REPORT ON ASSESSMENT OF ZEBRASTONE OCCURRENCE IN MINERAL

CLAIMS MCN 3988 AND 3989, VICTORIA RIVER REGION

FOR MR. P. PIROMANSKI

FOR NORTHERN TERRITORY DEPARTMENT OF
INDUSTRIES AND DEVELOPMENT

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<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2  CONCLUSION AND RECOMMENDATION</td>
<td>2</td>
</tr>
<tr>
<td>3  DIMENSION STONE - GENERAL</td>
<td>4</td>
</tr>
<tr>
<td>4  LOCATION AND ACCESS</td>
<td>5</td>
</tr>
<tr>
<td>5  TENURE</td>
<td>5</td>
</tr>
<tr>
<td>6  REGIONAL GEOLOGICAL SETTING AND ZEBRASTONE OCCURRENCE</td>
<td>8</td>
</tr>
<tr>
<td>7  BULLDOZER COSTEANING</td>
<td>11</td>
</tr>
<tr>
<td>8  QUALITY</td>
<td>23</td>
</tr>
<tr>
<td>9  QUANTITY</td>
<td>27</td>
</tr>
<tr>
<td>10 FURTHER WORK PROPOSED</td>
<td>28</td>
</tr>
<tr>
<td>11 REFERENCES</td>
<td>29</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

The writer was asked by the title holder, Mr. P. Piromonski, to carry out the work to evaluate an occurrence of ferruginous siltstone with distinctive and peculiar patches and patterns, unique to the Territory, known as zebrasone in Mineral Claims (application) NCW 3988 and 3989 and the surrounding EL 6345. The work, consisting of bulldozer costeaming and geological investigation, was conducted during a period of 27th December 1990 and 3rd January 1991.

As the work was related to the title holder’s financial arrangement seeking the government assistance as a Territory’s pioneer industry, Mr. G. Higgins of the Department of Industries and Development was also concerned with the assignment of the writer to the work.

The business proposal submitted by the title holder to the government is to set up, in not distant future, quarrying and processing operation of zebrasone starting from a small scale.

In this report, firstly the dimension stones and its business are discussed, and, subsequently, with reference to such requirements for the dimension stone, the quality of zebrasone as a dimension stone is discussed.

The quantity of zebrasone is discussed firstly in accordance with the need for the title holder’s business proposal. Although the quantity is deemed to be enough to meet such a minimum need, a certain follow-up geological work is considered to be highly recommendable for future expansion of zebrasone business, specifically the establishment of an export oriented dimension zebrasone business in the Territory and early prediction for the above possibility, about which the discussion is also set forth.

M. Sakurai, BE MAIMM
2 CONCLUSION AND RECOMMENDATION

Rock for dimension stone must be:

A) free of cracks,
B) of uniform texture,
C) of attractive colour and fabric,
D) capable of taking polish,
E) not be porous and
F) the stone deposit must be capable of producing dimension blocks at economical level.

Zebrastone is considered generally to meet those requirements. More precisely, zebrastone has satisfaction with (B), (C), (D), and (E). (A) and (E) are satisfactory with some reservation. -------------------------- (1)

The quantity of zebrastone needed for the title holder's business proposal is 10,000 sq m in 3 years. The quantity of proven material is 36,000 sq m counting only one zebrastone layer of 0.2 m immediate beneath soil and a thin fractured siltstone layer and using the most conservative waste percentage. ----------------------------- (2)

The above quantity is derived from:

Area \[100 \text{ m} \times 600 \text{ m} = 60,000 \text{ sq m}\]
Volume \[60,000 \text{ sq m} \times 0.2 \text{ m} = 12,000 \text{ cu m}\]
@ Zebrasone bed : 0.2 m
Quantity of slabs at nil waste percentage \[12,000 \text{ cu m} \times 30 = 360,000 \text{ sq m of slabs}\]
@ One cu m of stone block results in 30 sq m of slabs after cutting and polishing
Quantity of slabs after discarding waste \[360,000 \text{ cu m} \times 10 \% = 36,000 \text{ sq m of zebrastone slabs}\]
@ In this industry, up to 90 per cent of material extracted from a quarry is waste. Therefore, the most conservative waste percentage is 90 % and, in other words, only 10 per cent is the final zebrastone product.
From the above grounds (1) and (2), it is recommended that the government assistance for the business proposal submitted by the title holder would be favored.

Although some information has already obtained, the data so far obtained is not enough for a full satisfaction for the above (A) and (F), and to obtain a figure of waste percentage. These points are important for future growth of the zebrastone business and, particularly, for the establishment of an export oriented zebrastone business in the Territory.

In addition to the title holder's business proposal, the following work would be recommended to be conducted immediately.

1) Diamond drilling, four vertical drill holes, 30 metres deep each, totalling 120 metres.

2) Cutting and polishing 250 square slabs, each 10 cm a side and 2 cm thick, of which 50 are used for gift and demonstration purposes and the rest 200 are sold at various souvenir and jewelry shops mainly in Darwin.
Dimension stones are blocks with even surface of specific shape and of specific size. Most building stone is dimension stone and is used as cut or finished stone according to drawing supplied.

Today, buildings constructed of massive masonry may be none or are, if any, very rare. Buildings of stones like the magnificent cathedrals of Europe have been replaced by reinforced concrete and baked-clay products, and dimension stones are used only in the form of thin slabs for both exterior and interior of expensive skyscrapers and office buildings.

Recently, building stones in large cities are said severely to be affected by atmospheric gases. Carbon dioxide (CO₂), sulfur dioxide (SO₂) and sulfur trioxide (SO₃) are the main detrimental gases and cause problems of scaling. Calcite, the main constituent mineral of marbles and limestones, may be transferred into sulfate when it acts upon sulfurous gases and scaling results and, therefore, marbles are not highly resistant to weathering. Cyclical heating to a high temperature and subsequent cooling also may destroy a rock, particularly if the constituent mineral is calcite. Black and other granites have become more resilient and more fasionable than marbles and limestones.

It is surprisingly true that, despite the abundance of rock outcrops as rocks are the earth itself, rocks satisfying the requirements for dimension stones are few and are as hard to find as just about other mineral deposits. It is also hard to obtain dimension stone products because up to 90 per cent of material extracted from a quarry is waste.

The dimension stone business is booming internationally. The value of all stones has risen over the last several years. Prices vary, with the maximum of around US $1,200 a tonne.
4 LOCATION AND ACCESS

MCN (A) 3988 and 3989 and the surrounding EL 6345 are located in Victoria River District between Top Springs and Victoria River Downs and are situated 64 km west of Top Springs (Fig 1).

Top Springs is a small settlement of roadside inn along Delamere Road and is situated 450 km south of Darwin or 285 km South of Kaerine. It is linked to Darwin and Katherine by Stuart Highway, Victoria Highway and Delamere Road, all bituminous sealed until Top Springs and further.

The road distance from Darwin to Top Springs is Darwin - Katherine 314 km through Stuart Highway, Katherine - Willeroo 126 km through Victoria Highway and Willeroo - Top Springs 162 km through Delamere Road.

MCN (A) 3988 and 3989 are accessible by a station track, to the distance of 10 km north from a road connecting Top Springs, Victoria River Downs and Timber Creek.

5 TENURE

Exploration Licence EL 6345, Mineral Claims (application) MCN 3988 and 3989 are shown on Fig 2.

Exploration Licence EL 6345, covering 60 blocks or 258 sq km, was granted to Mr. P. Pionomski on 1st March 1989 for a period of 6 years. A 15% interest in the EL was transferred to Aboriginal Exploration and Development Pty Ltd on 28th September 1989.

Upon successful discovery of zebrastone outcrops in the EL, MCN (A) 3988 and 3989 were lodged within EL 6345 on 2nd July 1990 to cover the zebrastone deposits so far located.
Fig 2

MAP SHOWING TENUES

Scale 1: 200,000
The Victoria River region is the plateau and mesa country situated southwest of the Pine Creek Geosyncline.

The region is occupied by a sequence of dolomite, sandstone, siltstone, carbonaceous siltstone and shale, having been deposited into the Victoria River Basin during the Upper Proterozoic time under the shallow marine and lagoonal environment.

To the end to the Upper Proterozoic time, vast quantities of tholeitic lava erupted by which at times the entire region was flooded.

Geological sketch map of Victoria River Basin giving distribution of sedimentary rocks and the Antrim Plateau Volcanics is shown as Fig 3.

The Battle Creek Formation which is one of the sediments deposited into the Victoria River Basin contains beds of zebrastone. Zebrastone is a white clayey siltstone of uniform composition with extremely regular patches and patterns of brown iron oxide. The geological mechanism by which the peculiar zebrastone patterns were formed is unknown. The zebrastone bed is generally flat lying and in places is very gently dipping at less than 5 degrees immediate beneath soil layer in the area (Fig 4).

Only the said two formations, the Battle Creek Formations and the Antrim Plateau Volcanic occupy the area of Mineral Claims and the Exploration Licence. The former occurs along creeks and in lower ground and the latter on hilltops.
Fig 3  GEOLOGICAL SKETCH MAP OF VICTRIA RIVER DISTRICT

- Faults
- Antrim Plateau Volcanics
- Victoria River Basin sediments
- Other sedimentary rocks
7 BULLDOZER COSTEANING

A total 9 costeans with various widths, lengths and directions were excavated in NCN (A) 3989, within an area of 150 metres wide and 700 metres long. Costeans are plotted on Fig 5.

Zebrastone was recognized at all the costean sites and description of each costean is given as follows. The results of investigation is discussed in the following chapter 8.

COSTEAN 1

The costean excavation was started at 50 metres downstream of the site where the best zebrastone outcrop is recognized on a creek bed (Fig 6). This is a large costean with a width of 13 metres and a length of 50 metres (Fig 7). A good zebrastone block was obtained with a thickness of 28 cm (Fig 8).

A section seen at the excavation is:

0 - 0.4 m  Gravel
0.4 - 0.9 m  Fractured siltstone
0.9 m -  Zebrastone

COSTEAN 2

Costean 2 is a large open ground for preparation of quarry operation (Fig 9) and is situated 100 metres east of Costean 1. A zebrastone block obtained is 15 cm thick (Fig 10).
FIG 5 MAP SHOWING COSTEAN SITES,
MCN 3989
SCALE 1:2000
COSTEAN 3

Costean 3, 6 metres wide and 18 metres long, is situated 100 metres east of costean 2.

A section seen at the excavation is:

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.05 m</td>
<td>Gravel</td>
</tr>
<tr>
<td>0.05 - 0.4 m</td>
<td>Fractured siltstone</td>
</tr>
<tr>
<td>0.4 m -</td>
<td>Zebrastone</td>
</tr>
</tbody>
</table>

COSTEAN 4

Costean 4, 10 metres wide and 21 metres long, is situated 200 metres east of costean 3 (Fig 11). A zebrastone obtained from this costean is 20 cm thick (Fig 12).

A section seen at the excavation is:

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.1 m</td>
<td>Gravel</td>
</tr>
<tr>
<td>0.1 - 0.6 m</td>
<td>Fractured siltstone</td>
</tr>
<tr>
<td>0.6 m -</td>
<td>Zebrastone</td>
</tr>
</tbody>
</table>

COSTEAN 5

Costean 5, 25 metres wide and 18 metres long, is situated 15 metres east of costean 4 (Fig 13). A zebrastone block obtained from this costean is 22 cm thick (Fig 14).

A section seen at the excavation is:

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.1 m</td>
<td>Gravel</td>
</tr>
<tr>
<td>0.1 - 0.5 m</td>
<td>Fractured siltstone</td>
</tr>
<tr>
<td>0.5 m -</td>
<td>Zebrastone</td>
</tr>
</tbody>
</table>
COSTEAN 6

Costean 6, 4 metres wide and 19 metres long, is situated 70 metres northeast of costean 5 (Fig 15). A zebrastone block obtained from this costean is 14 cm thick (Fig 16).

COSTEAN 7

Costean 7, 6 metres wide and 18 metres long, is situated 100 metres north-west of costean 6 (Fig 17). A section seen at the excavation is:

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.15</td>
<td>Gravel</td>
</tr>
<tr>
<td>0.15 - 0.5</td>
<td>Fractured siltstone</td>
</tr>
<tr>
<td>0.5</td>
<td>Zebrastone</td>
</tr>
</tbody>
</table>

COSTEAN 8

Costean 8 is a narrow one with a width of 2.5 metres and length of 18 metres (Fig 18). A zebrastone block obtained from this excavation is 1.4 m thick (Fig 19).

COSTEAN 9

Costean 9, 6 metres wide and 17 metres long, is situated 100 metres south-west of costean 8 (Fig 20).

A section seen at this excavation is:

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.1</td>
<td>Gravel</td>
</tr>
<tr>
<td>0.1 - 0.6</td>
<td>Fractured siltstone</td>
</tr>
<tr>
<td>0.6</td>
<td>Zebrastone</td>
</tr>
</tbody>
</table>
8 QUALITY

Rock for dimension stone must be:

A) free of cracks,
B) of uniform texture,
C) of attractive colour and fabric,
D) capable of taking polish,
E) not be porous and
F) the stone deposit must be capable of producing dimension blocks at economical cost level.

Zebrostone is discussed with reference to each requirement as follows.

A) CRACKS

Fractured and cracked siltstone is seen on some outcrops (Fig 21), while outcrops with fewer fractures are also seen in places being not so far apart from the fractured outcrops (Fig 22, Fig 23). Yet, another zebrostone block with fewer fractures is also exposed by excavation (Fig 24).

Distribution of fractured and massive zebrostone and relationship between those two kinds have not yet been worked out. A better understanding could be given by the diamond drilling programme proposed, for which a thicker zebrostone layer with fewer fractures and fewer cracks is the direct subject to be looked for.

B) TEXTURE

Texture is geometrical aspects of the component particles of a rock including size, shape and arrangement. It appears that there is no problem in this respect for zebrostone. Further study of zebrostone specimen under a microscope could enable the writer to discuss in detail.
Fig 14: Photo of bedrock with visible fractures.
C) COLOUR AND FABRIC

In respect of (C), zebrastone could be said to be more than satisfactory but rather "credit". Colour and fabric are very important. Many architects are inclined to let colour and fabric predominate over other essential qualities. These are, however, a matter of taste and even of fashion.

D) CAPABLE OF TAKING POLISH

It appears that there is no problem in this respect for zebrastone. The proposed work to cut and polish 250 slabs could enable the writer to discuss in detail.

E) NOT BE POROUS

There is no problem in this respect for zebrastone.

F) ZEBRASTONE BLOCK

In respect of the requirement (F), if one sticks at a size of 15 - 40 tonne dimension block (which is usually sought for a dimension stone project), the data so far obtained for the deposit does not justify to say that one can quarry this size of zebrastone block, because of its bedding fracture. The thickest block so far obtained is 28 cm thick.

A big money in this business is in overseas market and the size of stone block is one of the most important economic factors in establishing an export oriented dimension stone project in the Territory which will significantly contribute to the Territory's economy. Therefore, potential maximum size of zebrastone which can be produced should be established now.
9 QUANTITY

A production of zebrastone slabs presumed by the title holder is:

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (sq m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>1,560</td>
</tr>
<tr>
<td>2nd year</td>
<td>3,125</td>
</tr>
<tr>
<td>3rd year</td>
<td>5,000</td>
</tr>
<tr>
<td>Total</td>
<td>9,685</td>
</tr>
</tbody>
</table>

The area investigated with costean excavation is 100 metres wide and 600 metres long. Therefore, the area where zebrastone occurs is:

\[ 100 \text{ m} \times 600 \text{ m} = 60,000 \text{ sq m} \]

Thickness of zebrastone block so far obtained varies with a maximum of 28 cm and a minimum of 15 cm. A thickness of 20 cm is deemed as an average. Therefore, the volume of zebrastone in the above area of 60,000 square metres is:

\[ 60,000 \text{ sq m} \times 0.2 \text{ m} = 12,000 \text{ cu m} \]

When stone blocks are cut and polished, one cubic metre of stone block results in 30 square metres of stone slabs. Therefore, quantity of stone slabs, in cubic metre, produced from 12,000 cubic metres of zebrastone block is:

\[ 12,000 \text{ cu m} \times 30 = 360,000 \text{ sq m of slabs} \]

In this industry, up to 90 per cent of material extracted from a quarry is waste. The most conservative waste percentage is 90 per cent, with only 10 per cent of the final stone product. Let us take the most conservative waste percentage. Quantity of slabs after discarding waste is:

\[ 360,000 \text{ cu m} \times 10\% = 36,000 \text{ sq m of zebrastone slabs} \]
It is obvious that the quantity of zebrastone in the area is enough for the proposition proposed by the title holder.

10 FURTHER WORK PROPOSED

It is recommended that the following follow-up study would be conducted immediately.

1) Diamond drilling, four vertical drill holes, 30 metres deep each, totalling 120 metres.

This is aimed to search for more thicker and crack-less zebrastone layers. A great many number of drill holes beyond the number proposed will not be necessary because the material sought is a sedimentary bed itself and the bed occurs fairly universally, nor be required deeper holes beyond the depth proposed because it will not be economical to collect stones from such a great depth. This programme also help to establish a stratigraphic section of the formation.

2) Cutting and polishing 250 square slabs, each 10 cm a side and 2 cm thick.

Of the above 250 zebrastone slabs, 50 are used for gift and demonstration purposes and the rest 200 are sold at various souvenir and jewelry shops mainly in Darwin.

This is aimed to obtain a better understanding for various kinds of patterns, relationship between the bedding plane and the patterns and ease (or difficulty) for cutting and polishing. Seeing initial reaction for marketing and promotion is another purpose.
11 REFERENCES

Victoria River District

Northern Territory, Canberra, A.G.P.S.