EL 8829

SPRIGGS & ENTIRE CREEKS
HARTS RANGE REGION, N.T.

NORTHWEST CORNER - ILLOGWA CREEK [SF 53-15] 1:250,000
SOUTHWEST CORNER - HUCKITTA [SF 53-11] 1:250,000

ANNUAL REPORT
TO N.T. D.M.E
FOR PERIOD TO 27/3/1997

LICENCE HOLDER:
CHAMBIGNE RESOURCES PTY LTD

REPORT COMPILED BY:
S.K. DOBOS
DOBOS & ASSOCIATES, BRISBANE
28-5-1997
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1 SUMMARY

The area covered by EL8829 lies on the northeastern flank of the Harts Ranges, along the northward-flowing lower reaches of Spriggs Creek, to where it is joined by Haddock Creek, and thereafter, along Entire Creek to near its confluence with the Plenty River (abutting EL8076, also held by Chambigne Resources). Exploration is focussed principally on detrital garnet and other industrial minerals in the sands of the creekbed.

As previously established, garnet grades in lower Spriggs and Upper Entire Creeks within the Entia Dome ranged from 10.87 to 19.22 wt %, with an average grade of 15.6%. The measured garnet resource for the approximately 14km detailed sampling length comprises 465,994 tons of almandine-rich garnet, in a creekbed system of 3,006,344 tons of sand. This is a small but worthwhile resource, now shown to be economically viable. Northern Entire Creek, outside the Entia Dome, while probably possessing lower overall garnet grades (at least from the limited sampling to date) is still quite prospective, since the creek widths on the floodplain are considerably larger, with much higher inferred resource tonnages.

Mineralogical work under way has demonstrated that there are two garnet populations in the heavy mineral fraction. The dominant “red” garnets, comprising approximately 67% of total garnet, are blocky angular fragments of originally larger garnet grains, largely derived from the Irindina Gneiss. These commonly have significant inclusions, which may comprise one or more of magnetite, quartz, biotite and amphibole, and one or more sharp edges.

The remaining 33% comprise the “purple” or lilac garnets, which tend to be more rounded, resulting from the abrasion of generally smaller isolated dodecahedral grains, largely derived from the Riddock Amphibolite. These are comparatively clear, with few inclusions, but have correspondingly smoother edges, and are probably less hard (being relatively enriched in the grossular and pyrope components).

Both garnet populations are quite “clean”, having little or no clayey coatings or clayey crack infills. The overall blend of garnet should provide a product quality similar to that established for the Plenty River, which meets or exceeds all internationally accepted garnet quality criteria if correctly processed.

Metallurgical testing on two bulk samples, and the 27"E" samples collected previously, and optimisation of separation techniques is also ongoing. Results to date serve not only to establish the viability of garnet production in EL8829, but have modified the envisaged processing stream to allow dry extraction of other industrial minerals if present in sufficient concentrations.

Work proposed for the 97/98 reporting period comprises the completion of metallurgical and processing studies, the completion of garnet and non-garnet mineralogical studies, and the detailed sampling and reserve calculation of the Entire Creek floodplain to the north of Entia Dome.
2 INTRODUCTION AND TENURE

EL8829, the creekbeds of lower Spriggs Creek and Entire Creek, was sought by Chambigne Resources as a source of high quality garnet to complement its other resources for this mineral in the Harts Range area, as well as for a range of other industrial minerals and potential industrial minerals known to occur in relatively high concentrations in this exploration target.

EL8829, comprising 36 graticular blocks of approximately 116km$^2$, was granted for 6 years to Chambigne Resources Pty Ltd on the 27th of March, 1995, after comparison of Chambigne's technical qualifications and financial commitments with that of competitors for the same area.

3 LOCATION AND ACCESS

EL8829 comprises the mid to lower reaches of Spriggs Creek, from near Spriggs Creek Bore to its confluence with Haddock Creek, and from there, all of Entire Creek to near its confluence with the Plenty River. To the west, EL8829 is bounded by 135° 02', and to the east, by 135° 16'; to the south, it is bounded by 23° 10' and to the north by 22° 52'. The precise locations of the graticular blocks comprising EL8829 are shown in Appendix Page 1.

Access to the EL is via the Plenty Highway, which runs east from the Stuart Highway, roughly subparallel to the Plenty River on its southern side, to the Entire and Valley Bore road which turns off to the south. This road enters the Huckitta Dome through the gap in the lowlying ranges at Mount Eaglebeak; continue south
past Valley Bore, and turn east along the Spriggs Creek Bore road, which leads directly to the southern part of the EL.

The Plenty Highway actually crosses Entire Creek several kilometres east of the Entire and Valley Bore road junction; from this crossing, the northern reaches of the EL may be accessed along the creekbed.

4 GEOLOGY OF EL8829

The southwestern part of the EL is sited in fairly steep terrain in the rocks of the Early Proterozoic Harts Range Group, most specifically the Irindina Gneiss, and the Riddock Amphibolite, which are drained by the feeders of Spriggs and Entire Creeks. Both these rock units are heterogeneous, and may carry from zero to 18 volume % garnet, though the average for the Gneiss is closer to 10%. From a consideration of the regional geology, petrology and topography, it is evident that the sources of almost all of the garnet in the creek sands are the two rock units named previously. There appears to be little if any contribution of grossular-andradite garnet from the rare garnetiferous calc-silicate members within the Irindina Gneiss.

Most of lower Spriggs Creek actually traverses the Entia Gneiss, which is non garnetiferous, and is joined by Haddock Creek which also drains a smaller area of mostly Entia Gneiss. There is a more noticeable drop in garnet grade at the confluence of Entire Creek with Inkamulla Creek, since the latter drains a large area of Entia gneiss. (Note that the Entia Gneiss is locally intruded by a suite of pegmatites and hydrothermal veins, some of which carry minor amounts of garnet, however, this is volumetrically insignificant).
Entire Creek drains the northern part of the Entia Dome, and once through the pass at Mount Eaglebeak, forms a flood plain cut by a number of channels which all drain towards the Plenty River. Over all its length, the dominant alluvium washed into the Entire is non garnetiferous, although a small western tributary (the so called "Red River") draining Irindina Gneiss does contribute some garnet. Consequently, the Entire creekbed has substantial sand volumes but of lower inferred garnet grades, whereas the Spriggs Creeks sands are volumetrically small, but of relatively high garnet grade.

The geological-lithological distribution of rocks drained by the creek system of EL8829 can be seen on the Illogwa Creek and Huckitta 1:250,000 Geological maps. For a more detailed appreciation of the relevant rock types, refer to the Quartz 1:100,000 geological map (Appendix Page 3) which clearly shows the distribution of the garnet source rocks. No purely geological mapping was carried out in any part of the EL in this reporting period. Written summaries of the regional geology of the area encompassed by the EL are presented in the notes to accompany the Huckitta and Illogwa Creek 1:250,000 geological maps; there is no equivalent in print for the Quartz 1:100,000 geological map, however the compilation notes appear as BMR Record 23, 1982, [Shaw et al.]. The above geological summary was derived partly from this record, and more directly from ongoing fieldwork and the original petrological research of Dobos (unpublished PhD thesis, Macquarie University, 1978).

5 WORK PROGRAM TO 3/97

The garnetiferous nature of the creekbed of Spriggs and Entire Creeks has been recognised since the early 1970s. In the previous annual report, a measured garnet resource of 465,994 tonnes was established in the creek system from the location of sampling site E1 through to E27, being the southern part of the EL
within the Entire Dome. Bearing in mind the commitment made to DME in 1995, prior to the granting of EL8829, it was decided to postpone further detailed sampling on the flood plain of the Entire Creek, and to concentrate efforts in this reporting period to garnet characterisation, separation techniques, metallurgy, recovery optimisation, and other industrial minerals, with a view to accelerating this resource to production.

To this end, a number of 200 litre drums of creek sand were collected from near sampling sites E1 and E17 (see Appendix Page 2), and shipped to Brisbane for characterisation, metallurgical and recovery optimisation studies. No other substantial fieldwork was carried out in this reporting period.

5.1 GARNET CHARACTERISATION

A large number of heavy concentrates, magnetic concentrates, and garnet concentrates of various purities have been examined microscopically, to establish the physical characteristics of the garnet in EL8829, utilising the “E” samples collected in November 1995, plus the bulk samples referenced above. Representative photomacrographs are presented in Appendix Pages 8 through 13.

The vast majority of creek-bed garnet grains are free of clayey coatings, or clay-filled cracks, which would leave clay films on the worked surface. This is important, since a number of potential garnet deposits in small creek systems close to the garnet source rocks (which are relatively “unworked”), have unacceptably high clay coatings or adhesions, and even with wet separation, not all of this is removed.

The garnet concentrates contain two populations of garnet - the “red” fraction, derived predominantly from the Irindina Gneiss, comprises fragments of originally larger garnet grains. These tend to yield angular, blocky grains with one or more
sharp grain edges (desirable), but also contain significant inclusion minerals; if magnetite comprises a significant volume of inclusions, these grains will tend to report to the high-magnetic fraction, which is not desirable for a dry first pass magnetic separation. If the garnet inclusions comprise too much quartz, this will negatively impact total ("free") silica content.

[The polarised-light microscopic, SEM and electron microprobe analysis of garnet concentrates is underway to address the above issues, but has been delayed due to lack of access to the electron microprobe at UQ. As requested, these will be detailed in the next annual report.]

The second garnet population comprises the “purple” or “lilac” fraction, and from petrological research by Dobos, and from previous work in EL7914, most of this fraction appears to have been derived from the Riddock Amphibolite. These are expected to be less almandine rich, with correspondingly higher mole fractions of the pyrope and grossular components. This in turn may reduce the Knoop hardness of these grains, and this will be tested on a multitude of grains once the complementary electron microprobe analyses are completed (only analysed grains will be tested for hardness, on the same polished thinsections).

The purple garnets also tend, especially in the larger size fractions, to comprise a higher proportion of unbroken grains, many of which clearly exhibit remnants of the dodecahedral faces observed in the Riddock Amphibolite source rocks. These in turn have somewhat more rounded forms (less desirable), and hence much lower concentrations of sharp edges (sharp edges cannot be easily generated from unbroken near-spherical crystals). On the other hand, these purple garnets are more glassy or clear, have less cracking, and are relatively inclusion free, to the extent that they will offset to some degree the likely quartz inclusions of the red fraction.
The proportion of red to purple garnets in virtually all of the garnet fractions, (excepting the -200µ fractions, not yet sufficiently purified for quantitative examination), is in the approximate ratio of 7:3.

5.2 METALLURGICAL TESTING AND RECOVERY OPTIMISATION

This work, by Kelvin Fiedler and Ausenco P/L, has been the principal focus of work in this reporting period. Much of this effort is near completion, but sections recently completed have not yet been tabulated or written up. Rather than presenting partial results, and as requested, the completed results, as appropriate, will be presented in the next report.

Appendix Pages 6 and 7 detail completed bench studies on garnet separation, on the “E” samples collected previously, and will be used (together with other ongoing work) to interpolate the metallurgical and separation optimisation results derived from the bulk samples over the entire creek system.

The ongoing metallurgical effort has resulted in the continuing modification of the separation plant to allow easier exploitation of other industrial minerals present in the sands of EL8829, if in sufficient concentration. The separation process as it currently stands is still entirely dry. The most immediate target minerals are ilmenite, magnetic and non-magnetic rutile, and zircon, though the aluminosilicates are an emerging possibility (see Appendix Page 13).

The entire garnet processing stream has been independently “audited” and computer modelled. Not only has it been shown to work in absolute terms, but at a performance level consistent with planned production levels, including capacity for increased future production.
5.3 STREAM SEDIMENT GEOCHEMISTRY

Six samples were collected from the central portion of the EL (see Appendix Page 4) for stream sediment geochemistry; the analytical results are tabulated in Appendix Page 4. One purpose of this effort was to see the prospectivity for recovery of minute amounts of alluvial gold or electrum, since large numbers of quartz-dominated hydrothermal veins (and an equally large number of near-eutectic micro-pegmatites) are present in the source rocks drained by the creek system. No substantive gold production has been recorded from this area, and the Au and Ag values only corroborate the inference that the vein systems carry no precious metals.

Similarly, though isolated scheelite occurrences have been documented in the general area (especially by the fossickers), the low W and Sn values confirm zero prospectivity for W and Sn heavy minerals. The slightly elevated Ba values only reflect the petrogenetic concentration of this element in partial-melt pegmatites (this would also hold true also for Li, B and Be).

Cr and Ni will occur largely in magnetite solid solutions as the chromite and trevorite end-members, as will some Mn and Zn; the occurrence of magnesio-chromite and substantial amounts of chromite are unlikely, bearing in mind that the exposed rocks in the Entia Dome are largely of reworked crustal protoliths.

Of direct consequence to the working of the creek system is the fact that concentrations of the environmentally unfriendly metals As, Cd and Sb, plus the base metals, are very low or near crustal averages; working these creek sands will not pose a heavy-metal water quality problem.
6 SYNTHESIS

Ongoing work has proved up an economically favourable garnet resource within at least the central portion of EL8829. Mineralogical work to date has demonstrated that the garnet quality will meet or significantly exceed those of currently worked deposits in Australia (WA at Port Gregory and NSW at Broken Hill), at least in terms of shape factor, sharpness, "cleanliness" and predictably low quartz content, and will be first rate by internationally accepted criteria.

By analogy with garnet from ELs 8076, 8384 and 8423, all derived from the same two principal rock units as the garnet in EL8829, Knoop hardness and water leach quality are likely to be similarly excellent; analytical work is in progress to quantify these parameters.

The ongoing and completed metallurgical studies indicate that the garnet may be extracted for profit, and that significant co-recovery of a number of other industrial minerals is feasible if in viable concentrations in the sands.

7 EXPENDITURE TO 3/97

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Total $53,044
8 PROPOSED WORK TO 3/97

Fieldwork proposed for the 97/98 reporting period should comprise the detailed sampling of the northern part of the Entire Creek, between the exit point from the Entia Dome to the northern boundary of the EL, where it abuts EL8076. Since this area comprises a wide floodplain, rather than a narrow channel system bounded by hard-rock banks and well defined levees, this will require a number of transects across the flow direction, to more precisely delineate the grade distribution. The samples from this fieldwork will then be processed for size/grade distribution, similar to samples from the rest of EL8829.

The second thrust of work proposed will be the completion of metallurgical studies and mineral separation optimisation currently under way, including the tabulation of data and documentation.

The mineralogical studies under way, including electron microprobe analysis, SEM imaging, Knoop hardness testing of the two garnet populations and the characterisation of non-garnet industrial minerals should be completed.

It is Chambigne’s intention to convert all workable parts of EL8829 to ML status as soon as practicable.

9 PROPOSED EXPENDITURE TO 3/98

It is expected that Chambigne will establish its first processing plant on the Plenty River in the vicinity of the Harts Range Police Station in the next 12 months. This
will reduce plant and transport costs, and will drastically reduce bulk sample and mineral separation costs due to use of in-house equipment and labour.

In light of the above, the following minimum expenditure is proposed for EL8829 to the year ending 3/1998.

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Total proposed expenditure 97/98 $15,000

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(Appendices and enclosure to follow)
SECOND SCHEDULE
(Plan of Area)

EL8829
36 BLOCKS
116 sq kms

Appendix Page 1
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Average: 0.65  2.83  2.62  3.20  5.29  0.41  15.00

% of total:
garnet  4.38  18.99  17.20  21.00  35.76  2.66
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This is a first-pass magnetic fraction, separated dry, of Entire Ck sand - there are two "populations" of garnet, those that are various shades of red (verging on orange, an artefact of the colour printing process) and those that are various shades of lilac to deep purlilsh red; real life colours are appreciably darker than printed. The purplish-lilac garnets on the whole are "clearer" or more glassy, having fewer penetrative cracks, and containing significantly fewer inclusions.

The balckish grains are dominantly amphiboles, with lesser amounts of brownish-black biotite and black to medium-green pyroxene, and some dark green epidote. There are very few discrete magnetites in this size fraction, though there are composite grains of garnet and amphibole intergrown with smaller fragments of magnetite, and a small fraction of garnet containing appreciable magnetite inclusions, both sufficiently magnetic to enable separation with a weaker magnetic field.

Appendix Page 8
Photo #1 - EL8829 sample site E17 - nominal -850μ magnetic concentrate
Field-of-view approximately 11x7.3mm; nominal magnification = 14x

This is another view of the first-pass magnetic fraction, separated dry, of Entire Ck sand. Note that there is a tendency for the purplish garnets to reflect their crystal morphology, namely that of discrete dodecahedra, yielding rounded grains, generally free of inclusions, whilst the red garnet fraction comprises fragments of larger grains, and is generally more angular.

Several white quartz grains are evident - these are milky, reflecting vein-derived provenance, rather than glassy clear, the dominant form of quartz in the Irindina Gneiss. Most of the milky quartz grains, at higher magnification, are intergrown with small magnetites, hence their presence in this first-pass magnetic separate.

Note a greenish diopsidic pyroxene at lower right of the photo, and a biotite aggregate near the bottom centre. A number of the amphiboles are "clayey" such as near the bottom left corner.

Appendix Page 9
Photo #1 - EL8829 sample site E17 - nominal -600μ magnetic concentrate
Field-of-view approximately 11x7.3mm; nominal magnification = 14x

This is a view of the first-pass magnetic fraction, separated dry, of Entire Ck sand, but of the next finer fraction from the previous photos. The gross features of this fraction are very similar to those of the +600-850μ fraction, but with a slightly higher amount of quartz carried over, showing more broken platy fragments of purplish garnet, and a slight increase in the ratio of biotite to hornblende.

Note the adjacent green diopsidic pyroxene and thin biotite cleavage flake near the left centre edge of the photo; there is another greenish pyroxene grain just SE of the centre.

Appendix Page 10
This is a clean garnet separate produced from the first-pass magnetic concentrates, separated dry, of Entire Ck sand.

Note first that the more angular grains are concentrated in the reddish fraction, comprising fragments of originally larger grains. The concentration of sharp edges in this fraction alone is sufficiently high to meet market requirements, as are the shape factors.

The purplish fraction in this size range tends to more rounded grains, with somewhat less desirable shape factors, and also with a tendency to less sharp edges, however, these as a whole are relatively inclusion free in comparison to the reddish fraction.
Photo #1 - EL8829 sample site E17 - nominal -850μ magnetic concentrate
Field-of-view approximately 11x7.3mm; nominal magnification = 14x

This is another view of the clean garnet separate produced from the first-pass magnetic concentrates, separated dry, of Entire Ck sand. In this field of view, the greenish pyroxene (with magnetite inclusions) is obvious, as is the milky kyanite fragment (also with magnetite inclusions) at the left edge.

Most importantly, both garnet populations are largely free of clay coatings and clayey crack infills, which would decreases the value of garnet product drastically, as the clay adheres to the work surface.

Also of note is the fact that the garnets are relatively free of penetrative cracks, especially the rounded purplish grains, which again is a plus feature of the likely garnet product from this area.

Appendix Page 12
Photo #1 - EL8829 sample site E17 - nominal -850μ high-magnetic concentrate
Field-of-view approximately 11x7.3mm; nominal magnification = 14x

This is a view of the high-magnetic fraction derived from the dry-separated first-pass magnetic concentrate from the Entire Ck sands - as a garnet product, these are rejects, although a few garnet grains are visible. Significant proportions of the hornblende composites are clayey.

There are very few discrete magnetite grains in this separate. Most grains are either silicate mineral composites with intergrown magnetite, or contain volumetrically high amounts of magnetite inclusions. Most of the ilmenite and magnetic rutile report to this fraction, but the amounts of these phases, at least in this sample, do not appear to be high.

Note that there is a significant concentration of prismatic magnetite-bearing kyanite and sillimanite? in this fraction, and that the two near-central quartz grains carry minute magnetite granules on their surfaces.

Appendix Page 13