DEPARTMENT OF MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1976/41

A REVIEW OF THE GEOLOGY AND GEOPHYSICS OF THE MARION PLATEAU

by

D. Jongsma

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CONTENTS

Figures

FOREWORD

Reviews have been made of the geology and geophysics of most of Australia's other island territories and other records in this series by the same author are:

Record No. 1976/12	Lord Howe Rise and Norfolk Ridge
Record No. 1976/36	Macquarie Island and Macquarie Ridge Complex
Record No. 1976/37	Christmas Island and Christmas Rise
Record No. 1976/38	The Cocos Islands and Cocos Rise
Record No. 1976/39	Queensland Plateau
Record No. 1976/40	Area of Mellish, Frederick, Kenn and Wreck Reefs, and Cato Island

SUMMARY

The Marion Plateau lies east of the southern part of the Barrier Reef. Sediment distribution over the Plateau is variable and ranges from 250 to 1000 m in thickness. The western half of the plateau is covered by fore-reef and back-reef deposits. The sedimentary section is probably Cainozoic and it overlies a seismic basement of presumed Phanerozoic rocks of the Tasman Geosyncline. This basement is thought to be deformed and intruded. The thinness of the sedimentary cover indicates that the Marion Plateau has very low prospectivity for petroleum.

INTRODUCTION

The Marion Plateau lies south of the Queensland Plateau and east of the Great Barrier Reef (Fig. 1). It supports two reefs - Marion Reef at the northern end, and Saumarez Reef at the southern end.

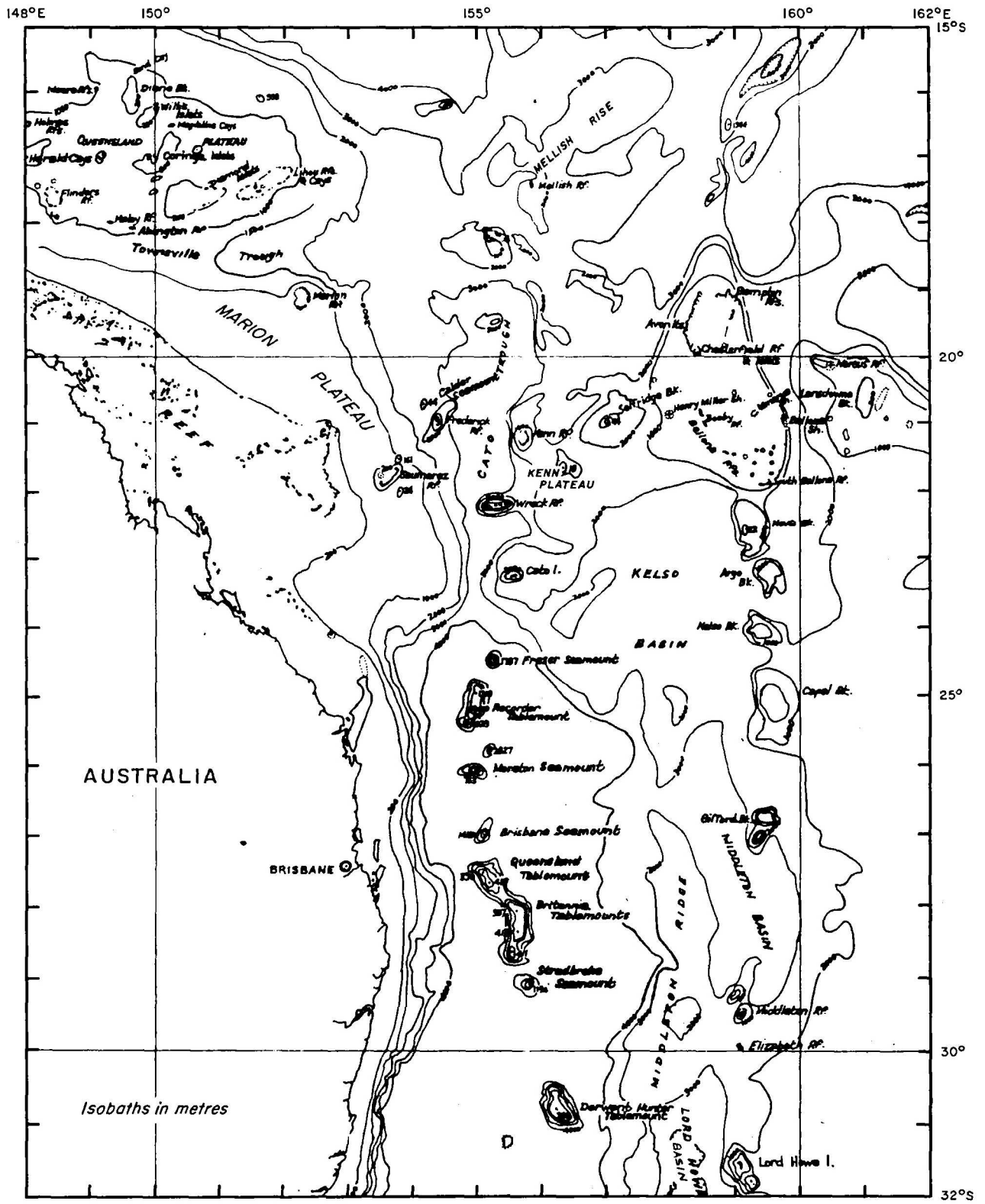
INVESTIGATIONS

Very little work was done on the Marion Plateau before 1970. Krause (1967) briefly described the regional bathymetry of the area, and Gardner (1970) studied the northern part of the Marion Plateau and interpreted it as a subsided continuation of the continental shelf off Queensland. Falvey (1972) described bathymetric results and the origin of the plateau. The Bureau of Mineral Resources recorded gravity, magnetic, bathymetric and seismic reflection data over the Marion Plateau in 1971, as part of its multisensor Continental Margin Survey. Figure 2 shows the ship's tracks over the plateau. Data from the survey are currently being processed.

MORPHOLOGY

The Marion Plateau is roughly triangular in shape (Fig. 1). Its northern boundary is formed by a graben, the Townsville Trough, which separates it from the Queensland Plateau. The western margin is created by the gentle rise towards the continental shelf and the Barrier Reef, and the eastern margin by the relatively steep descent into the Cato Trough. The surface of the plateau descends smoothly from a depth of 275 m at its inner margin to 550 - 750 m at its outer margin. The plateau is in places surmounted by small reef-like features of 9-18 m relief. Marion Reef lies at the northern end of the plateau and rises from about 250 meters water depth. Saumarez Reef lies at the southern end and rises from a slightly shallower depth of about 200 m water depth. Both are roughly circular in plan.

FIG. 1



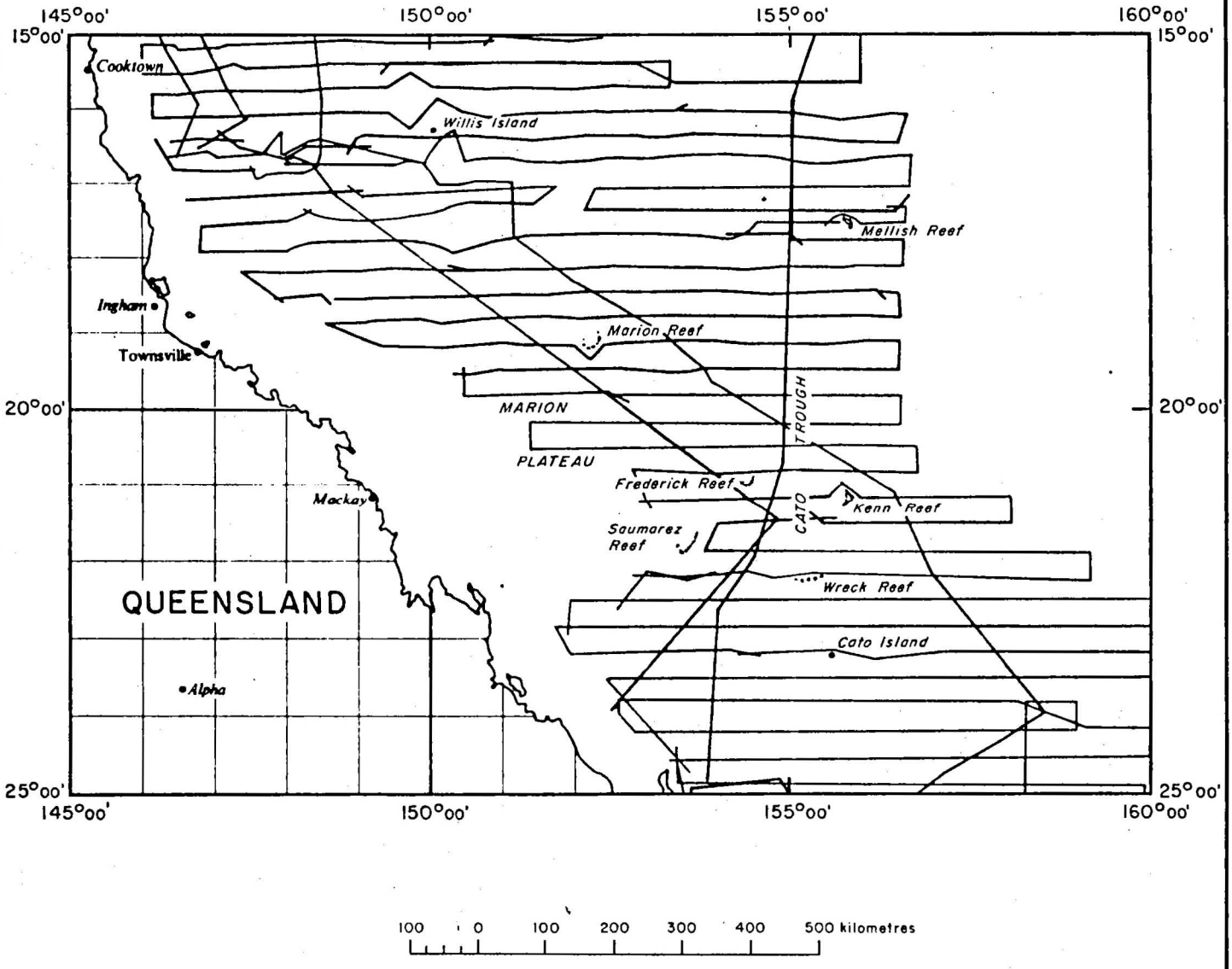
LOCATION AND BATHYMETRY OF THE MARION PLATEAU

(Detail of General Bathymetric Chart of the Oceans. Sheet AIII, Hydrographic Office R.A.N. Sydney, Australia, 1975)

Record No. 1976/41

Q/B8-87A

FIG. 2

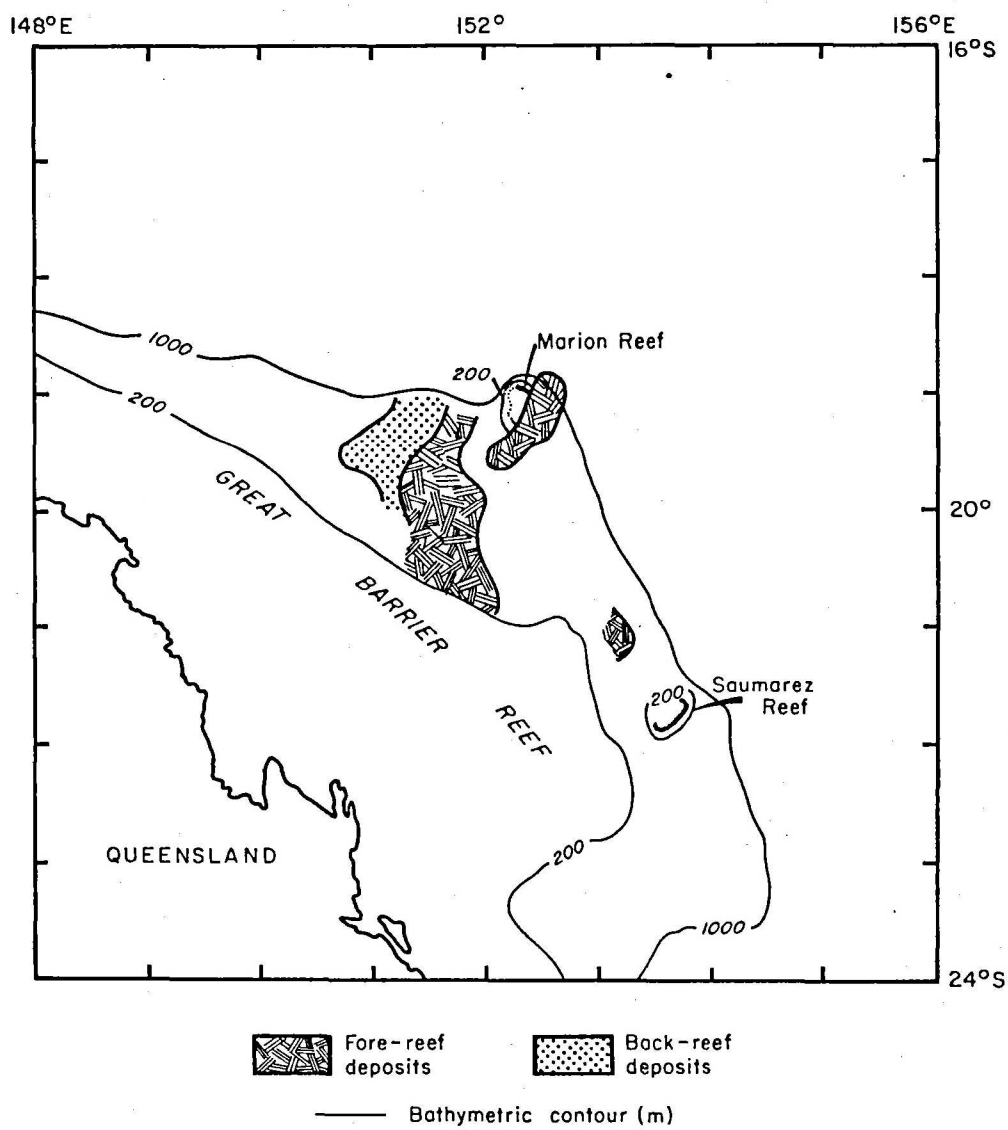


BMR MULTISENSOR SURVEY TRACKS OVER THE MARION PLATEAU

GEOLOGY

The geology of the Marion Plateau is poorly known. Most information comes from the seismic reflection profiles recorded by BMR in 1971 (Mutter, in prep.). The major part of the plateau is covered with drowned reefs. Both fore-reef and back-reef deposits have been identified and they occupy nearly the whole of the western half of the plateau with an average thickness of 250 m (Fig. 3). The fore-reef forms a northerly-trending zone with back-reefs distributed to its west and northwest. Up to 200 m of sediments overlie smoothly eroded basement to the east of the fore-reef. The thickness increases eastwards to 1000 m near the eastern margin. The plateau sediments are tentatively correlated with the Cainozoic sediments of the Queensland Plateau. An unconformity in the upper sediments on the Marion Plateau is correlated with a widespread Eocene/Oligocene unconformity found over most of the Queensland Plateau (Burns et al., 1973). Deposition in the Cato Trough to the east of the Marion Plateau has resulted in sedimentary thicknesses of greater than 2 km. These sediments are probably derived from erosion of the plateau which is cut by numerous submarine canyons along its eastern flank.

The basement of the Marion Plateau is probably similar to that of the Queensland Plateau, and is thought to consist of highly deformed and intruded Palaeozoic rocks of the Tasman Geosyncline. No refraction velocity determinations are available over the Marion Plateau.



DISTRIBUTION OF FORE-REEF AND BACK-REEF DEPOSITS ON THE MARION PLATEAU

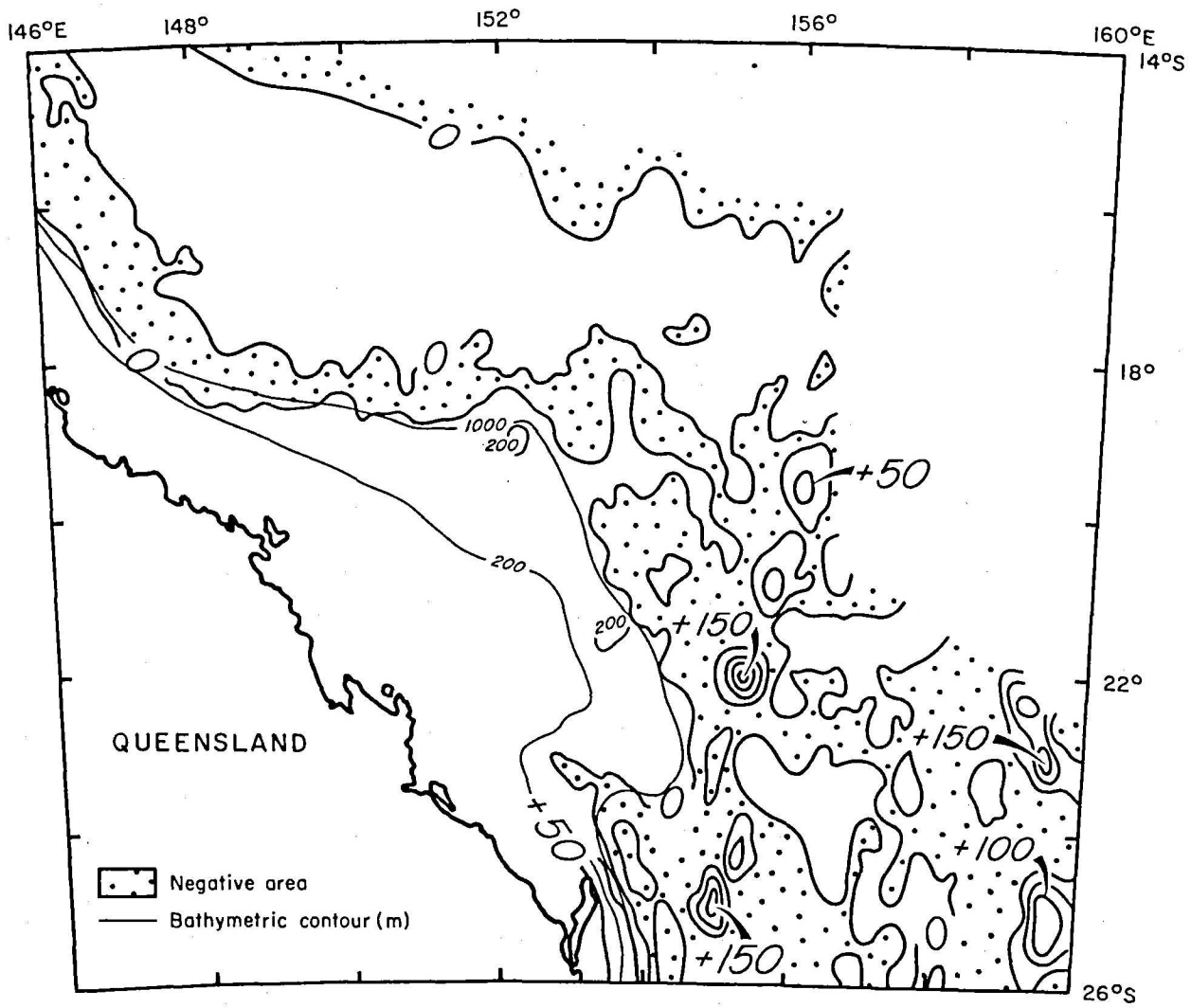
(after Mutter, 1976)

GEOPHYSICS

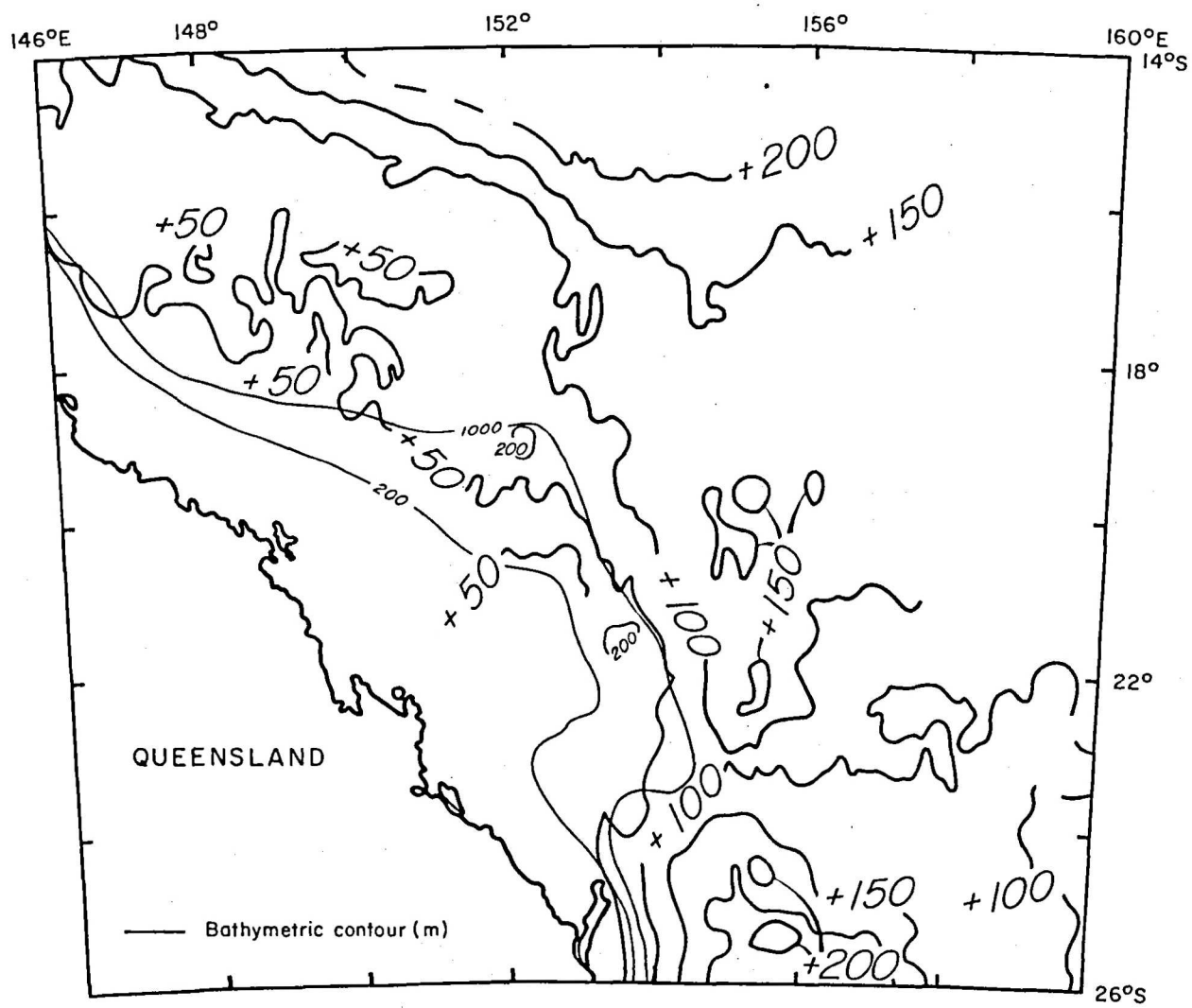
Free-air anomalies (Fig. 4) over the plateau are regionally positive, from 0 to 40 mGal. Bouguer anomalies (Fig. 5) are also positive, averaging 50 mGal over the plateau and rising to 150 mGal over the slope into the Cato Trough. Magnetic anomalies (Fig. 6) range from -400 to +500 nT; contour trends are northerly, as on the Queensland Plateau, and probably reflect structural trends of the Tasman Geosyncline.

PROSPECTIVITY

The prospectivity of the Marion Plateau and its associated reefs is low. The sedimentary cover is too thin to contain significant hydrocarbon accumlations, and no mineralization has been discovered on the two reefs.



FREE-AIR ANOMALIES IN THE REGION OF THE MARION PLATEAU



For the calculation of Bouguer Anomalies, 2·2 t/m^3 has been adopted as an average density

BOUGUER ANOMALIES IN THE REGION OF THE MARION PLATEAU

Record No. 1976/41

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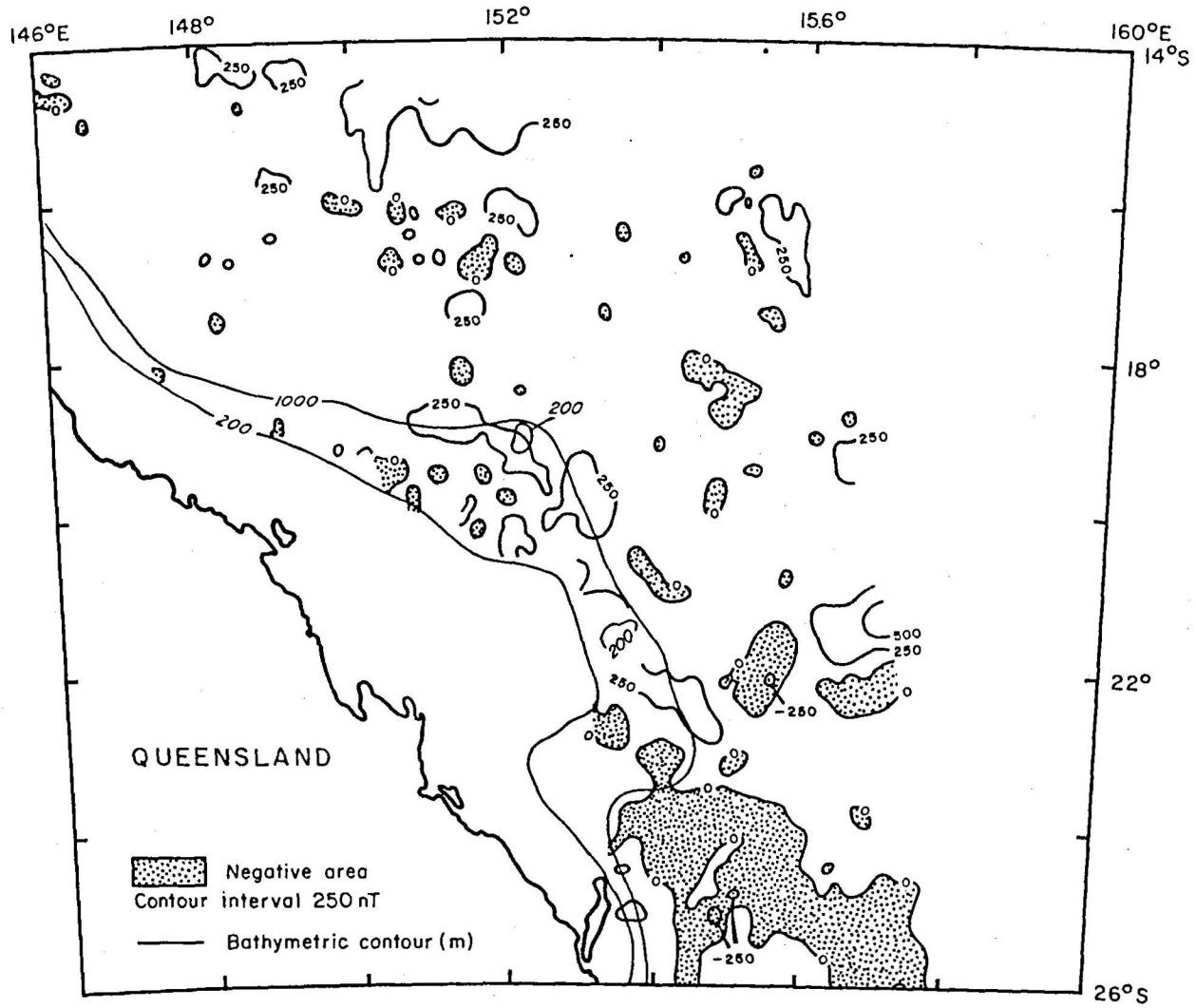
FIG. 6



MAGNETIC ANOMALIES IN THE REGION OF THE MARION PLATEAU

Record No. 1976/41

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