## MT. COSTIGAN MINES LIMITED
## ASSESSMENT OF BEACH SAND RESERVES
## SPL NO. 2. NARACOOPA
## KING ISLAND

MICROFILMED

## CONTENTS

24th October, 1966          Kenneth McMahon & Partners Pty. Ltd.

1.

## SUMMARY

A programme of hand drilling was undertaken near
Naracoopa on King Island on the area covered by Special
Prospecting Licence No. 2 to check reserves of beach sand
previously drilled with a Gemco rig.

Results confirm the volume of sand in the reserves,
but owing to the adoption of different conversion factors
the tonnage of rutile and zircon is slightly lower.

On the Sea and Milford Beaches the tonnage of rutile
is estimated as 19,904 long tons, as against 24,531 long
tons previously calculated. For zircon the corresponding
figures are 20,687 and 25,964 each being in long tons.

Total reserves on the Lanherne Beach are probably
much larger than have been proved so far. Though
established reserves should be assessed rather lower by
using a different conversion factor. In this case the
figures would be 22,070 long tons of rutile and 24,522
long tons of zircon, instead of the original figures of
29,231 long tons of rutile and 32,479 long tons of zircon
previously calculated.

There are good indications that further reserves
exist outside SPL No. 2 on other areas now held by the
Company.

CONCLUSIONS

1. The following reserves of heavy minerals have been confirmed on SPL No. 2

|  | Rutile (L. Tons) | Zircon (L. Tons) |
|---|---|---|
| Sea Beach | 2,807 | 2,301 |
| Milford Beach | 17,097 | 18,386 |
| Lanherne Beach | 22,070 | 24,522 |
| Totals | 41,974 | 45,209 |

2. Reserves of tin are insignificant and for practical purposes can be ignored.

3. The reserves of sand on the Sea & Milford Beaches as proved by the original drilling using the "Gemco" rig have been confirmed by the check drilling programme within a limit of 10%, which is regarded as satisfactory.

Reserves of rutile and zircon are slightly less than previously estimated owing to different tonnage conversion factors being used. Comparative figures are given in the following tables.

SEA BEACH

|  | Mt. Costigan Mines Ltd. | K. McMahon & Partners P/L |
|---|---|---|
| Volume of sand. Cu. yds | 66,981 | 80,885 |
| Volume of sand. Short tons | 119,226 | 113,476 |
| Volume of sand. Long tons | 106,452 | 101,318 |
| Conversion factor. Tons/cu. yd. | X 1.78 short tons equiv. to 1.59 long tons | Av. 1.25 long tons |
| Rutile. Long Tons | 4,365 | 2,807 |
| Zircon. Long Tons | 4,790 | 2,301 |

MILFORD BEACH

|  | Mt. Costigan Mines Ltd. | K. McMahon & Partners P/L |
|---|---|---|
| Volume of sand. Cu. yds. | 158,607 | 164,497 |
| Volume of sand. Short tons | 282,320 | 256,420 |
| Volume of sand. Long tons | 252,071 | 228,946 |
| Conversion factor. Tons/cu. yd. | X 1.78 short tons equiv. to 1.59 long tons | Av. 1.39 long tons |
| Rutile. Long Tons | 20,166 | 17,097 |
| Zircon. Long Tons | 21,174 | 18,386 |

*These factors are too high ( they appear to be the metric density factor which is inappropriate.)*

. 3.

4. Systematic check drilling on the Lanherne Beach was not possible owing to hard bands and stiff clay impeding the progress of the hand augers. Selected holes drilled to the same depth as in the original drilling showed that in general the heavy mineral content was undervalued by the "Genco" drill.

5. The conversion factor of 1.78 short tons per cu. yard is considered too high for the Lanherne Beach. A figure of 1.20 long tons or 1.344 short tons per cu. yard is considered more appropriate.

6. A very large part of the Lanherne Beach has not yet been drilled, and recent scout drilling has shown that payable values probably exist outside the area originally drilled. On this basis the ore reserves as given by Mt. Costigan Mines Limited are almost certainly on the low side. Comparative figures, as far as it is possible to give them at present, are as follows:-

LANHERNE BEACH

|  | Mt. Costigan Mines Ltd. | K. McMahon & Partners P/L |
|---|---|---|
| Volume of sand. Cu. yds | 1,021,770 | 1,021,770 |
| Volume of sand. Short tons | 1,818,751 | 1,373,259 |
| Volume of sand. Long tons | 1,623,963 | 1,226,124 |
| Conversion factor. Tons/cu.yd. | 1.78 short tons Equiv. to 1.59 long tons | 1.20 long tons/ cu.yd. |
| Rutile. Long tons | 29,231 | 22,070 |
| Zircon. Long tons | 32,479 | 24,522 |

7. Compared with similar deposits on the east coast of Australia, the Sea and Milford Beaches are unusually rich, but due to the shallowness of the sand the tonnage of available mineral is limited.

8. No great difficulty is likely to be met in mining the Sea and Milford Beaches where accepted methods of mining and treatment will be adequate, but the Lanherne Beach containing hard bands and stiff clay will require special and more costly methods for both mining and treatment.

9. The total area held under various forms of exploration licence by Mt. Costigan Mines Limited is large and far greater than the area under consideration in this report. Indications are that large areas may be economic to mine as large tonnage and low grade propositions; one area with good potential is near Cowper Point.

DESCRIPTION OF WORK DONE

Checking of the reserves of heavy minerals on the Sea, Milford and Lanherne Beaches was undertaken by two teams of men using hand drilling equipment. This work started on 28th July and finished on 11th August, 1966.

A summary of the work done is as follows:

| | |
|---|---|
| No. of Holes drilled | 124 |
| No. of samples taken | 398 |
| Total footage drilled | 1251 ft. |
| Average depth per holes | 10.1 ft. |

Above the water table, drilling was done with standard 3 in. augers, and below water table sludge bailers were used together with casing. Drilling proceeded until stopped by hard formations or until qucksand conditions rendered further sampling unrepresentative.

The east-west grid used for the "Gemco" rig in the original drilling programme was used once more and on the Sea and Milford Beaches holes were spaced 25 feet apart on lines 400 feet apart, starting at Grid Line 2 near the Fraser River on SPL No. 2 and working north to Line 35.

Drill lines were spaced 1000 feet apart North of Line 35 as far as Eldorado Creek on Permit to Enter No. 1916. These lines are numbered 45, 55, 65 and 75. Here again, Milford Beach was drilled with holes spaced 25 feet apart. While one hole only per line was drilled on the Sea Beach. The results of this drilling enable a better assessment to be made of the reserves further south on SPL No. 2.

On all lines the datum for measurement was taken to be the eastern edge of the Milford Beach, which is raised some 4 or 5 feet above the level of the Sea Beach.

Results from the above programme were sufficient to provide an independent check on the reserves of the Sea and Milford Beaches, but the presence of hard bands and stiff clay on the Lanherne Beach made it impossible to drill to a rigid pattern. Accordingly, selected holes were drilled to the same depth as the holes drilled by the Gemco and the results compared.

Part only of the Lanherne Beach System on SPL No. 2 had been drilled with the "Gemco" rig, and while the hand boring teams were available a small number of holes were drilled close to the escarpment near the Milford Beach. The results tabulated in this report are sufficient indication that the full potential of the Lanherne Beach has not yet been assessed.

The opportunity was taken to drill two holes on the dunes near Cowper Point to investigate mineral values at a deeper level than had previously been possible. Results from both holes are encouraging and clearly deeper and more extensive drilling is justified.

## RESERVES: SEA BEACH, LINES 2-35

| Line | Width (ft.) | Av. Depth (ft.) |
|------|-------------|-----------------|
| 2 | 87.5 | 7.2 |
| 6 | 87.5 | 6.9 |
| 10 | 87.5 | 8.6 |
| 14 | 87.5 | 7.5 |
| 18 | 87.5 | 5.5 |
| 22 | 87.5 | 8.5 |
| 26 | 87.5 | 5.5 |
| 31 | 87.5 | 5.5 |
| 35 | 87.5 | 6.9 |

H.M Constituents.

| Line | Sand (cu.yds) | L.Tons per cu. yd. | Sand (L.Tons) | H.M. % | H.M. L. Tons | Rutile % | Rutile L.Tons | Zircon % | Zircon L.Tons | Mags. % |
|------|-------|------|--------|------|-------|------|------|-----|------|------|
| 2 | 9,333 | 1.41 | 13,160 | 57.3 | 7541 | 9.74 | 734 | 8.3 | 626 | 72.5 |
| 6 | 8,944 | 1.30 | 11,627 | 39.1 | 4546 | 9.74 | 443 | 8.3 | 377 | 72.5 |
| 10 | 11,148 | 1.25 | 13,935 | 30.9 | 4306 | 9.97 | 429 | 8.9 | 383 | 71.4 |
| 14 | 9,722 | 1.25 | 12,153 | 28.8 | 3500 | 9.97 | 349 | 8.9 | 312 | 71.4 |
| 18 | 7,129 | 1.25 | 8,911 | 28.9 | 2575 | 11.2 | 288 | 7.3 | 188 | 66.2 |
| 22 | 7,518 | 1.20 | 9,022 | 21.3 | 1922 | 11.2 | 215 | 7.3 | 140 | 66.2 |
| 26 | 11,018 | 1.20 | 13,222 | 16.6 | 2195 | 8.09 | 178 | 5.5 | 121 | 76.0 |
| 31 | 7,129 | 1.20 | 8,555 | 9.3 | 796 | 8.09 | 64 | 5.5 | 44 | 76.0 |
| 35 | 8,944 | 1.20 | 10,733 | 13.3 | 1427 | 7.51 | 107 | 7.7 | 110 | 73.8 |
| TOTALS | 80,885 | 1.25 | 101,318 | 28.4 | 28,808 | 9.74 | 2807 | 8.0 | 2301 | 71.8 |

### RESERVES: MILFORD BEACH, LINES 2-35

| Line | Width (ft.) | Av. Depth (ft.) |
|---|---|---|
| 2 | 137.5 | 9.1 |
| 6 | 137.5 | 9.1 |
| 10 | 137.5 | 9.6 |
| 14 | 137.5 | 9.9 |
| 18 | 112.5 | 10.0 |
| 22 | 87.5 | 8.9 |
| 26 | 112.5 | 12.5 |
| 31 | 137.5 | 12.0 |
| 35 | 137.5 | 10.6 |

| Line | Sand (cu.yds) | L.Tons per cu. yd. | Sand L.Tons | % H.M. | H.M. Long Tons | Rutile % | Rutile L.Tons | Zircon % | Zircon L.Tons | Mag. |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 18,537 | 1.56 | 28,918 | 73.3 | 21,197 | 15.3 | 3,243 | 21.0 | 4,451 | 58.8 |
| 6 | 18,537 | 1.56 | 28,918 | 78.0 | 22,556 | 15.3 | 3,451 | 21.0 | 4,737 | 58.8 |
| 10 | 19,555 | 1.55 | 30,310 | 71.9 | 21,793 | 14.5 | 3,160 | 14.5 | 3,160 | 63.6 |
| 14 | 16,500 | 1.38 | 22,770 | 51.6 | 11,749 | 14.5 | 1,704 | 14.5 | 1,704 | 63.6 |
| 18 | 12,962 | 1.45 | 18,795 | 60.6 | 11,390 | 13.3 | 1,515 | 11.6 | 1,321 | 69.0 |
| 22 | 11,537 | 1.45 | 16,729 | 60.8 | 10,171 | 13.3 | 1,353 | 11.6 | 1,180 | 69.0 |
| 26 | 20,833 | 1.25 | 26,041 | 31.4 | 8,177 | 11.6 | 949 | 9.0 | 736 | 72.5 |
| 31 | 24,444 | 1.25 | 30,555 | 28.3 | 8,647 | 11.6 | 1,003 | 9.0 | 778 | 72.5 |
| 35 | 21,592 | 1.20 | 25,910 | 15.6 | 4,042 | 17.8 | 719 | 7.9 | 319 | 73.9 |
| TOTAL | 164,497 | 1.39 | 228,946 | 52.3 | 119,722 | 14.3 | 17,097 | 15.4 | 18,386 | 66.7 |

## RESERVES: LANHERNE BEACH

Reserves on the area of the Lanherne Beach originally drilled are estimated to contain 22,070 long tons of rutile and 24,522 long tons of zircon on a conservative basis.

The presence of hard bands and heavy clay in the Lanherne Beach precluded a systematic check drilling layout as carried out on the other beaches. Accordingly, certain selected holes were drilled to the same depth as when previously drilled with the "Gemco" rig. Results are as follows:-

| Hole No. | Depth | % H.M. | |
| | | Original % | Check drilling % |
|---|---|---|---|
| 14/1380 | 19' | 47.5 | 55.4 |
| 15/1500 | 10' | 61.4 | 73.5 |
| 16/1400 | 16' | 20.7 | 33.9 |
| 16/1500 | 12'6" | 9.8 | 16.0 |
| 20/1780 | 8'7" | 3.5 | 6.1 |
| 21/1800 | 8'2" | 2.9 | 6.5 |
| 22/1700 | 16'8" | 1.3 | 3.7 |
| 23/1600 | 15'3" | 2.0 | 13.5 |

A comparison between the original and the check drilling shows that the "Gemco" rig gave a result which was too low. Why this should be so is not clear, but on this beach with its heavy clay in places, drilling conditions are very different from the other beaches where good correspondence was obtained between the original and the check drilling.

A small number of holes were drilled near the eastern escarpment of the Lanherne Beach. Results are tabulated below. The indication is that further drilling is warranted in this area.

### Lanherne Beach

| Hole No. | Depth (ft.) | % H.M. |
|---|---|---|
| 2/170W | 10' | 2.7 |
| 6/170W | 10½' | 1.6 |
| 10/170W | 18' | 1.7 |
| 14/170W | 8' | 0.7 |
| 18/118W | 10' | 1.1 |
| 18/133W | 10' | 3.4 |

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## RESERVES ON PERMIT TO ENTER NO. 1918: LINES 45-75

North of Line 35, drilling was continued on the Milford and Sea Beaches on lines 1000 feet apart as far as Eldorado Creek to check the persistence of heavy mineral.

Holes were drilled across the Milford Beach at intervals of 25 feet, while one hole only per line was drilled on the Sea Beach.  Results are given in the following table:-

**MILFORD BEACH**

| Line | Length | Av. Depth | Sand cu.yds. | Sand L.Tons | Av. % H.M. | H.M. L.Tons | Rutile % | Rutile L.Tons | Zircon % | Zircon L.Tons |
|---|---|---|---|---|---|---|---|---|---|---|
| 35 / 45 | 137.5 / 137.5 | 10.6 / 5.7 | 21,592 / 29,028 | 25,910 / 34,834 | 15.6 / 12.6 | 4042 / 4389 | 17.8 / 17.8 | 719 / 781 | 7.9 / 7.9 | 319 / 347 |
| 55 | 162.5 | 11.4 | 68,611 | 82,333 | 5.5 | 4528 | 17.8 | 806 | 7.9 | 358 |
| 65 | 112.5 | 9.5 | 39,583 | 47,500 | 2.1 | 998 | 17.8 | 178 | 7.9 | 79 |
| 75 | 112.5 | 11.1 | UNPAY | | 0.8 | | | | | |
| TOTALS (Lines 45-65) | | | 137,222 | 164,667 | 6.0 | 9915 | 17.8 | 1765 | 7.9 | 784 |

A density factor of 1.20 tons per cu. yard has been used in the above table.

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## SEA BEACH

| Line | Hole | Depth | Av. % H.M. |
|------|------|-------|------------|
| 45 | 2E | 9½' | 4.7 |
| 55 | 2E | 8' | 1.7 |
| 65 | 2E | 12' | 1.2 |
| 75 | 2E | 10½' | 1.05 |

The above results on the Sea Beach show a progressive diminution of values     north towards the mouth of Eldorado Creek at Line 75 where the heavy mineral content is barely payable.  In general, values are lower than on the Milford Beach.

## COWPER POINT

Two holes were drilled in the dunes near Cowper Point with the following results:-

| Hole No. | Depth (ft.) | % H.M. | Average % H.M. |
|----------|-------------|--------|----------------|
| A.11 | 0-1 | | |
| | 1-5 | 2.9 | |
| | 5-10 | 2.8 | |
| | 10-15 | 3.9 | |
| | 15-20 | 2.8 | |
| | 20-25 | 2.7 | |
| | 25-30 | 1.5 | |
| | 30-35 | 2.3 | |
| | 35-40 | 3.1 | 2.7 |
| A.12 | 0-1 | | |
| | 1-5 | 1.0 | |
| | 5-10 | 1.7 | |
| | 10-15 | 1.2 | |
| | 15-20 | 1.9 | |
| | 20-25 | 0.5 | |
| | 25-28 | 2.5 | 1.4 |

Both the above holes show encouraging values and the possibility of proving further payable mineral in depth. This area warrants further investigation.

## HEAVY MINERAL ANALYSES

In the following table the various fractions are expressed as percentages of the heavy mineral present. Final results were obtained by chemical analysis.

| Locality | Line | Non-Magnetic fraction | | | Heavy Mineral | |
|---|---|---|---|---|---|---|
| | | % Sn | % TiO2 | % Zircon | % Non-Magnetic | % Magnetic |
| Sea Beach | 2 & 6 | Nil | 9.74 | 8.3 | 27.5 | 72.5 |
| | 10 & 14 | Nil | 9.97 | 8.9 | 29.6 | 71.4 |
| | 18 & 22 | Nil | 11.2 | 7.3 | 33.8 | 66.2 |
| | 26 & 31 | Trace | 8.09 | 5.5 | 24.0 | 76.0 |
| | 35 & 75 | Nil | 7.51 | 7.7 | 26.2 | 73.8 |
| Milford Beach | 2 & 6 | Trace | 15.3 | 21.0 | 41.2 | 58.8 |
| | 10 & 14 | Nil | 14.5 | 14.5 | 36.4 | 63.6 |
| | 18 & 22 | Nil | 13.3 | 11.6 | 31.0 | 69.0 |
| | 26 & 31 | Nil | 11.6 | 9.0 | 27.5 | 72.5 |
| | 35 & 75 | Nil | 17.8 | 7.9 | 26.1 | 73.9 |
| Lanherne Beach | 14,15,16 20,21,22, | Nil | 11.4 | 10.0 | 30.5 | 69.5 |
| | 23 | Nil | 12.9 | 6.9 | 44.5 | 55.5 |
| | Others | Nil | 13.1 | 13.2 | 34.7 | 65.3 |
| Cowper Point | A | Trace | 12.9 | 10.3 | 37.4 | 62.6 |

_(handwritten margin notes: 72.0 ; 67.5 ; 63.4 ; 3)37.4 = 12.5 ; 3)30.1 = 10.0)_

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## DENSITY FACTORS

In calculating tonnages of sand containing heavy mineral a factor of 1.78 short tons per cu. yard was used by Mt. Costigan Mines Limited in its original assessment of tonnages, final results being, of course, expressed as short tons.

Australian practice is to give all tonnages as long tons and this has been done in this report.

The percentage of heavy mineral varies considerably over the areas investigated and is often sufficiently high to warrant the use of a variable density factor.

A test was carried out at the Department of Mines, Launceston, to determine the density of sand containing heavy mineral, and this proves that the sliding scale of conversion factors used on the East Coast of Australia can be used for the sand at Naracoopa also. For comparison a few examples are given in the following table. The conversion factors giving long tons per cubic yard refer to sand with moisture not exceeding 2%.

| % H.M. | Long Tons per cu. yard |
|--------|------------------------|
| 0      | 1.20                   |
| 10     | 1.20                   |
| 20     | 1.20                   |
| 30     | 1.25                   |
| 40     | 1.31                   |
| 50     | 1.37                   |
| 60     | 1.44                   |
| 70     | 1.53                   |
| 80     | 1.63                   |

N.B. 1.78 short tons/cu. yard is equivalent to 1.59 long tons per cu. yard.

It is apparent that by using a factor of 1.78 short tons per cu. yard in the original calculation of reserves, the results are in general too high.