c.3

DEPARTMENT OF MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1976/7

055113

RINGAROOMA BAY MAGNETOMETER AND SPARKER PROFILING SURVEY, TASMANIA, 1973

by

B.H. Dolan

Record 1976/7

RINGAROOMA BAY MAGNETOMETER AND SPARKER PROFILING SURVEY, TASMANIA, 1973

by

B.H. Dolan

CONTENTS

ILLUSTRATIONS

SUMMARY

The Bureau of Mineral Resources, Geology and Geophysics (BMR) carried out a seismic profiling and continuous magnetometer survey in Ringarooma Bay, Tasmania in 1973. The main object of the survey was to locate any sediment-filled river channels which may be prospective for tin. Most of the area had a thin sediment cover, but a possible sediment-filled channel was indicated in the western part of the Bay.

1. INTRODUCTION

From February to May 1973 BMR carried out a geological reconnaissance of the Tasmanian continental shelf and parts of Bass Strait (Davies & Marshall, 1973). During this survey, on 21 and 22 February, detailed sparker and magnetometer traversing was carried out in Ringarooma Bay. This Record describes only the Ringarooma Bay geophysical work. The party supervisor was Dr. H.A. Jones (geologist) from the Marine Geology Group of BMR. The sparker and magnetometer work was carried out by B.H. Dolan (geophysicist) and P.V. Mooney (technical officer). The principal object of this part of the survey was to locate any sediment-filled river channels by the use of continuous seismic reflection profiling. These channels may contain cassiterite, which previously was mined on the neighbouring land.

The motor tug Sprightly owned by T. Korevaar and Sons was used for the survey. Details of this vessel are given by Davies & Marshall (1973).

2. METHODS AND EQUIPMENT

For the sparker profiles a BMR modified 0.4 kJ sparker, a BMR 7-element hydrophone, an Edgerton, Germeshausen, & Grier (EGG) model 232 Power Supply, a modified EGG model 231 triggered capacitor (Dolan, in prep.) and an EPC model 4100 graphic recorder were used.

The principle of operation of all sparker profiling systems is basically the same. A pressure pulse introduced into the water by an electric discharge is transmitted through the water at a known velocity (1.5 km/s). At the water-bottom, some energy is reflected back to the surface and some is transmitted through the sedimentary layers. Further reflections will occur at the boundaries between layers with different acoustic impedance, e.g. between sediment and rock (Sargent, 1969; Taylor Smith & Li, 1966). The reflections are received by the hydrophone and this signal is then frequency filtered, amplified, and recorded on an electrosensitive paper recorder such that the distance down the paper is proportional to the time between transmission and reception of the pulse, called the two-way travel time. The pulses are transmitted at a rate of about one per second as the vessel moves at a constant speed across the area of investigation: reflections from a boundary are therefore recorded continuously. The depth to a particular boundary is computed by multiplying half the two-way travel time by the average velocity of the layers through which the energy travels. The velocity of propagation in sea water is 1.5 km/s $\pm$ 4%, depending on temperature and salinity, and in unconsolidated sediments ranges from 1.5 to 1.8 km/s (Shumway, 1960).

The magnetic profiles were obtained using a Geometrics G803 Marine/Airborne proton precession magnetometer. This instrument measures the total intensity of the Earth's magnetic field and the output can be continuously recorded on a paper chart recorder. A measurement was taken every six seconds, synchronized to be in between discharges from the sparker, and the sensitivity of the reading was 1 nT.

Cassiterite usually contains some iron as an impurity, but by itself would have a relatively low magnetic susceptibility. However, its association with other heavy minerals, notably magnetite, makes it amenable to detection by the magnetic method. To be effective, the bedrock over which the sediments were deposited would have to have a low magnetic susceptibility, i.e. a low magnetite content.

3. RESULTS

About 135 km of simultaneous sparker and magnetometer lines was run in the bay. The locations of the lines are shown in Plate 1, and the seismic and magnetometer profiles are shown in Plates 2 to 4. On both the seismic and magnetometer profiles the horizontal time-scale is the same. The vertical scale on the seismic profiles shows the two-way travel time in milliseconds.

On the second day the weather deteriorated to such a degree that much of the information obtained was unusable. As a result only the cross-sections recorded on the first day are shown.

The seismic profiles show that over most of the area the cover of unconsolidated material is thin, i.e. less than 2 m. The records show that bedrock in this area consists of a layered formation dipping to the west at about 8° with a strike of 2.5°. The layers are truncated at or just below the sea-bottom. The results indicate that in the western part of the area there is a sediment-filled channel which could be a continuation of a channel between Waterhouse Island and the mainland of Tasmania.

The anomalies on the magnetic profiles range from broad, deep-seated anomalies to short-wavelength anomalies with the causative body at the sea-bed. No attempt has been made to interpret the deep anomalies or anomalies such as the steep high on line C which correlates with a topographic high on the sea bed.

On Traverse F a zone of shallow anomalies extends from 1710 to 1747. The same features appear on Traverse E between 1620 and 1700 but with decreased amplitude owing to greater water depths. On Traverses D and C the amplitudes are further decreased. Depths to the tops of the causative bodies were calculated from the anomalies listed in Table 1 using the slope method of Peters (Dobrin, 1960). These show that depths vary from water depth to about 20 m below the sea bed. The anomalies are probably due to variations in the magnetic properties of the steeply dipping strata as the sediment cover is thin, but the possibility of some anomalies being due to a high magnetite content in the sediment cannot be altogether discounted. At about 1750 on line F the short-wavelength anomalies cease even though water depth is shallowing and the strata are still steeply dipping. Some lithologic change in the strata is therefore required to account for this.

In other areas of thicker sediment cover any anomalies due to changes in the magnetic properties of the sediment are too small to identify.

Table 1

Depth Determinations from Magnetic Data

Time	Location	Depth to top of feature (m)	Water depth (m)
1411	Line D No. 1	48	30
1427	Line D No. 2	28	26
1625	Line E No. 3	50	28
1635	Line E No. 4	36	25
1726	Line F No. 5	31	17
1737	Line F No. 6	34	20
1743	Line F No. 7	27	21
1745	Line F No. 8	22	22

4. CONCLUSIONS

Most of Ringarooma Bay has a very thin cover (less than 2 m) of unconsolidated material overlying a dipping formation which is truncated near the water bottom. A possible sediment-filled channel runs in a northeasterly direction from Waterhouse Point. The magnetometer lines showed anomalies which correspond to the areas where the dipping formation was truncated but no clear anomalies were noted which could have correlated with variations in the sediment.

5. REFERENCES

DAVIES, P.J., & MARSHALL, J.F., 1973 - BMR marine geology cruise in Bass Strait and Tasmanian waters - February to May, 1973. Bur. Miner. Resour. Aust. Rec. 1973/134 (unpubl.).

DOBRIN, M.B., 1960 - INTRODUCTION TO GEOPHYSICAL PROSPECTING. N.Y., McGraw - Hill.

DOLAN, B.H., in prep. - Westernport Bay seismic profiling survey, Vic, 1973. Bur. Miner. Resour. Aust. Rec.

SARGENT, G.E.G., 1969 - Further notes on the application of sonic techniques to submarine geological investigation. 9th Comm. Min. metall. Cong. 1969, Min. Petrol. Geol. Section Pap. 28.

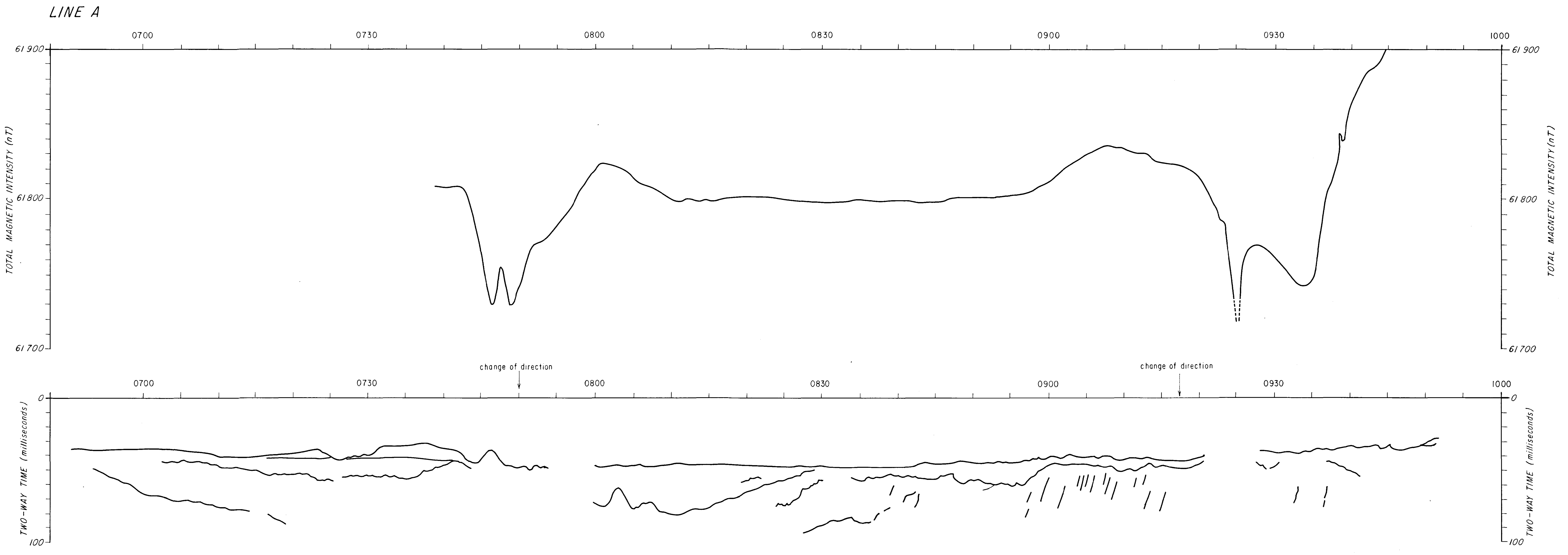
SHUMWAY, G., 1960 - Sound speed and absorption studies of marine sediments by a Resonance Method II. Geophysics, 25(3), 659.

TAYLOR SMITH, D., & LI, W.H., 1966 - Echo sounding and sea floor sediment. Marine Geol., 4(1966), 353-64.

PLATE I


RINGAROOMA BAY, TASMANIA
SPARKER AND MAGNETOMETER
TRAVERSES
LINE A
LINE B
LINE C
LINE D
LINE E
LINE F
RINGAROOMA
BAY
WATERHOUSE ISLAND
LITTLE WATERHOUSE ISLAND
WATERHOUSE POINT
Pinnacle Rock
TOMAHAWK ISLAND
Tomahawk Point
TOMAHAWK
TOMAHAWK R
Maclean Island
Baynes Island
Campbells Point
RINGAROOMA R
LOCALITY MAP
TASMANIA
Launceston
HOBART
LEGEND
Traverse 21-2-73
Traverse 22-2-73
500 0 1000 2000 Metres
147°40'
147°45'
147°50'
147°55'
40°45'
40°50'
2·5°
8°
Record No. 1976/7
K55/B5-110

PLATE 2



LINE A
MAGNETIC AND SPARKER PROFILES

Record No. 1976/7

K55/B5-111

PLATE 3

LINES B AND C
MAGNETIC AND SPARKER PROFILES

Record No. 1976/7

K55/B5-112

PLATE 4

LINES D,E AND F
MAGNETIC AND SPARKER PROFILES

Record No.1976/7

K55/B5-113