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**DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS**

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RECOMMENDATIONS FOR FUTURE ACTIVITIES IN MARINE GEOLOGY
IN THE BMR.

by

Tj. H. van Andel



The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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Summary of Principal Recommendations

It is recommended that:

- 1) BMR adopt an orderly mapping programme to the scale of 1:1,000,000 of all shelves of the continent, and that legend and mapping procedures be established at an early date to insure uniformity of approach. Area priorities should be based on all mineral interests, not those of phosphorite alone.
- 2) the northwestern shelf, including a revision of existing Sahul Shelf data to standard map format, be completed first, preferably before the end of 1969.
- 3) either the Tasmania Shelf - Bass Strait region or the shelf off New South Wales and southern Queensland be the next target, in order to stimulate an orderly evaluation by industry of the offshore mineral resources in these areas. Both programmes could be completed by 1973 or 1974.
- 4) every effort be made to establish a second survey team, in order to complete mapping of all important shelf areas within the next decade.
- 5) active programme co-ordination and mutual utilization of results be encouraged between the marine activities of the Geophysics and Geology Branches.

1. Introduction

In 1965, this author presented a series of recommendations for marine geological programmes in the BMR with special emphasis on the search for phosphorite (Record 1965/188). In 1967, the execution of some of these recommendations had begun. From February to March of the current year, the author has again visited BMR, has become acquainted with the current status of the programme, and with new developments in offshore minerals and participated in a cruise of the BMR vessel to assess the marine operational capability. The following discussion and recommendations, which have benefitted greatly from detailed discussions with various members of the BMR staff, in particular Dr. H.A. Jones, represent an updating and revision of the earlier report and suggest long term programme guide-lines.

2. General Recommendations

In Record 1965/188, the following definition of BMR's role in marine geology was given:

2.

1) to map the sediments and shallow subsurface strata and structure of the continental shelf and adjacent slopes of Australia, and to study the Cainozoic geologic history of its continental margins.

2) to map and investigate the mineral resources of the upper, mainly unconsolidated portion of the continental shelf sediments with special emphasis on marine phosphorite, to study their genesis, and to encourage and guide their commercial development.

3) to do basic research as required and indicated by 1) and 2), and to encourage and assist marine geological studies by other Government agencies and Universities.

4) to collect, collate, and interpret marine geological and bathymetric data collected by other investigators as they bear on the tasks listed under 1) and 2).

The review of the current situation indicates that this statement of purpose continues to reflect accurately BMR's role in the field. However, whereas conditions in 1965 made it desirable to determine priorities on the basis of phosphorite potentials, it now appears that a broader view must be taken. Without doubt, in the coming decade reviews and reorientation of emphasis will continue to be necessary as industrial interest in the oceans accelerates.

The discovery of the Duchess phosphorite deposits on land and re-evaluation of the Christmas Island reserves indicate that the search for marine deposits must be oriented towards establishing long-term reserves for the future rather than toward immediate exploitation. On the other hand, interest in minerals other than phosphorite and oil on the shelves, as predicted in 1965, has rapidly boomed. As stressed by L. C. Noakes (Record 1967/159), this industrial activity, although fairly intense, suffers from a severe lack of fundamental and regional information (and frequently ignorance of what does exist), is hampered by limited technical and financial resources, and often characterized by an excessive promotional attitude. If such conditions continue to exist, rapid fluctuations from exaggerated optimism to unwarranted disillusionment may be expected. It is in the interest of the Commonwealth and the industry itself, that offshore mineral development be stabilized and channelled into an orderly development. This is a legitimate task of BMR and can best be accomplished by means of a systematic mapping programme of all areas of interest. This activity will yield a nucleus of marine experts that is useful in the management of these resources.

It is therefore recommended that with all due speed commensurate with available facilities, personnel and funds a mapping programme to the scale of 1:1,000,000 be established with a target completion date of 1978.

It is further recommended that priorities in this programme be assigned on the basis of all offshore mineral interests rather than on those of phosphorite alone.

Furthermore, it is recommended that this programme proceed in an orderly fashion by successive completion of map sheets or sets of sheets, and that work on targets of opportunity be minimized as far as possible.

A corollary of this is that programmes such as the Japanese Barrier Reef expedition should not be allowed to interfere with a rapid

and orderly completion of the north-west shelf mapping.

It is further recommended that an early study be made of map formats, the parameters to be mapped, and appropriate legend, symbols, and map procedures, so that reasonable standardization is obtained, while retaining the flexibility required by the wide range of existing shelf facies. To a large extent, this will be pioneering work, but contact should be established with the U.S. Geological Survey's shelf mapping programme, and with the programme of the New Zealand Oceanographic Institute.

Once this legend and procedures have been established, earlier map efforts such as the Sahul Shelf and Gulf of Carpentaria surveys, should be revised, cast into the adopted map formats and published.

Finally, it is recommended that steps be taken to overcome the current lack of communication and coordination between the marine efforts of the Geophysics and Geology Branches, so that total effort can be minimized.

3. Programme Plan

In 1967/1968 a satisfactory survey of a large portion of the north-western shelf adjacent to the area of earlier study of the Sahul Shelf has been completed. Together, the two surveys provide the greater part of the data required for map sheets extending from Melville Island to Northwest Cape. In addition, detailed geophysical information for the same region is available, or will be obtained in the near future. The seismic reflection data obtained by the Geophysics Branch are suitable for replay at higher frequencies and resolution rates, and reduce sharply the need for additional seismic reflection work by the marine geology subsection.

Consequently, it is strongly recommended that for the 1968/1969 year, highest priority be accorded to a final sampling cruise in this area, to cover sampling from Broome to Northwest Cape, to fill in gaps in earlier surveys, and extend, if feasible, the survey somewhat eastward from the arbitrary eastern limit of the Sahul Shelf survey, perhaps as far as the 132nd parallel. It is estimated that this programme, including the completion of laboratory analysis, an interpretation of the geophysical data and a revision of the earlier survey to present format, can be completed by the end of 1969.

The Papua/New Guinea cruise, held early in 1968, has as a result of inherent shortcomings of vessel and equipment not provided a suitable reconnaissance base for a mapping programme, nor has it yielded encouraging data on phosphorite occurrence. It is recommended that further work in this complex and difficult region be deferred until very late in the programme.

In accordance with the arguments presented in section 2, it is recommended that the next mapping targets for 1969/1973 be designed to support offshore mineral activities in areas of current or future interest. Two such principal targets appear to exist:

- a) The shelf off Tasmania and Bass Strait
- b) The New South Wales and southern Queensland shelf.

Both at this time are sites of active, although perhaps somewhat misdirected industrial interest, and preparation of suitable regional maps will substantially support this effort. There are at present no grounds for a choice between the two areas, and since the logistic and material requirements are roughly similar, no early decision is needed. Each of the two projects would probably require two field seasons of 3-4 months each. Thus, if the present situation with only one team is continued, the two areas will not be completed until 1973 or 1974. Addition of another team within the next two years will speed this up by one to two years.

It is premature to attempt to outline the programme beyond 1973/74 in detail. The following areas, not necessarily in that order, appear to this author to be of interest. Very approximate estimates of the number of field seasons needed for each are added in parenthesis.

- 1) western shelf from Northwest Cape to Cape Leeuwin and east to the 124th parallel (2)
- 2) southern shelf from termination of Bass Strait survey west to 134th parallel (2)
- 3) Great Barrier Reef (minimally 4). Feasibility of effective mapping of this region depends mainly on considerable improvements in navigation charts.

No need is envisaged at this time for early mapping of the Great Australian Bight and the Arafura Sea, but it is probably that changing circumstances will eventually require their study.

Another area eventually certain to require mapping is the southern shelf of Papua. Again, it is not possible at this time to determine its proper place in the list of priorities.

These estimates indicate that even with two field teams completion of the 1:1,000,000 series of shelf maps cannot be expected until the end of 1978 at the earliest. There is no doubt that long before this the need for maps on better scales will become urgent and require additional effort.

4. Supplementary Studies

The mapping programme suggested above will consume all or nearly all of the available resources for the foreseeable future. Nevertheless, there exist at this time two opportunities for supplementary studies of interest, that demand relatively little effort in proportion to their probable interest.

- 1) A reconnaissance shallow seismic reflection study of several traverses of the Great Barrier Reef. Existing information on the structure and geological history of the Queensland shelf and Great Barrier Reef is so scanty, that no reasonably supported hypotheses concerning it can be advanced. A short traverse run recently reveals an unexpected thick sedimentary sequence, horizontally bedded and showing no evidence of reefs or reef influence. If this shelf should be the product of extensive and thick prograding, with the reefs being merely pinnacles or perhaps even crowning subsurface structures as in the Gulf of Mexico, the area might have interest for oil, gas, and sulphur.

Since the northwest shelf programme for 1968/1969 will probably not require all of the budgetted ship funds, it is recommended that the possibility of a brief (30 days) operation from a small launch (for example 45') be considered to obtain several traverses across the reef and through its passages. If a suitable skilled scientist could be interested in the interpretation of the data on a short-term appointment, such a limited reconnaissance might prove extremely useful in future planning.

2) Phosphorite sampling in the Tasman Sea and Coral Sea.

Relatively shallow banks in this region have been recommended previously as possible targets for phosphorite search. This recommendation has recently been underscored by the find of phosphorite nodules on the Lord Howe Rise in 1,000' of water. Obviously, such occurrences even if present in commercial quantities, do not at present represent exploitable resources. However, they may be important long term reserves. A reconnaissance study would be desirable to establish better the potential of the area, and to clarify Australian interest in these portions of the sea floor. Such a study would require the use of HMAS Diamantina and the assistance of an experienced marine geologist skilled in deep water work.

Both supplementary studies are recommended, but only insofar as they can be carried out without significant interference in the northwest shelf mapping programme.

Canberra

March 18, 1968.

sgd. Tj. H. van Andel

APPENDIX Recommendations regarding vessel, equipment, and procedures.

The following suggestions are presented as an aid in improving the acquisition of a suitable vessel, and its operation at sea.

Present information indicates that response to the request for tender for the current charter was not representative for the type of vessel that may be available. Most owners of small vessels acquire charters through word of mouth rather than through impersonal announcements. It is suggested that a knowledgeable staff member of BMR visit most potential home ports in person for inquiries from harbour masters, brokers, and ship owners. Such an inquiry in Cairns for only one day yielded two potential candidates, one certainly far better than KOS II. Subsequently, copies of the request for tender can then be distributed to contacts.

It is desirable that the charter contract be made more specific to avoid unintentional and intentional misunderstandings that have occurred in the past. For example:

The meaning of 24-hour operation should be spelled out further by requiring the presence of 3 certificated deck officers and at least two engineers, an adequate power supply for work at night, and availability of gyrocompass and radar. BMR should retain the right to approve all appointments of ship's officers, in particular the master, before sailing. Four days of in-port time for each four weeks of sea time appear ample. The possibility should be considered to impose penalties for late departures after a few days of grace. BMR assumes substantial losses in time of personnel and equipment during prolonged inactivity of the vessel, even if no charter rate applies.

The availability of adequate spares should be ascertained and confirmed in writing before sailing.

The agreed-upon cruising and maximum speeds should be demonstrated in a short sea trial.

The power supply should be well in excess of the minimum of ship and science requirements together and the science supply should preferably be independent.

The availability of emergency power and adequate safety provisions should be ascertained.

Special emphasis should be placed on adequate staff quarters. Primitive accommodations have a long range deleterious effect on staff morale and increase staff turnover.

Demonstration of satisfactory legal status of the vessel (legal log, properly defined and signed articles, quality insurance, adequate survey reports) should be required before sailing.

Before establishing the charter rate, an independent judgment as to its adequacy should be sought. A charter rate less than or close to the owner's cost, is ultimately detrimental to the charterer.

A suitable payment period after completion of each section of the cruise should be established in the contract.

The financial status of the owner should be investigated to ascertain that he is adequately solvent to operate the vessel.

The equipment has in general been adequate. The following modifications and additions are suggested:

1) acquisition and hull mounting of an EDO 12kc transducer to operate with one of the Ocean Sonics transceiver-recorder systems. A full range sounding system is essential.

2) a medium dredge/piston coring winch carrying 15,000' of 3/8 or 1/2 inch wire, 3 ton capacity and at least 100 m/min. line speed. Acquisition of such a winch by BMR from an experienced supplier may be preferable over reliance on the contractor.

3) replacement of grab sampling by a short, light corer wherever possible.

4) addition of another 9,000 joule sparker unit.

5) availability of two tested hydrophone streamers at all times. Provision should be made for a small boat to test reflection equipment and configurations before the sailing of a large cruise. Adequate spare parts to insure continuous simultaneous operation of both recorders is necessary. It would be desirable to distribute in the future the scientific activities over two huts, and keep sample operations separated from geophysical and plotting work.

Personnel and Procedures: The BMR parties on board the KOS II have operated remarkably well, in particular the two technical officers. A six man party, including the chief scientist still appears optimal for full operation.

Before the start of the cruise, formal orders should be issued to all members of the ship's scientific party and the officers, and be countersigned as seen by the owner. These orders should state the purpose of the cruise, the relative orders of authority of master and chief scientist, the duties of ship's officers towards the survey programme, and instructions regarding lines of command, behaviour, and standard operations. Conflicts and misunderstandings can be avoided by proper orders, and safety enhanced.