

Exploration Potential in North East Tasmania - EL
17/1991
Cala Resources Proprietary Limited*
Gresham, J.J. EL17/1991

EXPLORATION POTENTIAL

**A Report on the Exploration Potential of the Ground Held by
Cala Resources Pty Ltd in Northeast Tasmania**

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1. Introduction

Cala Resources Pty Ltd hold an extensive land package in the gold-prospective region of northeast Tasmania. Northeast Tasmania is a major gold province and contains the 1 million ounce Beaconsfield deposit, which is still operating, and a number of significant historic mining centres. Cala's land package, comprising some 1649 square kilometres, includes the historic Mathinna, Mangana, Golden Ridge and Dans Rivulet goldfields that have a total historic production of 300 000 ounces of gold. The tenements surround the historic Lisle and Alberton goldfields and also contain a number of minor gold occurrences and previously defined anomalies.

The bulk of the historic production (253 000 ounces) from within the Cala tenements came from the New Golden Gate mine at Mathinna. Gold occurs in a series of somewhat randomly oriented quartz reefs that vary from 0.1- 9.0m wide. The strike length of individual quartz veins may reach 300m but most of the gold occurrences are restricted to short strike lengths of +/- 30m. Gold occurs as native gold and within auriferous pyrite and arsenopyrite. Minor sphalerite and galena occurs in some of the quartz veins. Production from the area ceased in 1929 and although the immediate mine area has been subjected to a number of exploration and evaluation campaigns the mine has never reopened.

Although the area held by Cala has been explored by a number of different companies since serious, modern exploration commenced in northeast Tasmania much of this work has been focussed around the historic mining centres. Given the consolidated and commanding land position held by Cala in the area, there is a unique opportunity to pursue a more regionally oriented exploration program, targeting a number of different ore deposit models. This report briefly summarises the geology and previous exploration of the area and then discusses a variety of ore deposit types that could potentially be found within the Cala tenements. A brief outline of an exploration strategy and budget is also presented.

2. Geology

East of the Tamar Fault, the rocks of northeast Tasmania are dominated by a sequence of Ordovician-Lower Devonian sedimentary rocks known as the Mathinna beds and a series of Devonian granitic intrusives.

The Mathinna Beds apply to all the pre Upper Carboniferous folded sedimentary rocks in eastern and northeastern Tasmania. The oldest rocks (Ordovician) lie immediately east of the Tamar River and are generally fine-grained and in some places have been mined for slate. To the east, the Silurian-Devonian unit of coarser grained arenites occurs. No contact between these 2 units has been mapped and it is possibly a faulted contact. Poorly sorted and graded sandstones with weakly developed sedimentary structures dominate this sequence. Interbeds of finer grained material are common throughout the eastern sequence. Rocks of volcanic affinity are rare within the Mathinna beds but some recrystallised ashflow tuffs of Devonian age are known to occur in the area. The Mathinna Beds have been deformed into a series of parallel NW to NNW trending folds

generally with horizontal or gently plunging fold hinges. The deformation in these rocks is considered part of the Tabberabberan Orogeny that affected all rocks of Early Devonian and older age throughout Tasmania and parts of Victoria.

During the waning stages of the Tabberabberan Orogeny a series of major granitoid bodies were intruded into the Mathinna Beds. These bodies were emplaced at high crustal levels and the intrusion was generally of a passive nature. However local doming and folding within the Mathinna Beds is noted in some localities close to the granite contact. Limited contact aureoles are developed within the sediments. Two major granite types occur in the area. Fairly massive, medium to coarse grained granodiorites dominate in the east. These contain abundant fine-grained dioritic enclaves and are dominated by amphibole, biotite, plagioclase, K feldspar and quartz. More variable biotite adamellites and granites are the other dominant granitoid. These contain plagioclase, biotite, quartz, K feldspar and accessory zircon.

A variety of tin and tungsten deposits are associated with the biotite adamellites and granites. Disseminated cassiterite occurs in greisenised phases of the granite and quartz-wolframite-cassiterite veins can occur in, and marginal to, the granite. Most of the gold deposits occur in a 70km long NNW trending belt that extends from Mangana in the south, through Mathinna to Lyndhurst on the north coast. However some important occurrences (i.e. Golden Ridge) fall outside of this belt. The gold occurrences are variable in nature, ranging from the sediment-hosted quartz veins at Mathinna and Lefroy to the occurrences in quartz veins in, and adjacent to, the Blue Tier and Scottsdale Granites at Hogans, Lisle and Golconda. The genetic link between the granodiorites and the gold deposits has been vigorously debated for years but the spectrum of deposits from those remote from any known granite (i.e. Lefroy) to those within the granite is strongly supportive of this concept.

3. Previous Exploration

Since modern exploration commenced in northeast Tasmania in 1959, the area has been subject to a number phases of exploration by both major companies and junior explorers. Much of the work carried out has been for gold but some base metal exploration has also been carried out.

Much of the historic exploration work has been focussed on the historic Mathinna mining area with a view to finding extensions or repetitions of the ore system close to the old workings. Junior exploration companies have mainly conducted this work. A series of reverse circulation and diamond drill programs have been carried out over the years but none of these have been successful in defining enough mineralisation to justify a resumption of operations.

Other, mainly major mining companies, have pursued a more regional exploration approach and in some instances targeted styles or types of mineralisation different to those previously discovered and mined in the area. Placer acquired an Exploration Licence in the Mt Saddleback area in 1990 and pursued an exploration program for Carlin/Ketza River style gold mineralisation. They did regional stream sediment

sampling, analysing the samples for bulk leach extractable gold. This work defined 3 anomalies but only one survived follow up sampling. The defined anomaly, Sweets Creek, resulted in the discovery of a small (120x10m) quartz stockwork. Newcrest explored in the area in the early 1990's with a focus on large scale, stockwork style gold deposits similar to some of the Pine Creek (e.g. Enterprise, Union Reefs etc.) and Californian Mother Lode deposits (e.g. Carson Hill, Jamestown). They did geological mapping, aeromagnetic interpretation, drainage sampling and follow up detailed soil and rock geochemical surveys. This work resulted in the delineation of a number of extensive zones of quartz vein stockworking in altered Mathinna Beds, but most were unmineralised and no large bulk mineable deposits were discovered. Billiton acquired a large Exploration Licence in the Scamander River area slightly to the east of the main mineralised trend. They joint ventured this area to MPI Ltd and MPI's initial focus was also for large, low grade, high tonnage deposits. However their work quickly focussed in on the small, historic Golden Ridge mining centre. A number of diamond drilling campaigns resulted in some very high grade intercepts, some of which had not been adequately followed up before MPI withdrew from the joint venture.

Although the gold-prospective area of northeast Tasmania has been subjected to a number of exploration programs over the years, at no stage did any one company have the strong, consolidated land position that Cala now has in the area. This gives Cala the unique opportunity to pursue a regional, soundly based exploration program. This program would be based on the full knowledge and documentation of all the historic exploration in the area and an improved understanding of targets and the types of ore occurrences likely to be found in the area. The exploration program would utilise the latest geochemical and geophysical technologies and be a major advance in the search for ore deposits in the region. The area is considered favourable for further discoveries.

4. Targets and Ore Deposit Models

The geology of northeast Tasmania and the regionally extensive gold-mineralising event in the area affords the potential development of a number of different ore deposit types.

4.1 High Grade Quartz Veins

The characteristic gold occurrence in northeast Tasmania is as high-grade deposits in narrow, structurally controlled quartz veins. Although individual veins may extend to 300m in strike length the high grade shoots seldom have strike lengths of more than 30m. It is also apparent that the high grades are restricted to relatively limited vertical extents. At Lefroy almost all the high-grade material occurred between 30 and 100m below the surface. Below 100m grades declined and the high grades were restricted to the irregular pyritic inclusions in the quartz veins. Grades also diminished significantly at depth at the New Golden Gate mine.

The narrowness of the veins, the limited strike and depth extent of the higher grade zones makes this type of gold occurrence a difficult exploration target. However, these are economically important deposits but have a limited areal extent, may have little or no surface expression and have extremely subtle geochemical and geophysical signatures.

They remain an attractive exploration target. A detailed analysis of the structural and stratigraphic setting of the known deposits is required to allow for a search for analogues elsewhere in the area. The application of geochemistry and geophysics in the search for this type of deposit also requires detailed review.

4.2 Quartz Stockworks

Another type of deposit likely to develop in the geological environment is stockworks of quartz veins that generally generate larger, lower grade deposits. Typical examples of this type of deposit are those in the Pine Creek Geosyncline in the Northern Territory (Nicholson and Eupene, 1990, and Miller et al., 1998). In these deposits, (e.g. Enterprise, Goodall etc.), vein systems are commonly found along or close to axes of major anticlines. Veining is commonly associated with seritisation and silicification with lesser amounts of carbonitisation and chloritisation. Vein systems may either be a series of discrete elongate veins continuous over several hundred metres or stockworks generally elongate to the bedding or cleavage. Stockwork zones may be up to 30m thick but individual veins are generally only 1-2 cm thick.

Given the broad folding within the Mathinna Beds and the extensive mineralising system in the region it is highly probable stockwork systems were developed. Some small systems have been already been located by previous exploration and there is good potential for the discovery of a major stockwork system in the region.

4.3 Granite-Hosted Gold Deposits

Although the genetic link between the granites and the gold mineralising event is to be conclusively proved some of the historic production from the field was sourced from quartz veins from within the granite and further discoveries of this type and other granite-hosted deposits are a potentially attractive exploration target. Gold can occur within granite both in late stage quartz veins and as disseminations, usually associated with minor amounts of sulphides.

The granodiorites that intrude the Mathinna Beds of northeast Tasmania require detailed geological and geochemical study to assess their potential to host significant gold deposits.

4.4 Porphyry-Sheeted Vein Deposits

Large intrusive stocks can evolve and produce porphyritic phases with associated gold and copper mineralisation. The mineralisation can be variable in nature and range from copper only to gold-copper to gold only. The mineralisation can occur both within the porphyritic body itself and in the adjacent host rocks and may occur as disseminations or associated with a series of parallel or "sheeted" veins.

The best known deposit of this type in Australia is the Cadia deposit (Newcrest Mining Staff, 1998) in New South Wales. In this deposit, gold-copper mineralisation occurs within a package of thin, (1-20mm), parallel quartz veins. The veins make up less than 5% of the rock mass and occupy a broad package 100-300m wide and 1km long. The Cadia deposit contains more than 9 million ounces of gold and 1.2 million tonnes of

contained copper. There is a broad, pervasive alteration halo associated with this style of mineralisation but the alteration around individual veins can be subtle and of limited extent.

Although no significant porphyritic phases of the granodiorites of northeast Tasmania have been recorded there is still opportunity for this style of mineralisation to occur in the area. The porphyritic phases may have no surface expression but subtle signatures of this style of mineralisation may exist in the Mathinna beds. Indications of porphyry-related alteration should be carefully documented and zones of quartz veining (e.g. the Targa prospect) should be mapped in detail.

4.5 Carlin Style Deposits

Sediment-hosted, disseminated gold deposits ("Carlin" style) are a well-recognised and documented group of deposits. (Percival et.al., 1988) Although the gold occurrences discovered to date in northeast Tasmania would be classified as mesothermal rather than epithermal in character, the Carlin model should be considered when exploring the region. Sedimentary rocks of nearly any lithology may serve as hosts if the permeability is favourable for the introduction of hydrothermal fluids. Placer predicated their exploration program in the early 1990's on this model.

4.6 Other Deposit Types

Although it is important to have deposit models as an aid to exploration strategy and the techniques applied it is important not to become too focussed on one particular model. The extensive and pervasive gold-mineralising event that occurred in northeast Tasmania gives rise to the potential development of a number of different deposit types and possibly some that do not "fit" with any particular model. There are numerous examples (e.g. Olympic Dam) of major discoveries being made when the exploration program was predicated on a different ore deposit model. It is important that the exploration program that is developed is comprehensive, technically soundly based, utilises all the historic exploration data and applies the best and most effective exploration technologies.

5. Exploration Strategy and Budget

The strong land position that Cala retains in northeast Tasmania represents a unique opportunity to develop a comprehensive regional exploration program for the discovery of further gold deposits. Although not necessarily definitive, the program outlined below is suggested as a starting point for the exploration of the area.

5.1 Review of Previous Exploration

\$30 000

Northeast Tasmania has a long and extensive exploration history. It would be extremely important to diligently research and document what work has been done previously within the Cala tenements. The plotting and understanding of regional geochemical surveys would be critically important. However if there are any doubts as to the location of the sampling points or as to the quality of the analyses performed on the samples, the data should be disregarded. The cost of regional stream sediment work is not high and it is of critical importance to have a consistent and reliable geochemical data set. The best

available airborne magnetics should be compiled together with any other regional geophysical data sets.

5.2 Geological Mapping

\$20 000

Although the area has been mapped in some detail by geologists of the Tasmanian Mines Department there is a need for further mapping to gain a better understanding of both the regional geology and the geology associated with known mineralisation. A "best information" geological map should be compiled and then further regional mapping carried out that would focus on the character and nature of the Mathinna Beds and of the phases within the granodiorites. Detailed mapping in areas of known mineralisation or prospects should focus on the structure and alteration of the host rocks.

5.3 Geochemistry

\$100 000

Following compilation of all the historic geochemical data sets an assessment and a decision will have to be taken as to whether these data are reliable. If some, or all, of the data is considered both analytically and geographically reliable some "leveling" of the various data sets would be required to ensure consistency and compatibility. If there are any doubts at all about the quality and reliability of these data, consideration should be given to conducting a survey throughout the complete area to ensure standard and consistent data. Some level of regional geochemical sampling will inevitably be required and should be accounted for in the budget. It would be important that high levels of quality control are exercised in this work. As a precursor to this work some orientation surveys in areas of known mineralisation would be recommended to gain an understanding as to the levels and nature of gold in the streams known to contain sediments that are shedding from known mineralised occurrences.

Some soil and rock chip surveys have already been conducted in the area and the results of the Targa survey, although of a low order, are considered of real interest and are a demonstration of the effectiveness of this type of work. Given some of the anomalies defined by previous workers further soil surveys could be carried out immediately in selected areas.

Geochemistry would be considered a critical aspect of the exploration of this area and it is important that someone with a good understanding of the issues involved in this type of work be engaged to overview and to establish quality control aspects of the program.

5.4 Geophysics

\$150 000

Once all the airborne magnetics for the area has been compiled an assessment will have to be made as to whether further airborne surveys are required in places where the flight line spacing is inadequate to give the required level of detail for interpretation purposes. Line spacing of 200m would be considered the maximum spacing to allow for the extraction of meaningful data for interpretation purposes. Some allowance in the budget should be made for additional surveys.

When the airborne data has been compiled it should be subjected to rigorous analysis that would include "worming" of the data to aid the definition of major structures and buried

intrusives. The definition of these features is of critical importance in the search for gold deposits.

Almost all gold deposit types likely to occur in northeast Tasmania will be associated with variable amounts of sulphides (pyrite, arsenopyrite etc.) and will be detectable by electrical geophysical techniques. The application of Induced Polarisation (IP) is ideal for detecting bodies with low-moderate abundances of disseminated sulphides. Given the limited amount of weathering and oxidation in the area, IP should be trialed at an early in areas of geochemical anomalism.

5.5 Drilling

\$200 000

The definition of any significant geochemical and/or geophysical anomalies will require early drill testing. Given that fresh rock generally occurs close to the surface most of the drilling would be reverse circulation drilling with selected follow-up diamond drilling.

6. Budget Summary

The program and expenditure outlined above represents a good "first pass" regional program for the Cala tenements in northeast Tasmania and should be considered a minimum work program for the area. Depending on field and weather conditions the program could be effected in 6-9 months. I would be confident that such a program would result in the definition of a number of targets and anomalies that would require substantial work and expenditure beyond that outlined above.

Budget Summary

Activity	Expenditure (\$)
Review of Previous Exploration	30 000
Geological Mapping	20 000
Geochemistry	100 000
Geophysics	150 000
Drilling	200 000
Total	500 000

7. References

Burnett, C.F. and Martin, E.L., eds., 1989, *Geology and Mineral Resources of Tasmania*. Geological Society of Australia Inc. Special Publication 15

Miller G.C. Kirk C.M. Hamilton G. and Horsburgh J.R., 1998, in *Geology of Australian and Papua New Guinean Mineral Deposits* (Eds D.A. Berkman and D.H. McKenzie) (The Australasian Institute of Mining and Metallurgy: Melbourne)

Newcrest Mining Staff, 1998, *Cadia Gold-Copper Deposit*, in *Geology of Australian and Papua New Guinean Mineral Deposits* (Eds. D.A. Berkman and D.H. McKenzie) pp641-646 (The Australasian Institute of Mining and Metallurgy: Melbourne)

Nicholson, P.M. and Eupene, G.S., 1990. Gold Deposits of the Pine Creek Inlier, in Geology of the Mineral Deposits of Australia and Papua New Guinea (Ed. F. E. Hughes). pp 739-742 (The Australasian Institute of Mining and Metallurgy: Melbourne)

Percival, T. J. Bagby W. C. and Radtke A. S., 1988. Physical and Chemical Features of Precious Metal Deposits Hosted by Sedimentary Rocks in the Western United States Symposium Proceedings: Bulk Mineable Precious Metal Deposits of the Western United States pp 11-34. Published by The geological Society of Nevada.
