas disposal or leaching on mine.

Lease Holder: Private syndicate - H.H. Carroll, manager, Wiluna Gold Mines, and F.B. Norwood, Metallurgical Engineer, Kalgoorlie, are members. At present under option to Mining and Industrial Finance Ltd. London (de Bernales interests).

Ore Reserves: Blatchford (W.A. Department of Mines) estimates 60,000 tons 4-5% copper in pillars; 80,000 tons in surface dumps assaying 3-4% copper.

Whyte (underground manager, Wiluna Gold Mines) estimates 1,000,000 tons 4% copper could be developed in oxidised zone. R.C. Wilson (W.A. Department of Mines) believes that no reliance can be placed on this estimate, but that the ore body is extensive.

A drilling campaign proved persistence of orebody and the sulphide zone contains pyrite beside copper minerals and sphalerite and occasionally galena.

Orebody: Flat dipping 25° from horizontal. No defined walls. Length of workings 1200 ft. along strike and 700 ft. in direction of dip. Width varies 6 ft. to 12 ft. with 40 ft. in places (R.C. Wilson). Blatchford states copper occurs over 2700 ft. length of strike.

Prospects of Increasing Ore Reserves: Work to date has been confined to mining of richer areas with hand-picking of ore for shipping overseas or for leaching. Appears to be a reasonable expectation of increasing ore reserves considerably, but the 80,000 tons in surface dump containing 2,800 tons copper would permit commencement of operations whilst mine development proceeds.

Ore Treatment: Norwood claims applicability of segregation process involving crushing and roasting with charcoal and salt followed by classifications and flotation of cement copper at total cost 23s.6d. per ton for milling and treatment.

Total costs of copper production at Port Kembla not less than £60 per ton working at rate 500 tons per day yielding about 6,000 tons copper per annum.

Metallurgical process not proved and would require pilot plant operations for at least one year (G. Lindsay Clark).

Actual Position: Reserve position and value of ore body substantiates claim that this property is a potential producer of copper, providing metallurgical treatment is solved. Chief drawback is inaccessibility of area with subsequent difficulties of accommodation, housing, maintenance of supplies; low rainfall of 10 inches per near necessitating water storage reservoirs and this position needs investigation. Present shipping position doubtful.

F.B. Norwood, metallurgist and a member of the holding syndicate has recently visited the mine and reports that power plant, crushers and buildings are available at the mine. He estimates that with Commonwealth grant of £60,000 production could be commenced within 9 months if preference is given to manufacture of necessary plant, by Australian firms. He again emphasises that the segregation process intended for this ore has worked satisfactorily in Katanga, Belgian Congo.

The W.A. Mines Department advises that if the above mentioned option is exercised, either the State or Commonwealth Government will be asked to loan half the sum of £60,000 mentioned.

RAVENSTHORPE DISTRICT

Copper lodes occur near margins of granite intrusions. Total output about 100,000 tons ore. Gold is varying amounts is associated with the copper ores.

The Beryl Gold Mines Ltd. some short time ago arranged to erect a plant with a capacity of 1,200 tons monthly for the treatment of copper-gold ore. Estimated cost of plant was £30,000 but owing to war restrictions the necessary funds could not be obtained from the London Office of the Company. Now engaged on treatment of accumulated tailings with the object of completing the plant from the profits of same. This will take approximately twelve months. I have written to this company seeking additional information re ore reserves and statement of the whole position. The ore averaging 1.5 to 2% copper and 5 dwts gold per ton and it is believed that the organisation is connected with Great Boulder Gold Mines.

There are a number of gougers in this district but the ore realisation is faced with heavy freight charges to Pt. Kembla. In order to test the possibility of additional copper production from this source, the W.A. Department of Mines have approved of an advance to one party of 40% of the estimated net value after treatment of a parcel of 50 tons, to be sent to Pt. Kembla. If successful, the State Department will give similar encouragement.

MT. MALCOIM

Near Eulaminna in the Mt. Margaret gold field. This mine has produced about 60% of the State's total copper production. Production of ore about 85,000 tons concentrated in bonanzas and only worked to shallow depths. For several years this mine was operated as a source of pyrite for acid and fertiliser manufacture, but this was only economic with the creation of a favourable rail freight.

SOUTH AUSTRALIA

South Australia was a most important copper producing State for many years, but since the closing of the Wallaroo-Moonta Mines in 1923 the output has been insignificant.

Copper lodes are well developed over large areas of Pre-Canbrian rocks The discovery of the Kapunda mine in 1842 and the Burra Mine in 1845 were responsible for the production of rich copper ore. The Burra Mine operated until 1877 and produced at least 234,640 tons of ore containing 51,622 tons copper. The Kapunda mines closed in 1879, and the only authentic record of output is from 1870-1879, during which period 11,235 tons of ore averaging 16.2% copper and 1,484 tons precipitates assaying 64.2% copper were sold. This ore was extracted from the open cuts and previous to this period the value of copper production is reputed to have been one million pounds sterling.

The Wallaroo mine was discovered in 1860, and the Moonta mine in 1861. These mines produced consistently until 1923 when operations ceased.

WALLAROO-MOONTA AREA

The ore bodies in the old mines of the district are considered either to have been worked out or are too small in magnitude and grade to warrant the erection of plant for further production.

A survey of the possibility of reopening the mines of this field was made by the Director of Mines - Dr. L. Keith Ward - in 1940, and he considered that there are insufficient ore reserves in the district to warrant re-opening of the mines. There are no outcrops of orebodies in the Moonta-Kadina-Wallaroo area and the surface is practically a level plain over which there is an almost continuous cover of travertine limestone. Much drilling has been done by the South Australian Mines Department to ascertain whether orebodies extend beyond the limits of underground workings, but without success. Forty five drill holes were bored in the Kadina-Wallaroo district.

Following representations by Mr. R. S. Richards, M.P. in 1933 to the S.A. Government, Sir Herbert Gepp visited the area and the outcome was the launching of the Moonta Mining Scheme which operated until August, 1938. This scheme provided for a co-operative basis of mining and milling ores raised by unemployed miners of the district. Both the Commonwealth and State Governments granted monies for the equipment of mining and milling plant, and the operations were controlled by the Department of Mines. During the period 41,550 tons of ore averaging 2.7% copper were treated for the production of 3,474 tons concentrate assaying 28.36% copper and containing 985.56 tons copper and 507.62 ozs gold. The total expenditure involved was £60,680 for the production of £59,292 value of metals. The value of the same production today with copper at £90 per ton and gold at £9/15/- oz would be £93,649. The scheme closed "owing to the complete exhaustion of ore reserves" (S.A. Department of Mines, Mining Review No.57).

Mr. S. B. Dickinson, Assistant Government Geologist, is at present engaged on a survey of the field to investigate the possibility of reopening some of the mines of this area.

Kapunda Mines

It is evident that only the easily obtained ore was mined in this area which has been subjected to prominent block faulting. The exhaustion of rich oxidised ore and the metallurgical difficulties of treating the lower grade sulphide ore coupled with a large inflow of water were probably the chief causes of cessation of operations.

A survey of available information points to a possible tonnage of 190 tons of copper ore per foot depth over a length of 2700 feet and a width of shear zone of 500 to 600 feet. The grade would probably be about 15% copper. Any work on this area should be preceded by a diamond drilling campaign.

Burra Mine

Little accurate information is available as to the behaviour of this large, rich, outcropping lode below water level. Its past production is most impressive and there is no doubt that the possibilities of the sulphide zone of this mine should be explored. Ore reserves are practically nil, and the investigation of this and similar properties requiring drilling should not be considered until the possibilities of mines with known reserves are assessed. It is, however, a legitimate drilling bet and one that has been too long neglected when considered with a knowledge of past production.

Mount Gunson

This deposit of horizontal to sub-horizontal cupriferous sandstone is being operated for the production of siliceous flux required by the Broken Hill Associated Smelters, Pt. Pirie. Present production rate is 350 tons per week of 3.5 - 4.0% copper ore containing about 80% silica. Ore reserves are unknown but as the ore is mined by cheap open cut methods, the copper bearing beds will be mined to their economic limits. Mineralisation consists of malachite, chrysocolla and chalcocite. Thus the ore is not amenable to simple concentration methods and there is no immediate prospect of tonnage increase.

Dome Rock

This small copper mine is situated about 24 miles north of Mingary and about 70 miles from Broken Hill. It is at present being geologically surveyed by the S.A. Mines Department. A small production is obtained but a recent Government sampling of mine dumps showed 1,485 tons averaging 11,74% copper. This will probably be dispatched to Pt. Kembla. The report on this property will shortly be available.

Kanmantoo - Bremer

About 36 miles S.E. from Adelaide.

The Kanmantoo Mine was investigated in 1938-39 by Austral Development P Pty. Ltd. who sunk a new shaft 170 ft. deep and at 168 ft. drove west 152 ft. from which four holes were drilled. The results did not prove the continuity of the economic ore, which appeared to be in small lenticular formation.

The Bremer Mine ceased operations in 1907. It is reputed to have a lode 16 ft. wide averaging 14% copper at the 600 ft. level. The mine has a heavy water intake. Any investigation should be confined to drilling operations.

NORTHERN FLINDERS RANGES

This area of ancient Pre-Cambrian rocks contains many copper lodes. The best known mines were the

Appealinna
Blinman
Mt. Lyndhurst
Mt. Burr
Nilpena
Nuccaleena
Oratunga
Parabarana

Paul's Consolidated
Sliding Rock
Yudnamutana

The Blinman and Yudnamutana mines were equipped at one time with smelting plants. The Blinman mine was stoped to the 70 fathom level and for the last three years ended 31/12/13 about 300 tons of 17% ore were marketed. Since that date operations have been confined to gouging small seams above water level. The lode formation is from 30 to 35 feet wide with cross seams of richer ore. This is another diamond drilling proposition.

The whole of the northern Flinders Range area is deserving of a statistical and geological survey which must necessarily precede any investigation of intended exploratory work.

Summing up South Australia possibilities, there is no moderate sized mine in this state possessing sufficient ore reserves, which could be regarded as a producer of copper for the immediate war effort. There are, however, several properties worthy of drilling campaigns. The report of the Department of Mines on the Wallaroo-Moonta district will be of interest as it is believed that the concentrating plant operated under the Moonta Mining Scheme is intact and that there is a skilled labour force available for operating any mines recommended by the Department.

TASMANIA

Apart from the famous Mt. Lyell district, there are no important producers of copper ore in this state. The Tasmanian Department of Mines have drawn attention to the Scamander, Blythe, Dove River and Nicholls Range fields. These are all in the prospecting stage and call for geological and geophysical surveys with drilling of the more favourable areas. No ore reserves are available from any of the deposits.

Scamander Field

Situated in the North east of the island. The ore occurrences consist of groups of parallel chalcopyrite bearing veins with arsenopyrite marked by gossan outcrops. At present can only be considered as prospects. The Mines Department estimates that 3,000 feet of drilling is required to test the prospects of this field.

Blythe Mineral Field

Situated in the north west of the island. At present being surveyed by the Field Geologist of the Mines Department.

Dove River

Situated in north west of island. The limited exploratory work to date has failed to locate payable ore reserves. The area is difficult of access. Prospecting stage only.

All known deposits of copper ore in Tasmania excluding the Mt. Lyell field can only be considered as prospects; and should only be considered after the prospects of mines with known reserves have been assessed.

(Sgd.) M. Mawby.

Broken Hill.

July 23, 1941.

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APPENDIX "B".

THE BHP CORPORATION LIMITED.

(Incorporated in England with Limited Liability).

Mine Office.

BROKEN HILL, N.S.W.

Address Mail to P.O. Box 46, Broken Hill, N.S.W. Australia.

July 1, 1941.

A. C. Smith, Esq.,
Secretary, Copper & Bauxite Committee,
Department of Supply and Munitions,
CANBERRA, A.C.T.

Dear Sir,

Mount Chalmers

Mr. Mawby has now completed his report on the time required and expense necessary to pump out the Mount Chalmers mine to the 300-ft. level, and I attach a copy of his report for each member of the Committee and yourself.

Summarising the report -

By purchasing Pensons pump and Deisel engine available, we can dewater to 300-ft. level in 13 weeks at a cost of £3130 plus probably £800 for contingencies and supervision	£	Total 3930
By purchasing Gympie Plant we can dewater to 300-ft. level in 20 weeks at a cost of £5030 plus probably £1200 for contingencies and supervision		Total 6230
We can purchase and instal both plants and dewater the mine to 300-ft. level in 13 weeks for £8160 plus £1840 for incidentals, contingencies, and supervision		Total 10000

and thus be prepared to immediately repair the shaft, if necessary, and carry out the next obvious step, namely, to mine sufficient ore for flotation test.

From the many reports which have been prepared there seems to have been general agreement on the Ore Reserve tonnage and grade, but the salient facts in connection with the metallurgical recovery, and particularly flotation, are contradictory, and mostly so old, that present methods may represent a very different picture.

Therefore it appears that if time means anything we should not wait for the water to be out before installing the Gympie Plant but should instal it along with the Deisel and Pensons pump.

If this is agreed upon it means approximately £10,000 to dewater and have a look, and, at the same time, be prepared to continue metallurgical investigation.

Will you kindly send a copy of this letter to each member of the Committee together with a copy of the report by Mr. Mawby.

Yours faithfully,

(Sgd.) A. J. KNAST

P.S. We have not estimated in any of this for any difficulties in the shaft.
(Sgd.) A.J.K.

The Members,

Copper and Bauxite Committee:

REPORT ON DEWATERING MT. CHALMERS MINE

In accordance with instructions received from the Copper and Bauxite Committee, I inspected the Mt. Chalmers mine on 18th June. On the previous night I met three directors of the Mt. Chalmers Company at Rockhampton - Messrs. Garrick, Bright Lock and Booker. The Company has no funds and during the past two to three years has expended approximately £16,000. This money has been more or less expended ineffectively from the point of view of investigation of the mine as a potential producer of copper. A small battery was erected and surface gouging produced small parcels of ore for treatment at the battery and at Chillagoe Smelters. Such operations were not profitable. Portion of the money was spent in conjunction with a State Government subsidy for a drilling campaign during which seven diamond drill holes were bored aggregating 2391 feet. The drill hole sites were chosen by State Geologist Reid and were not successful in proving the continuation of the main Mt. Chalmers orebody; but only two were bored in favourable locations to intersect the orebody on its pitch.

On 18/7/1940 the Queensland Government offered to make available to the Mt. Chalmers Company a complete winding plant and poppet head erected by Oriomo Explorations Ltd. on the Inglewood Deep Shaft at Gympie. This complete plant (itemised later in the report) was available for £1,000 for any security given by the Company.

Later in the same month a small winch and boiling plant with suitable boiler was offered by the State Government to the Company, and although the offer was acknowledged, nothing was done by the Company to proceed with, or plan, any dewatering campaign.

The Company had unsuccessfully tried to raise £30,000 by public subscription in June, 1940.

During a visit to Rockhampton by the Minister for Mines - Mr. Gledson - on 29th April, 1941, the Department's offer of the small dewatering plant was again made, but in the meantime the Company had approached the Federal Government for an advance of £30,000 to dewater, sample and equip the mine for the production of 1500 tons ore per week in accordance with their consulting engineer's (Mr. O.E. Wallace) proposals and estimates.

The Company directors informed Mines Inspector Carlson of Rockhampton on 3rd June 1941 that if they could receive Commonwealth Government assistance they proposed to purchase the Oriomo Exploration's plant at Gympie and use it to dewater the mine. They had no proposals for personnel and supervision, but expected that their Consulting Engineer Wallace would recommend a man - whom it was thought would be Mr. Geo. More.

The Company's proposal to the Federal Government "was for a loan of £30,000 or alternatively for a provision of a guarantee to a Bank for an overdraft of £30,000, such funds to be used for the purposes of dewatering and repairing the Company's mines to permit the extraction of 75,000 tons of ore per annum for railage to the Mount Morgan Ltd., mines .... to produce an anticipated yield of 1,842 tons of refined copper and 6,299 oz gold per annum; and also for the purchase of necessary plant and to repay the Queensland Mines Department a debit of £2242 (principal). It is a condition of the loan or guarantee

Copy sent to all members ✓ 3/7/1941.

that the Company shall agree that following repayment then all available profits shall be loaned to the Government without interest as for the period of the war or as for five years which ever is the less

This proposal for aid would have to be considered with the estimated cost of additional equipment at Mt. Morgan for treatment of the Mt.Chalmers o This cost assessed at £52,400 by the Mt. Morgan Company would also be the subject of a loan application to the Commonwealth Government,making a total Commonwealth loan of £82,400 to the Mt. Chalmers enterprise as a whole.

This however, can be discussed later and the immediate scope of my investigation is to deal with proposal and cost of unwatering of the Mt. Chalmers mine.

It is only possible to dewater to No. 3 level (300') leaving the dewatering of the 350 ft. intermediate level and No. 4 level, neither of which is connected to the south shaft, or any shaft from surface, to be carried out by an electrically-driven pump if and when these levels are required to produce ore. No credit for this postponed dewatering is taken into account in this report as 86% of the proved ore reserves exist above No. 3 level; this additional dewatering can well be postponed for the present.

Available information from men who were conversant with the mine operations prior to 1914 suggest that the mine workings are relatively dry and that a small pump would handle the ordinary mine drainage after unwatering.

Plant available for unwatering to 300 ft. level:

1. Small plant available from Queensland Mines Department 11/6/41.

   Winch - double cylinder - 8" dia. x 12" stroke, 3' dia. drums 12 Hp at 100 lb. steam pressure with lift 35 cwt. and at 165 r.p.m. geared 5 : 1 Rope speed approx. 305 ft. per minute.

   22 Hp Portable Boiler and Marshall & Sons engine with pair 10"dia. cylinders.

   Temporary headgear and two new 100 gal. buckets. Capacity 5,000 gals. per hour.

2. Gympie Plant:
   Owned by Queensland Government, standing erected and housed at Inglewood Deep shaft, Gympie. Erected by Orlomo Explorations,1936. Headframe built of new material and plant was put together of sound secondhand units and material.

   I inspected this plant and found it in good condition with all exposed surfaces greased. One wooden skyshaft leg which can easily be replaced, was ant-eaten, but the remainder of the headframe was in very good condition. The plant includes :-

   One 4-post pyramid-type headframe, 65 feet in height to pulley centres; landing brace 24½ feet in height above ground brace, ironbark timber complete with pulleys and safety bail.

   One double-cylinder, double loose drum, 1st motion winding engine; cylinders 16 in. dia. by 3½ ft. stroke, drums 8 ft. dia.

Two Cornish boilers, each 24 ft. long by 6½ ft. dia; flue diameter 3½ ft. Galloway tubes 4 in number; grate size 6 ft. by 3½ feet; last certificate 80 lb. working pressure.

Two boiler feed pumps - one Blake and one Worthington.

One boiler injector (cold water).

One boiler stack (steel).

Two steel wire hoisting ropes, each 1500 ft. in length by 1¼ in. dia.

One engine house of wood with galv. iron covering, gable roofed, 32 ft. long by 24 ft. with 18 ft. walls.

One boiler house 32 ft. by 21 ft. of similar construction attached to engine house on south side.

One air compressor room 23 ft. by 12 ft. of similar construction skillioned on north side of engine house.

(Note: air compressor of old type in room but practically useless).

One office and store building of wood with galv. iron gable roof 26 ft. by 12 ft.

One Blacksmith's shop of galv. iron, 21 ft. by 11 ft.

One steam gauge.

About 80 lengths 2" galv. iron piping about 1384 feet.

About 1347 ft. ¾" galv. piping
" 1981 " 1 in. " "
" 319 " 1¼ in. " "
" 31 " 1½ in. " "
" 19½ " 1½"in. " "

Five machine hoses.

Two L9 - 55 lb. Sullivan Rockdrills

One machine bar and sundry tools

Assuming tanks of 400 gals. capacity and 40 trips per minute, capacity of plant 32,000 gals. per hour. The Mt. Chalmers Company has a 5 Hp kerosene engine and pump at the mine which would serve to pump boiler feed water from the supply well to storage tank of 28,000 gals. capacity situated above proposed boiler installation.

3. Pumping Plant:

Available from Australian agents - F. M. Bethune Pty. Ltd., Temple Court, 422 Collins Street, Melbourne.

(a) One secondhand H 4 N Belted discharge head pump 6" x 1-13/16" column and shafting; 1-11 stage 10" L C turbine driven at 1760 r.p.m. capacity 25,000 to 27,000 gals. per hour against a total head of 350 feet. Power requirement approx. 65 Hp.

Price f.o.b. or f.o.r. Melbourne £830
Delivery 2 weeks from receipt of order.

(b) One secondhand H 4 N Belted discharge head pump, 8" x 1-13/16" column and shafting 1-10 stage 12" L C turbine driven at 1760 r.p.m. capacity 50,000 gals. per hour from 300 feet and 45,000 gals per hour from 350 feet. Power requirement 110 Hp at pump shaft.

Price f.o.b. or f.o.r. Melbourne £1400
Delivery approx. 8 weeks from receipt of order.

(c) One secondhand H 4 P electric head pump fitted with 100 Hp vertical Westinghouse squirrel cage motor running at 1460 r.p.m. 1-15 stage 12" L C turbine, 8" x 1-13/16" column and shafting. Capacity 38,000 gals. per hour from 350 feet and 43,000 gals per hour from 300 feet. Power requirement approx. 90 Hp.

Price f.o.b. or f.o.r. Melbourne £1600
Delivery approx. 8 weeks from receipt of order.

The electric head pump 3 (c) may be disregarded as electric power would not be available. A prime mover is required for the belt-driven pumps and for the unwatering stage a Diesel engine would be most flexible.

A four-cylinder two-cycle vertical Crossley DRS type 110 Hp 500 r.p.m. Diesel engine is erected on a prospecting property near Rockhampton (Pioneer Syndicate) but is at present tied up with a court order. This cost over £1000 seven years ago. It is unlikely to be free under one month and then will probably be offered by public auction. A similar model which has only done six months work, is available in Brisbane for immediate sale for £1300. This type of engine would be most suitable for driving the Pomona pump. The collapse of shaft timbers preventing the installation of the pump column must be considered as a possibility to hold up any pumping campaign.

4. Air-Lift Pumping:

This is probably the simplest of all known methods of unwatering, but probably the most inefficient if considered on a power basis. The efficiency is largely dependent upon the percentage of submergence, i.e. the ratio of submergence to total length of delivery pipe. The South shaft at Mt. Chalmers is believed to be only a few feet deeper than the No. 3 level and auxiliary pumping would be necessary for a large proportion of the lower level water. The air consumption also increases rapidly as the percentage of submergence decreases, e.g. air consumption in c.ft. free air per minute per gallon water pumped from 300 feet rises from about 0. with 75% submergence to about 2.3 with 25% submergence.

The method is worthy of consideration on an established mine where often ample compressed air is available and the only cost is the air line and air lift column.

To handle 30,000 g.p.h. a compressor of 1000 c.ft. capacity and prime mover would be required, making the cost prohibitive unless the whole plant could be utilised in the actual operating campaign. The condition of the shaft below present water level, being unknown, also forces me to strongly recommend a winding engine installation.

Composition of Mine Water:

Analysis of Mt. Chalmers mine water 1935 by the Queensland Mines Department showed -

Calcium sulphate	78.0	grains per gallon
Magnesium sulphate	35.0	
Alkalinity as Calc.bicarbonate	16.3	
Ferrous bicarbonate	4.0	
Zinc sulphate	29.8	
Sodium chlorides	10.5	
Copper	Nil	
	173.6	
Total solids	176.0	

I took two samples - one from surface of water about 40 feet below collar of South shaft and the other about 120 feet below water level, which returned 127.2 and 127.8 grains per gallon respectively. Copper content 0.75 grains per gallon. The water was acid of pH value slightly less than 6.0 but much of the acidity was due to carbon dioxide. It is difficult to estimate the corrosive action of the water on pipes and pumps, but it would certainly be existent. The acidity and copper content may vary within the body of underground water. This factor may assume great importance in any pumping operation. However, I feel that my proposed pumping campaign of 8 weeks' duration could be undertaken without fear of any great trouble from this source.

Estimated Time and Cost of Unwatering:

1. Small plant of portable boiler and engine and winch may be disregarded on account of long time factor of twelve months for unwatering.

2. Organic Plant:
Removal and Installation (12 weeks)

Purchase price, Queensland Government	£1000		
Dismantling, transport, and re-erection	2500		
Cost - 2 400-gal. baling tanks	200	£	
1 skeleton cage	50	3750	

Unwatering (8 weeks)

104 tons coal @ 30s	156	
Supplies *	124	
Labor	480	760
Supervision (26 weeks)		520
		5030

* This may be increased if shaft timbers are not intact.

3. Pumping Plant:

Considering the 6" Pomona pump in Melbourne (2A) and the 8" pump in Western Australia (2B) -

	2 A	2 B
Capacity - gals. per hour from 300 ft.	25,000	50,000
Cost of pump, Melbourne	£830	£1400
110 Hp Diesel engine	1300	1300
Freight and erection costs	1000	1300
	£3130	£4000

	2 A	2 B
Time of delivery pump to mine	3 wks.	9 wks.
Time of installation	2 "	2 "
Time of unwatering	8 "	4 "
Total time	13 "	15 "

The smaller 6" pump is favoured.

4. Air Lift Pumping:

The cost of suitable prime mover, compressor and piping would be at least £3500 and the method has the disability of not allowing for any method of shaft repairs and reconditioning. As an auxiliary to the installation of a winding plant, the installation has no advantages over a Pomona pump.

Summary of Unwatering Proposals:

Disregarding the small boiling plant and the air lift pumping as discussed above :

	Time to dewater	Cost
Gympie plant	20 weeks	£5,030
6" Pomona pump	13 "	£3,130

The Gympie plant is recommended for installation as it enables any shaft reconditioning to be done, and the equipment is all necessary for any operation of mining. The Pomona pump installation by itself would not permit of shaft work and in the event of a decision to proceed with the breaking of a 500 ton parcel for Mt. Morgan or similar investigational work, a winding plant would have to be installed, and this would probably be the Gympie plant as it is available at a salvage price in good condition and is suitable as a permanent installation for mine operation.

The installation of the Pomona pump would have the mine pumped to the 300 ft. level about the same time as the Gympie plant was erected at Mt. Chalmers. Whether this saving of 7 weeks in the unwatering programme is worth £3,130 to the Government under existing conditions can only be assessed by the Committee and is dependent upon the urgency for increased copper production.

My recommendation is to instal both the Gympie plant and the Pomona pump. The Diesel engine driving the Pomona pump will be valuable for driving an air compressor or generator needed in possible subsequent operations. To the estimated cost of £3,160 for both plants I would add £1840 to cover incidentals such as purchase of tools, etc. making an estimated cost of £10,000 minimum to dewater the mine to the 300 ft. level within 13 weeks, when the headframe and winding plant should also be in commission.

Supervision:

This is a most important consideration and the services of a capable energetic engineer are required. The Management of Mt. Morgan informed me that they have no engineer available. I have stated that the Mt. Chalmers Company may suggest Mr. G. W. More, on Mr. O. H. Wallace's recommendation. Mr. More erected the Gympie plant for Orient Exploration. It may be possible to arrange for the Queensland Mines Department to loan the services of Chief Mines Inspector Morley and Mines Inspector Carlson (Rockhampton) to supervise the work, but this gives a divided responsibility. Mr. C. W. Morris, late Underground Manager of New Occidental Ltd., and J. O'K. Lyons, late of Mt. Isa and Talbot Alluvials are two qualified young men who may be available.

E.Hill. 1/7/41

H. MANBY

(C O P Y)

APPENDIX "C"

THE ZINC CORPORATION LIMITED

BROKEN HILL, N.S.W.

July 7, 1941.

A. C. Smith, Esq.,
Secretary,
Copper & Bauxite Committee,
Department of Supply & Development,
CANBERRA, A.C.T.

Dear Sir,

Mount Chalmers and Laloki

I am sending you copies of summarised reports on the above properties for circulation to each member of the Committee. They already have copies of my report on the dewatering of Mt. Chalmers Mine and Mr. Keast's views on the Laloki Mine, Papua. The enclosed reports will give each Committee member an outline of the history, ore reserves and present position of each property.

It is my intention to summarise every potential copper producer in Australia in a similar manner. These will be incorporated in my interim report in accordance with the enclosed programme of investigation. This should be completed before the end of next week.

Yours faithfully,

(Sgd.) M. Manby..

LALOKI MINE, PAPUA.

Source of Information:

Report by Geo. More 15:5:40 to Mandated Alluvials Limited. Report by Geo. More 12:6:41 to Sir Colin Fraser. Information supplied by Secretary, Mandated Alluvials Limited, Pitt Street, Sydney.

Location:

About 18 miles from Port Moresby, Papua. Connected by main road to Port Moresby.

History:

Taken over by Great Fitzroy Mines Limited (Mt. Chalmers) under direction of Bewick, Moreing & Company in 1914, who developed a sulphide orebody estimated to contain 319,200 tons assaying 4.75% copper, 2.5 dwts gold, 11.4 dwts. silver per ton.

Passed to New Guinea Copper Mines Limited in 1917 who unsuccessfully carried out a policy of mining, smelting and converting, resulting in liquidation of the Company in 1925. This Company appears to have spent some £364,000 on plant and equipment, aerial ropeway from mine to Bootless Inlet deep sea loading jetty, and 3½ ft. gauge railway to Bootless Inlet where power and smelting works were established. The jetty and railway appear to have been taken over in 1923 by the Papuan Government for £45,000. Loss on working account for final year was £94,400. Prior to smelting the Company forwarded 2,514 tons of ore, averaging 4.8% copper, to Pt. Kembla, but as the ore was liable to spontaneous combustion, shipments were discontinued. Reason for unsuccessful smelting appears to have been due to attempt at pyritic smelting for which the ore was not suitable. A sintering plant was installed and the sinter produced appears to have permitted successful non-pyritic smelting. Before the benefit of this work could be felt a landslide closed the Laloki Open Cut and the Bank foreclosed on the Company's assets. The tonnage of ore mined during 1923-25 when smelting was being attempted was about 35,600 tons from Laloki Mine and 10,000 tons from the nearby Dubana Mine. More than 105,000 cubic yards of overburden were excavated to permit ore extraction.

Lease Holder:

Mandated Alluvials N.L., Dalton House, Pitt Street, Sydney.

Leases include Moresby King, Sapphire, Sapphire King and Laloki mines.

Present Operations:

Smelting operations commenced 1st April, 1938 and to 28th February, 1940, the following tonnages of ore were smelted -

Moresby King Mine	6063	tons	oxidised	1862	tons	sulphide
Sapphire Mine	3724	"	"	2681	"	"
Sapphire King Mine	390	"	"	170	"	"
Laloki Mine	-			1271		
	10177	"	"	5984		

Production 802.78 tons matte, 30.45% copper, 7.89 oz. gold, of gross value £65,646. Furnace concentration 20 to 1. Approximate working profit £18,950.

Since 28th February, 1940, the following tonnages of ore have been smelted -

2,800 tons oxidised ore 9 dwts. gold 1% copper
2,700 " sulphide " 2 " " 2% "

for production of 470 tons matte, value and grade unknown.

At present only intermittent smelting is practiced because of re-organisation and extension of plant, which is nearing completion. Anticipated production average 40 tons matte for next three months, increasing steadily to over 100 tons per month.

Ore Reserves:

Estimates by -

1.	Prior (Bewick, Moreing & Co.)	1917	319,200 tons	(Laloki)
2.	Late Chas. Gibson, B.E.	1920	170,000 "	(above adit level only)
3.	E. Hogan Taylor	1920	200,000 "	(above adit level & Dubuna Mine)
4.	Late Erle Huntley	1925	211,000 "	(Laloki only)
5.	Geo. More	1940	149,000 "	(above adit level, Laloki Mine) value 4.5% copper, 2.5 dwts. gold, 10.0 dwts. silver per ton.

Geo. More, 1940, refers to the "exhaustion of the Moresby King and Sapphire Mine and the uncertain outlook of the Sapphire King Mine," which have, until May, 1940, supplied the ore for the present smelting campaign.

General analysis of Laloki ore (Erle Huntley) -

Copper	4.5%
Gold	2.5 dwts. per ton
Silver	10 " " "
Iron	40%
Sulphur	40%
Silica	5-6%

Recommendations:

(As outlined in Mr. Keast's report 5:7:41: copies of which have been circularised.)

1. Appointment of capable, energetic underground manager.
2. Testing of amenability of ore to concentration by the flotation process with attendant lowered working costs.
3. Installation of assay office at the mine.
4. Advance of £2,500 to be made by Federal Government to permit advance and clearing of adit.

(Sgd.) M. MAWBY..

BROKEN HILL
July 7, 1941.

MOUNT CHALMERS

Location

Eleven miles NE Rockhampton; one mile Mt. Chalmers railway station.

History

Prospecting stage only to 1907, thence operated by Great Fitzroy Copper and Gold Mines Limited, under direction Bewick, Moreing & Co., until 1914. Available records show production 403,000 tons for recovery of 2.4% copper, 2.4 dwts gold and 9 dwts silver per ton.

Lease Holder

Mount Chalmers Limited, head office - Rockhampton. Capital: £100,000 in 400,000 ordinary shares of 5s. Subscribed capital: £15,476. 5.s.0d.

Ore Reserves

Bewick, Moreing & Co's. estimate 1914 -

Proved - 442,409 tons, 2.73 copper, 2.27 dwts gold above 300 ft. level, made up as follows -

Level	Tonnage	% Cu	Au Dwts	Fe%	Insoluble %
No. 1	35,307	2.65	2.58	16.7	55.0
1-2	107,399	2.93	2.53	14.2	57.2
2-3	237,669	2.56	2.10	10.6	67.0
3 Inter.	62,034	3.09	2.31	10.0	70.0
Total	442,409	2.73	2.27	11.9	64.1

Probable - (Estimate 27:3:39 J.H. Reid, Government Geologist.)

120,000 tons 2.73% copper, 2.27 dwts gold, between 70 and 225 ft. levels.

250,000 tons 3.0% copper, 1.5 dwts gold in NE and S extension of ore body at Nos. 2 and 3 levels.

70,000 tons - 2.5 dwts gold, adit level 40 ft. - 70 ft.

Prospects of Increasing Ore Reserves

The managerial report for the last year of operations ended 31:5:14 shows tonnage mined -

Level	Tons	% wt	% Cu	dwts Au	Dwts Au per unit copper
No. 1	1,066	1.3	2.83	6.32	2.233
2	20,764	25.4	3.08	3.41	1.107
3	30,249	37.0	2.81	2.69	0.957
Inter.	12,558	15.4	2.55	1.66	0.651
4	17,028	20.9	2.23	1.30	0.583
	81,665	100.0	2.70	2.46	0.911

The rapid diminution of gold values at depth is an important consideration.

Seven drill holes were bored during 1937-38 with the assistance of a Government subsidy, but disappointing results were obtained. Only two holes were really well placed to penetrate the probable location of the ore body on its dip. Following this campaign the Government Geologist reports 27:3:39 "that the lode is a central and richer portion of an enormous zone of replacement." This rather implies a pessimistic view of size and grade of ore body below known workings.

Metallurgy

During the last year of operation 64,457 tons of ore assaying 2.47% copper, 2.13 dwts gold, were milled for the production of 12,780 tons concentrates assaying 11.0% copper, 8.01 dwts gold, equivalent to recoveries of 88.2% of the copper and 74.6% of the gold.

Selective flotation has improved considerably since 1913-14 and flotation results today on the clean ore should be better as regards ratio of concentration, grade of concentrate and metal recoveries.

Operating Costs

	Mt. Chalmers Co. Estimate by Winter		Actual Operations 12 moths. ended 31:5:14		G.A.More's Estimate
	s d	s d	s d	s d	s d
Ore Extraction					
Breaking	11 4		8 0.24		
Trucking & raising	2 6		1 9.42		
Filling	1 7		1 6.74		
Development		16 1	7.51	11 11.91	22 0
Ore Concentration			5 11.85		
Sintering and Briquetting			1 11.69		
Smelting			11 3.86		
Converting Realisation		22 3	1 4.80	20 8.20	22 3
Transport at mine	1 0				
" mine to Mt. Morgan	4 6	5 6		-	5 6
General Expenses		3 6		1 10.66	
Amortisation		1 4			
		£2 8 8		£1 14 6.77	£2 9 9

Value of Ore

Price of copper £90 18.0s per unit

Price of gold £9 15s-0d oz. 9.75 s per dwt

Proved ore reserves 442,409 tons, 2.73% copper, 2.27 dwts gold

Value of ore s. per ton	Full Contents	B.M. & Co's Recoveries 1913-14 Cu 83.8% Au 73.8%	Mt. Morgan's estimated recovery Cu 83.0 Au 60.39	G.A. More's estimate Cu 95 Au 75
Copper	49.14	41.18	40.79	46.68
Gold	22.13	16.33	13.36	16.60
Total	71.27	57.51	54.15	63.28

Note: Mount Morgan recoveries are estimated from tests carried out on large lumps of ore obtained from mine dump, which assayed 2.36% copper, 1.2 dwt gold.

Costs of Re-opening

	£
Initial dewatering	10,000
Mining and despatch of 500 ton parcel to Mt. Morgan	1,270
	11,270

Plant and Equipment to mine 1,500 tons per week

	£
New mining plant (G. More)	25,000
Mt. Morgan Mill and Smelter addition	52,400
	77,400
Plus initial testing	11,270
Grand total expenditure	88,670

Comments on Mt. Chalmers Position

There appears little doubt that the ore reserves as given by Messrs. Bewick, Moreing & Co. can be accepted. In addition there are probable ore reserves accepted by the Queensland Mines Department above quoted.

John Adam in a personal communication writes me -

> "The mining proposition is not an easy one, in fact, it is about as difficult as I have experienced. Consider mining a most difficult proposition requiring square-sets and pillars with close filling. Do not under rate difficulties or costs".

For this reason I believe that the mining costs will be in excess of the 22s allowed for by Geo. More, and I would allow 27s 6d as a tentative figure pending examination of the mine after dewatering.

Mount Morgan cost of Equipment is estimated thus -

	£
Transport at Mine	
1. Alterations to existing 3'6" gauge railway siding	1000
Coarse Crushing Section	
1. Rough ore bins, crusher, and conveyors	7300
2. Fine ore bin, feeders conveyor, and building	3530
Fine Grinding Section	
1. Ball Mill and classifier from No. 1 Mill and new building	5000
Flotation Section	
1. Flotation Cells, auxiliaries and building	9000
2. One circuit pump system	1500
3. One standard 16 x 14' Oliver filter with auxiliaries and building	6300
4. Concentrate filter plant, auxiliaries and building	4280
5. One 24' dia. concentrate thickener	1460
Smelter Section	
1. One standard Edwards roaster with rabbles feed bin, conveyor, etc.	6800
2. Polyclone dust collector, screw conveyors, fan and flue	1730
3. Scheme for returning converter slag direct to reverbatory furnace	2000
	49900
Plus 5% contingencies	2500
	52400

Recommendations:

Recommendations for dewatering have been outlined in my report to the Committee dated 1/7/41.

1. During dewatering campaign, preparations to be made for breaking of ore for testing at Mount Morgan plant and experimental testing.

2. On completion of dewatering immediate inspection of mine by a mining engineer conversant with mining of very heavy ground and determination of method and costs of mining.

3. Final decision as to the organisation and management of the property.

Broken Hill
7th July, 1941.

(Sgd.) M. MAWBY.

(C O P Y)

APPENDIX "D"

THE ZINC CORPORATION LIMITED

BROKEN HILL, N.S.W.

July 5, 1941.

A. C. Smith, Esq.,
Secretary, Copper & Bauxite Committee,
Department of Supply & Development,
CANBERRA. A.C.T.

Dear Sir,

At Sir Colin Fraser's suggestion I have concentrated on the examination of all the data available in connection with Mandated Alluvials Laloki.

Amongst the various reports and letters dealing with the subject was the report by Mr. G. More dated May 15, 1940 which comprehensively covered the situation as it was at that time. Since then Mr. More has written a memorandum dated 12th June 1941 to Sir Colin Fraser bringing the information up to date.

It would appear that in the interval of time between Mr. More's report and now considerable but intermittent smelting has been done, and the £10,000 loan from the Government has been expended. The Company has now requested a further advance by the Government of £2,500, and it is at this point that the Copper Committee has had the matter presented to it for consideration.

In order that we could expedite the matter and present the case to the Committee for consideration, I arranged for Mr. Mawby to get in personal contact with Mr. More when he was in Sydney.

My views on the position are as follow -

It appears that the obvious thing to do is to spend sufficient money in prepering the mine for the estimated 130tons per day and refrain from any further expense at the Smelter until at least enough daily tonnage is assured for the Smelter to run continuously and for the mine to pay expenses.

An amount of £2500 should get the main adit in another 500 feet in ore, and probably clear out two of the crosscuts to the footwall of the ore. Undoubtedly from the experience with the adit to date difficult mining conditions must be expected on the level due to the collapse of the old workings following the fire.

Assay equipment and facilities are very necessary and will be needed in the development work in the mine.

The report of Mr. P. Walsh clearly indicates that the Smelter contains plenty of problems and is very second-hand.

An important suggestion dwelt on in Mr. More's report is the possibility of a flotation concentrate being made cheaply. His comments are as follow -

"There is operating on a large scale today in Australia a milling and flotation plant which is dealing, as part of its programme, with heavy copper-gold sulphide ores containing as low as 20% silica. The copper percentage is much less than in Laloki Sulphides. The plant is obtaining a concentrate carrying 25% to 30% copper plus the gold, with a very satisfactory recovery of both metals. The final tailings are of the nature of 40% iron sulphides and 60% silica.
The concentrate is melted in a reverberatory furnace to a matte of converting grade and the cost of the whole operation to that stage makes Laloki treatment costs look foolish.
There seems to be no good reason why Laloki ore should not be amenable to the same treatment, particularly as the ore may contain, as the writer suspects, secondary sulphides of copper in the hanging wall zone right from surface to Adit level.

"The writer suggests that it may be well worth while for your Company to seek a practical test of the amenability of Laloki ore to this class of treatment. The testing of 100 tons of the ore could be so successful and convincing as to entirely alter the present outlook at Laloki; and if this should be so your Company is in the fortunate position of possessing, for the cost of re-conditioning and re-erection a power plant of ample capacity for the requirements of a milling and flotation plant capable of dealing with 40,000 to 50,000 tons per annum."

During the three to four months probable development period this test could be carried out, and it may completely alter the outlook. However, if flotation does not prove to be metallurgically economical it would at least be proof that smelting is the correct method of treating the ore. No time would be lost by doing this experimental work if the aforementioned plan of operation were to be followed.

The cost would not be great and it is in keeping with the procedure proposed in respect of Mt. Chalmers ore.

Meantime, I have been searching Australia for a suitable Underground Manager to recommend to the Mandated Alluvials Directors. To date I have not been successful but still have hopes, and will inform the Committee within a few days of any results achieved in this respect.

Sir Colin Fraser, after reviewing my investigations, which were ahead of others at his request, telegraphed me on the 4th July as follows -

"Your letter 1st received. I entirely agree with your conclusions and proposals regarding Mandated Alluvials Laloki. Suggest you circulate your report to Committee"

My letter to Sir Colin was, in substance, my views included in this letter, a copy of which I shall be glad if you will send to each member of the Committee.

Yours faithfully,

(Sgd.) W. KEAST

Member of Committee.

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