ANNUAL REPORT FOR YEAR ENDING
18.1.82, EXPLORATION LICENCE 3244
CALVERT HILLS AREA N.T.

FOR

J. ERICKSON
HOLDER OF EXPLORATION LICENCE

BY

J. SHIELDS, GEONORTH
MINERAL EXPLORATION AND GEOLOGICAL CONSULTANTS
DARWIN N.T.

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SUMMARY

Exploration Licence No 3244 was granted to J. Erickson for a period of 12 calendar months from the 18th January 1982 under the Mining Act 1939 to 1979. The Mining Act 1980 came into force on 1st July 1982 and, under Section 191, the exploration licence continues in force for a period of six years from the date of original grant.

The exploration licence covers a small area of 29.43 square kilometres and is in the southern part of the Mc Arthur Basin, just north of Murphys tectonic ridge. Proterozoic carbonate rocks of the Karns, Dolomite (Mc Arthur Group) and sedimentary rocks of the Masterton Formation (Tawallah Group) underlie the area.

Copper, lead, zinc and manganese are known within the area and the Redbank copper breccia pipes are about 40 kilometres to the east.

A free option was given to Henry and Walker Ltd. to explore the area during the year. A local consulting geologist for Henry and Walker Ltd. advised on the area and tried to interest exploration companies in the area without success. The option was terminated after 7 months, during which time little or no actual work was carried out in the area. Sampling of prospects was carried out by J. Erickson and J.H. Niddrie on separate occasions towards the end of 1982.
In December Mr. J. Erickson asked J.W. Shields of Geonorth, mineral exploration and consulting geologists, to review all information regarding the area and compile a report to be submitted to the Department of Mines and Energy as an annual report. Recommendations as to future work on the area if warranted were to be included in the report.
CONCLUSIONS AND RECOMMENDATIONS

After comparison of the manganese occurrences on the exploration licence with other similar occurrences throughout Australia, it is apparent that the manganese occurrences on the exploration licence area may continue with comparable grade as at the surface to a greater depth than was considered previously and reported on by Shannon 1971.

Two deposits in the Pilbara manganese province, Mount Sydney and Woodie Woodie are similar to the Calvert Hills manganese deposits and have been shown to extend to depths of 80 metres and at least 30 metres respectively.

Similarities include age (proterozoic), host rock (dolomite), structure (in faults or joints) and in grade (about 50% Mn).

Shannon (1971) estimated that 200,000 tons of manganese ore could be present in the number 1 prospect at Calvert Hills and he evidently based this on the assumption that the ore would probably not be more than 50 feet (15 metres) deep.

So that, if the ore extends to a depth of 30 to 80 metres, as in the Pilbara, the ore reserves at Calvert Hills could approach half a million tonnes or more.

With this in mind, it is evident that the manganese ore could be economically exploited if a market could be found where it could compete with manganese ore from Groote Eylandt.
Preliminary reaction from Energy Resources of Australia personnel at Ranger indicates that they might be interested in obtaining manganese from a mainland source. Pancontinental have also been approached, as they intend to use manganese in the treatment of uranium ore at Jabiluka.

Also, it has been established that neither the grade of the manganese, nor the presence of impurities affect its suitability to any marked degree when it is being used in the treatment of uranium ore, to control the redox potential.

So it is recommended that further negotiations be held with Energy Resources of Australia and Pancontinental to determine whether they would be prepared to buy manganese from Calvert Hills, what would be the maximum price they would pay for it, and the form they would like it in e.g. lump or fine.

A feasibility study would then be necessary to determine what costs would be involved in mining, crushing (if necessary) and carting it to the East Alligator Rivers area. It would be necessary to mine, cart and stockpile enough manganese ore in the dry season to supply the consumers for a full year.

If the study showed that the operation is viable, limited drilling may be necessary to definitely establish that enough ore is present to support the operation for a definite length of time.

If the study showed that the operation would not be viable, then the deposit of manganese would still be a valuable resource if
uranium mining and treatment were ever carried out in the nearby Pandanus Creek - Westmoreland uranium province.
LOCATION AND ACCESS

The description of the exploration licence area is as follows:

All that piece or parcel of land in the Northern Territory of Australia containing an area of 11.36 square miles (29.43 square kilometres) more or less, the boundary of which is described as follows:-

Commencing at the intersection of latitude 17 degrees 10 minutes with longitude 137 degrees 25 minutes thence proceeding to the intersection of latitude 17 degrees 10 minutes with longitude 137 degrees 28 minutes thence proceeding to the intersection of latitude 17 degrees 13 minutes with longitude 137 degrees 28 minutes thence proceeding to the intersection of latitude 17 degrees 13 minutes with longitude 137 degrees 25 minutes thence proceeding to the intersection of latitude 17 degrees 10 minutes with longitude 137 degrees 25 minutes

subject to all applications for mining tenements and excluding therefrom all mining tenements granted or registered, all reserves included within the definition of "reserve" in section 7 of the Mining Act and all land held by the Commonwealth.

The nearest habitation to the exploration licence is the homestead at Calvert Hills which is about 15 kilometres to the south west. The 1:250,000 sheet on which the exploration licence area is situated, derives its name from this homestead and the surrounding pastoral lease on which cattle are raised.
A formed gravel road leads from this homestead through the exploration licence and passes near the Red Bank copper occurrences to Wollogorang (another homestead), then crossing the border into Queensland and connects with Burketown.

Going from Calvert Hills north westerly, a road connects with Borroloola, then along the Carpentaria Highway, joining the Stuart Highway a few kilometres south of Daly Waters.

At this stage access to the exploration licence area from Darwin is practically all bitumen road.
REGIONAL GEOLOGY

The area of the exploration licence falls within the boundaries of the McArthur Basin (see Plate 3). This Basin consists of the Carpentarian, Tawallah and McArthur Groups and the Adelaidean or Carpentarian Roper Group, and their stratigraphic equivalents. The basin is bounded by the Murphy Tectonic Ridge in the south east and overlies the Pine Creek Geosyncline in the north-west. To the north, south and east the basin extends beneath younger cover or the sea; the subsurface limits are unknown. The rocks were mildly to moderately deformed during the Adelaidean.

Three main suites are recognised in the basin: the oldest is a quartz arenite/basic volcanic suite (typified by the Tawallah Group), which is overlain by a carbonate suite (McArthur Group), which in turn is overlain with regional unconformity by an arenite-lutite suite (Roper Group).

The McArthur Group, and its equivalents throughout the Basin have stratigraphic distribution of lead zinc mineralisation, including the H.Y.C. deposit, Bulman deposit, mineralisation in the Karns dolomite at Calvert Hills and in the Vizard Formation at Roper River and small deposits in the McArthur River area, such as Cooley, Cooks, Cox, Bald Hills, W-Fold and Reward (Plumb and Derrick 1975).
Within the exploration licence area, the Karns Dolomite is predominant with some underlying Masterton Formation rocks outcropping on lower ground around creek lines. Lower Cretaceous cappings are present in the south east corner of the exploration licence. The beds are all fairly flat lying.

A fault, parallel to the Calvert fault runs through the south western part of the licence area.

The unconformity between the Masterton Formation and the overlying Karns Dolomite is quite major as can be seen by its highly irregular nature. Jointing is well developed with two major directions of $090^\circ$ and $110^\circ$, with a less well developed set at around $350^\circ$.

Chamosite and manganese are widespread throughout the dolomite and chert is a common constituent in the exploration licence area.

Lead occurs as galena apparently filling cavities in two small areas, one about 2 miles north of the largest manganese occurrence and the other about 2 miles south.

Copper occurs as chalcopyrite and associated with galena in a small area about 6 kilometres south south west of the largest manganese occurrence.

The manganese occurrences are discussed under the heading "Manganese Deposits".
PAST WORK

Early work in the area was carried out by AGGSNA in the period 1939-1940, mainly in the Wollogorang district and around the Redbank copper occurrences which were discovered in 1916.

When uranium was discovered at Pandanus Creek in 1955, considerable interest was shown in the area and several mining companies were active in the ensuing four years. The Bureau of Mineral Resources carried out geological investigations and an airborne radiometric survey in 1956 and 1957.

Systematic mapping of the Calvert Hills 1:250,000 sheet area was carried out in 1961 and the map and accompanying explanatory notes were published in 1963 (Roberts, H.G., Rhodes, J.M., and Yates, K.R.-1963). This map shows the occurrences of Copper, Lead and manganese near the Calvert Hills Homestead in the Karns Dolomites. These occurrences are those within exploration licence 3244. The text also briefly mentions them, commenting that the disseminated chalcopyrite apparently occurs in specific beds within the Karns Dolomite. The galena is said to show similar field relationships to the disseminated chalcopyrite.

As to the manganese, the following is a quote (page 21):
"Numerous small manganese deposits occur within the Karns Dolomite within a twenty mile radius of Calvert Hills Homestead. The mineral constituents are pyrolusite, cryptomelane, and wad, assayng from 30 to 40 percent manganese. The deposits are too small to be of economic importance."

In 1971, C.H.C. Shannon mapped three of the manganese prospects in detail and sampled and assayed them, though not exhaustively.
MANGANESE DEPOSITS

There are three separate deposits of manganese within the exploration licence area, all of which have been mapped in detail by Shannon (1971). In addition, manganese is present in all of the dolomite in the area, but not, of course in commercial quantities.

Shannon (1971) considers that the manganese occurrences were formed by the segregation of some of the manganese from the dolomite into joints and also replacing other material, perhaps chert which is a normal constituent in the bodies. The chert beds within the manganese occurrences are, quite often, disrupted and tend to dip in towards the core of the bodies. This core is often made up of massive manganese minerals with a sub-vertical banding, and where this banding is present, the mineralisation is suggestive of a fissure filling rather than a replacement body.

The largest of the manganese prospects (known as Manganese Prospect 1) is located near the centre of the exploration licence. There are 8 joints with manganese along them with an aggregate length of 1400 metres and an average width of 6 metres within an area of about 50 hectares. The joints have major directions of 090° and 110° magnetic with a less pronounced direction of 350° magnetic.

Chip sampling across the manganese bodies gave assay results between 40 and 50% Mn or 60 to 80% Mn O₂. Iron content varied between 1 and 8%.
Psilomelane is, according to Shannon (1971), the principal manganese mineral of the outcropping manganese bodies, except for sub-outcrops which contain pyrolusite as the main manganese mineral.
SIMILAR MANGANESE DEPOSITS IN AUSTRALIA

Before the Groote Eylandt Mining Co. Ltd. (a subsidiary of B.H.P.) began mining, treatment and sales of manganese ore from the deposits at Groote Eylandt, manganese was produced in Australia from many small, scattered deposits.

These included near-surface enrichments of manganese dioxide which were formed by weathering of manganiferous beds of the Tasman Geosyncline in Queensland (Mary Valley and Gladstone) and New South Wales (Walcha and near Barraba); small superficial deposits of similar origin are known south of Cloncurry in Queensland and at Mucketty (near Renner Springs) in the Northern Territory. At Pernatty Lagoon in South Australia, the manganese deposits are thought to be a result of manganese weathering from a Proterozoic dolomite, and being deposited in a much younger lake. The Peak Hill deposits in Western Australia are a result of manganese weathering from Archaean metasediments, including thick beds of banded iron formation.

The deposits of manganese which are similar to the Calvert Hills deposit are those from the Pilbara Manganese Province in Western Australia. The two main deposits which are quite markedly similar are Woodie Woodie and Mount Sydney.

At Woodie Woodie, Proterozoic dolomites contain solid manganese bodies as caps or in fissures. Manganese content is higher than 50 percent with cryptomelane, braunite and pyroslusite. In 1965 reserves were 100,000 tons, and it was considered that 50 feet in depth (De La Hunty (1965)).
Later work (Blockley (1975)) established that a pipe like body of manganese is present to a depth of 30 metres.

Originally, the manganese outcropped 100 feet (30 metres) above the plain level and was mined to a depth of 80 feet (24 metres) below it. Drilling disclosed a further 80 feet (24 metres) of ore at depth.

At Mount Sydney (in the Pilbara), manganese ore is present in a cavity formed on a north-trending joint in Proterozoic dolomite. In 1972, nearly 100,000 tonnes of metallurgical grade were won from this deposit to a depth of 15 metres (Blockley 1975).

It would seem reasonable to expect that both the examples above are a near surface concentration of manganese derived from a dolomite with a much higher than average concentration of manganese. That such deposits occurring in joints or cavities can extend down to 50 metres below plain level is probably significant when considering the Calvert Hills manganese outcrops.

Carbonate rocks are usually fairly high in manganese content. Hawkes & Webb (1962) give an average figure of 1300 ppm. Beus (1976 p.267) says "Dolomite in some regions (Latvian Republic of USSR, Poland, etc.) is considerably enriched in manganese, though no adequate information is now available which would allow us to consider the average parameters of manganese distribution in this rock."

Thomson (1965) mentions Proterozoic dolomite associated with manganese in the Adelaide Geosyncline.
MARKET PROSPECTS FOR MANGANESE

A very large and easily mined manganese deposit has been found and exploited by a subsidiary company of B.H.P. at Groote Eylandt.

Mining, treatment, loading and port facilities have all been established and manganese with various specifications is being supplied to a world market.

At the present time, manganese is being supplied from this source to treat uranium at the Ranger site and also at the Narbarlek site. However, Queensland Mines plan to discontinue use of manganese in favour of hydrogen peroxide in the near future.

The large deposits of uranium at Jabiluka could be exploited fairly soon and the Company, Pancontinental Mining, plan to use manganese to leach the ore together with sulphuric acid.

However, these companies have expressed interest in obtaining manganese from another source other than from Groote Eylandt, especially if it did not involve transport by sea.

Negotiations have been arranged to follow up the initial interest shown and it is envisaged that once some concrete agreement has been reached, a feasibility study will be carried out to make an estimate of the cost of landing the product in the Alligator Rivers area in the form required.
EXPENDITURE

Because of the free option which Henry and Walker Ltd. had on the area, the exploration licence holder did not undertake any field work at that time. However, it appears that this Company, although holding the option for seven months, did no actual field work.

Towards the end of the year, the exploration licence holder sampled small manganese occurrences within the area. Also J.H. Niddrie looked at and sampled the main manganese occurrence.

Consultant geologist, John Shields researched manganese occurrences in Australia, concluding that the bodies may be deeper than thought previously.

Total expenditure during the year amounted to $7,500.
PROPOSED PROGRAMME AND EXPENDITURE

The main thrust of the exploration programme for the exploration licence will be towards establishing a market for the manganese which occurs in the area. At the same time field work will be carried out, not only to prove up the manganese deposits but also to investigate the base metal potential.

The exploration licence holder has recently been approached by a financier who is interested in the prospects of the area. Steps are being taken to form a Company with the object of pursuing the development of the exploration licence.

Once the Company has been formed, negotiations will be started with companies in the Alligator River Areas who may be expected to be a consumer of manganese. Should the company formation not eventuate, negotiations will proceed nevertheless.

Field work will be commenced in the dry season in the area and detailed mapping, costeaining and sampling of the manganese deposits will be carried out on a regular grid system. Also, detailed stratigraphic compilation will be carried out around the known occurrences of lead and copper, together with sampling and assaying. A pathfinder geochemical stream sediment survey is also envisaged. This work will be carried out by, or under the direction of John Shields, consulting geologist of Geonorth.

Minimum expenditure would be of the order of $10,000 but this could well be exceeded by a considerable amount if circumstances dictate.
REFERENCES

Beus, A.A., 1976:- Geochemistry of the Lithosphere, Mir Publishers Moscow


De La Hunty, L.E., 1965:- Manganese Deposits of Western Australia in Geology of Australian Ore Deposits (Ed. J. McAndrew) pp 140-146 (Eighth Commonwealth Mining and Metallurgical Congress: Melbourne).


