Probable Carbonatites in the
Strangeays Range Area,
Central Australia

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By J.W. Styles and B.G. Wallis
PROBABLE CARBONATITES IN THE STRANGWAYS RANGE AREA, CENTRAL AUSTRALIA.

by

P.W. Crohn and D.C. Gellatly

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INTRODUCTION

A carbonatite origin is suggested for a group of crystalline carbonate rocks containing apatite, magnetite, and zircon, which occur in the Strangways Range at about 23°01'S, 134°16'E, 60 miles north-northeast of Alice Springs, Northern Territory. No carbonatites have previously been recognized in Australia.

Attention was first drawn to this locality by the detrital magnetite, apatite, and zircon, which are widely scattered over the areas underlain by the carbonates. The first known reference to the locality is by Owen (1944), who examined it as a possible source of phosphate, and considered the carbonate rocks to be metamorphosed sedimentary limestones. In 1965 a low-level aeromagnetic survey of the area was made by the Bureau of Mineral Resources (Tipper, 1966). In 1966 Geopoko Ltd, who named the carbonate lenses Enterprise 2, 3, 4, and 5, carried out diamond drilling on the two eastern lenses (Williams, 1967).

FIELD OCCURRENCE

Three lenses of crystalline calcitic and dolomitic carbonate rocks and gneissose micaceous carbonate rocks occur in a northeast-trending zone 1 1/2 miles long, with a fourth lens 1 1/2 miles to the west-southwest. The most easterly lens, with a surface extent of about 2,000 by 2,000 feet, is the largest.

The carbonate rocks are highly altered and in part ferruginized at the surface. In places they show banding due to differences in texture and variations in the contents of non-carbonate minerals, mainly mica, apatite, and magnetite. The trend of this banding is north-east at Enterprise 3 and 4, but variable at Enterprise 2. Individual bands range from a few inches to several feet in width.

Apatite occurs generally as massive aggregates, some of which are up to two feet in diameter, and individual grains of more than one inch are not uncommon. Magnetite forms twinned octahedra up to three inches in diameter and occasional irregular aggregates of even larger size. Zircon typically occurs as relatively squat prismatic crystals up to two inches long and one inch across.
The rocks surrounding the carbonate lenses are schist, gneiss, and basic igneous rocks of the Arunta Complex. The complex has generally been regarded as Archaean, but probably includes some younger rocks. In places biotite schist and mylonite can be traced to within 50 feet of the carbonates, but the actual contacts are not exposed. The schist locally contains augen of feldspar and less commonly garnet, but these are not restricted to the vicinity of the carbonate rocks.

Small lenses and irregular masses of basic rocks and aegirine-augite- and sodic amphibole-bearing pegmatite, generally less than ten feet across, occur within the carbonates, but their contacts again are not exposed.

The shape and intensity of the magnetic anomalies obtained by the B.M.R. aeromagnetic survey (Tipper, 1966, Plate 6) suggest that the three eastern lenses dip steeply to the northwest. Mapping by Williams (1967) suggests that Enterprise 3 and 4 are part of a continuous band, and are separated from Enterprise 2 by a fault striking northwest.

The carbonate lenses lie on the axis of a regional gravity high, which includes the Papunyah Gravity Ridge to the west and the Illogwa Gravity High to the east (Flavelle, 1965).

**PETROGRAPHY**

The carbonate rocks range from non-foliated dolomitic and calcitic rocks to gneissose rocks composed largely of calcite and biotite. The bulk of the magnetite, apatite and zircon occurs in the non-foliated rocks, in which dolomite generally forms large irregular grains, whereas calcite typically occurs as smaller interstitial grains. Small scattered ovate grains of apatite and small euhedra of magnetite are preferentially associated with calcite. Rare large aggregates of apatite and large euhedra of magnetite are also present. Minor constituents comprise zircon, ilmenite, pyrite, amphibole and phlogopite; the latter shows reverse pleochroism, i.e. maximum absorption normal to (001). One specimen contains aggregates of pale grey-brown microcrystalline highly birefringent material, thought to be columbite after pyrochlore.
GEOCHEMISTRY

Trace element determinations by Australian Mineral Development Laboratories, Adelaide, on 13 samples of drill core from Enterprise 3 indicate the following values:

<table>
<thead>
<tr>
<th>Element</th>
<th>Minimum to Maximum ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nb</td>
<td>20 to 450</td>
</tr>
<tr>
<td>Cu</td>
<td>10 to 250</td>
</tr>
<tr>
<td>Zn</td>
<td>-100 to 100</td>
</tr>
<tr>
<td>Pb</td>
<td>2 to 6</td>
</tr>
<tr>
<td>Co</td>
<td>8 to 60</td>
</tr>
<tr>
<td>Ni</td>
<td>10 to 120</td>
</tr>
<tr>
<td>V</td>
<td>10 to 600</td>
</tr>
<tr>
<td>Cr</td>
<td>10 to 60</td>
</tr>
<tr>
<td>Ti</td>
<td>200 to +10,000</td>
</tr>
<tr>
<td>Ga</td>
<td>1 to 8</td>
</tr>
<tr>
<td>Ba</td>
<td>250 to 1,000</td>
</tr>
<tr>
<td>Sr</td>
<td>800 to 1,500</td>
</tr>
<tr>
<td>La</td>
<td>-100 to 700</td>
</tr>
<tr>
<td>Pr</td>
<td>-100 to 100</td>
</tr>
<tr>
<td>Nd</td>
<td>-300 to 300</td>
</tr>
<tr>
<td>Y</td>
<td>80 to 200</td>
</tr>
<tr>
<td>P</td>
<td>-100 to +10,000</td>
</tr>
<tr>
<td>Rb</td>
<td>-3 to 15</td>
</tr>
</tbody>
</table>

- indicates "less than"
+ indicates "more than"

Several of the elements, notably niobium and the rare earths, and to a lesser extent barium and strontium, are present in amounts greater than those normally found in sedimentary carbonates, and the assemblage as a whole is comparable with that from known carbonatites. However, all the values are well below economic concentrations.

The highest result for Nb was obtained from the specimen containing suspected pseudomorphs after pyrochlore. Cu, Zn, Co, Ni, V, Cr, and Ti are higher than average in magnetite- and pyrite-bearing specimens; barium and strontium are moderately high in all samples. Rare earths (La, Pr, Nd, and Y) have maximum concentrations in anapatite-rich sample, but there is no consistent relation between rare earths and apatite contents.

CONCLUSIONS

Many of the petrographic and geochemical features of the Strangways Range carbonate rocks suggest that these rocks are carbonatites. These features include the presence of apatite, magnetite, zircon, and possible pseudomorphs after pyrochlore; the
ovate form of the achatite; the reversed pleochroism of the phlogopite; the association with aegirine-augite- and sodic amphibole-bearing pegmatite; the high niobium and rare earth contents; and to a lesser extent the moderately high barium and strontium contents.

Further work on this occurrence is in progress.

ACKNOWLEDGEMENTS

We gratefully acknowledge the assistance of Geopeko Limited, who supplied drill core material, and of Mr. B.T. Williams for permission to include data from his map of the area.

REFERENCES


Carbonate Rocks

Basic intrusive rocks

Schist and gneiss

Structural trend

In part after Williams (1967)

Bureau of Mineral Resources, Geology and Geophysics