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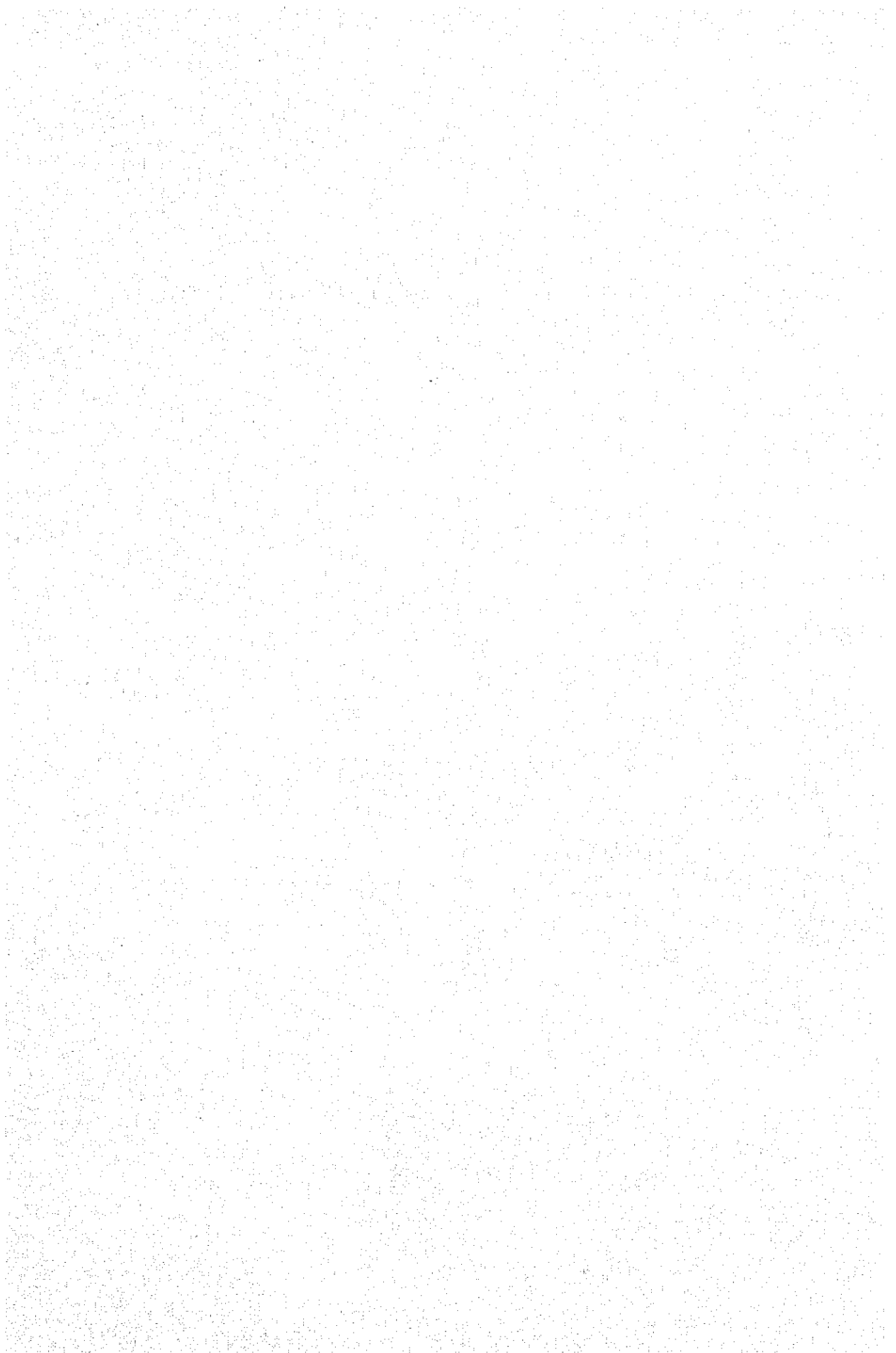
**BASIC DESIGN STUDY REPORT**  
**ON**  
**OFFSHORE MINERAL EXPLORATION VESSEL PROJECT**  
**IN**  
**THE PHILIPPINES**

**September, 1982**

**Japan International Cooperation Agency**

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國際協力事業団	
受入 用油 584.392kg	1180
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**MINERAL DISTRIBUTION MAP OF THE PHILIPPINES**

Scale: 1:500,000

Compiled and drawn by the Geographical Survey Service, Bureau of Mines, Manila, 1973

- EXPLANATION**
- Secondary and Metamorphic Rocks
  - Quaternary (Q)
  - Geologic Facies
  - Geologic Facies (Tertiary)
  - Geologic Facies (Quaternary)
  - Geologic Facies (Cenozoic)
  - Geologic Facies (Paleozoic)
  - Geologic Facies (Precambrian-Paleozoic)

- Active and Semi-active Volcanic, without mineral resources
- Active and Semi-active Volcanic, with mineral resources
- Active and Semi-active Volcanic, with mineral resources (Copper)
- Active and Semi-active Volcanic, with mineral resources (Gold)
- Active and Semi-active Volcanic, with mineral resources (Silver)
- Active and Semi-active Volcanic, with mineral resources (Iron)
- Active and Semi-active Volcanic, with mineral resources (Zinc)
- Active and Semi-active Volcanic, with mineral resources (Lead)
- Active and Semi-active Volcanic, with mineral resources (Nickel)
- Active and Semi-active Volcanic, with mineral resources (Cobalt)
- Active and Semi-active Volcanic, with mineral resources (Manganese)
- Active and Semi-active Volcanic, with mineral resources (Sulfur)
- Active and Semi-active Volcanic, with mineral resources (Uranium)
- Active and Semi-active Volcanic, with mineral resources (Vanadium)
- Active and Semi-active Volcanic, with mineral resources (Chromium)
- Active and Semi-active Volcanic, with mineral resources (Molybdenum)
- Active and Semi-active Volcanic, with mineral resources (Cadmium)
- Active and Semi-active Volcanic, with mineral resources (Selenium)
- Active and Semi-active Volcanic, with mineral resources (Tellurium)
- Active and Semi-active Volcanic, with mineral resources (Iridium)
- Active and Semi-active Volcanic, with mineral resources (Rhenium)
- Active and Semi-active Volcanic, with mineral resources (Osmium)
- Active and Semi-active Volcanic, with mineral resources (Platinum)
- Active and Semi-active Volcanic, with mineral resources (Palladium)
- Active and Semi-active Volcanic, with mineral resources (Rhodium)
- Active and Semi-active Volcanic, with mineral resources (Copper-Nickel)
- Active and Semi-active Volcanic, with mineral resources (Copper-Zinc)
- Active and Semi-active Volcanic, with mineral resources (Copper-Lead)
- Active and Semi-active Volcanic, with mineral resources (Copper-Silver)
- Active and Semi-active Volcanic, with mineral resources (Copper-Gold)
- Active and Semi-active Volcanic, with mineral resources (Copper-Iron)
- Active and Semi-active Volcanic, with mineral resources (Copper-Zinc-Iron)
- Active and Semi-active Volcanic, with mineral resources (Copper-Zinc-Lead)
- Active and Semi-active Volcanic, with mineral resources (Copper-Zinc-Silver)
- Active and Semi-active Volcanic, with mineral resources (Copper-Zinc-Gold)
- Active and Semi-active Volcanic, with mineral resources (Copper-Zinc-Iron-Gold)
- Active and Semi-active Volcanic, with mineral resources (Copper-Zinc-Iron-Silver)
- Active and Semi-active Volcanic, with mineral resources (Copper-Zinc-Iron-Gold-Silver)

- Geological Symbols
- Geological Symbols (Cenozoic)
- Geological Symbols (Paleozoic)
- Geological Symbols (Precambrian-Paleozoic)

- Minerals Other than Mineral Fuels
- Minerals Other than Mineral Fuels (Iron and Ferrously Metals)
- Minerals Other than Mineral Fuels (Base Metals)
- Minerals Other than Mineral Fuels (Precious Metals)
- Minerals Other than Mineral Fuels (Industrial Minerals and Rocks)
- Minerals Other than Mineral Fuels (Coal)
- Minerals Other than Mineral Fuels (Uranium)

- Minerals Other than Mineral Fuels (Iron and Ferrously Metals)
- Minerals Other than Mineral Fuels (Base Metals)
- Minerals Other than Mineral Fuels (Precious Metals)
- Minerals Other than Mineral Fuels (Industrial Minerals and Rocks)
- Minerals Other than Mineral Fuels (Coal)
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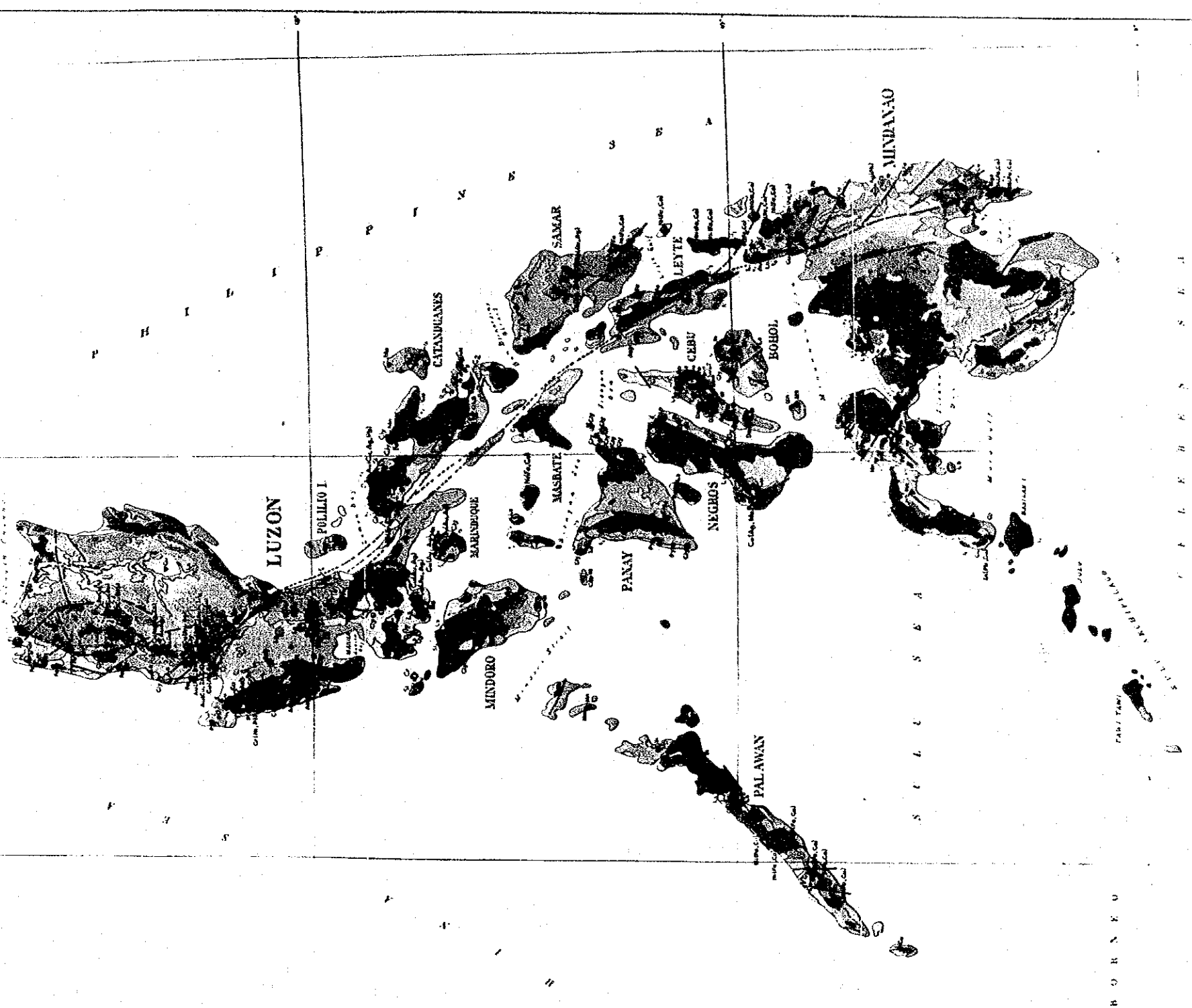
- Minerals Other than Mineral Fuels (Iron and Ferrously Metals)
- Minerals Other than Mineral Fuels (Base Metals)
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- Minerals Other than Mineral Fuels (Industrial Minerals and Rocks)
- Minerals Other than Mineral Fuels (Coal)
- Minerals Other than Mineral Fuels (Uranium)



PHILIPPINE ISLANDS

LUZON

MINDORO

PALAWAN

PANAY

NEGROS

CEBU

BOHOL

SAMAR

LEYTE

MINDANAO

Visayas

Mindanao

PHILIPPINE ISLANDS

PHILIPPINE ISLANDS

LUZON

MINDORO

PALAWAN

PANAY

NEGROS

CEBU

BOHOL

SAMAR

LEYTE

MINDANAO

Visayas

Mindanao

PHILIPPINE ISLANDS





## P R E F A C E

In response to the request of the Government of the Republic of Philippines, the Government of Japan decided to conduct a survey on the Basic Design for offshore Mineral Exploration Vessel Project and entrusted the survey to the Japan International Cooperation Agency (J.I.C.A.).

The J.I.C.A. sent to the Philippines a survey team headed by Mr. Norio Hattori, Deputy Director, Planning Div., Economic Cooperation Bureau, M.F.A., from April 10th to 24th, 1982.

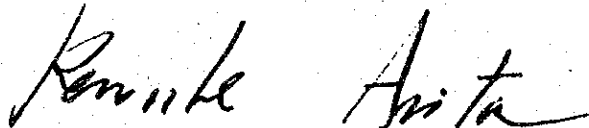
The team had discussions on the project with the officials concerned of the Government of the Philippines and conducted a field survey.

After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the team.

September, 1982

A handwritten signature in black ink, appearing to read 'Keisuke Arita', written in a cursive style.

Keisuke Arita

President

Japan International Cooperation Agency

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial reporting and auditing. The text notes that incomplete or inconsistent records can lead to misunderstandings, disputes, and potential legal consequences.

2. The second section focuses on the role of technology in modern record-keeping. It highlights how digital tools and software solutions have revolutionized the way data is stored, accessed, and analyzed. These technologies offer enhanced security, ease of access, and the ability to integrate data from various sources, thereby improving the efficiency and accuracy of record management.

3. The third part of the document addresses the challenges associated with data security and privacy. It discusses the risks of data breaches, unauthorized access, and the loss of sensitive information. To mitigate these risks, the text recommends implementing robust security protocols, such as encryption, access controls, and regular security audits. Additionally, it stresses the importance of adhering to relevant data protection regulations and standards.

4. The fourth section explores the impact of record-keeping on decision-making and strategic planning. It argues that well-maintained records provide valuable insights into organizational performance, trends, and risks. By analyzing historical data, management can identify areas for improvement, optimize resource allocation, and make more informed decisions that drive long-term success.

5. The final part of the document concludes by reiterating the significance of record-keeping as a foundational business practice. It encourages organizations to invest in the necessary infrastructure and training to ensure that their record-keeping systems are up-to-date, secure, and effective. The text also suggests that regular reviews and updates to record-keeping policies are essential to adapt to changing business environments and regulatory requirements.

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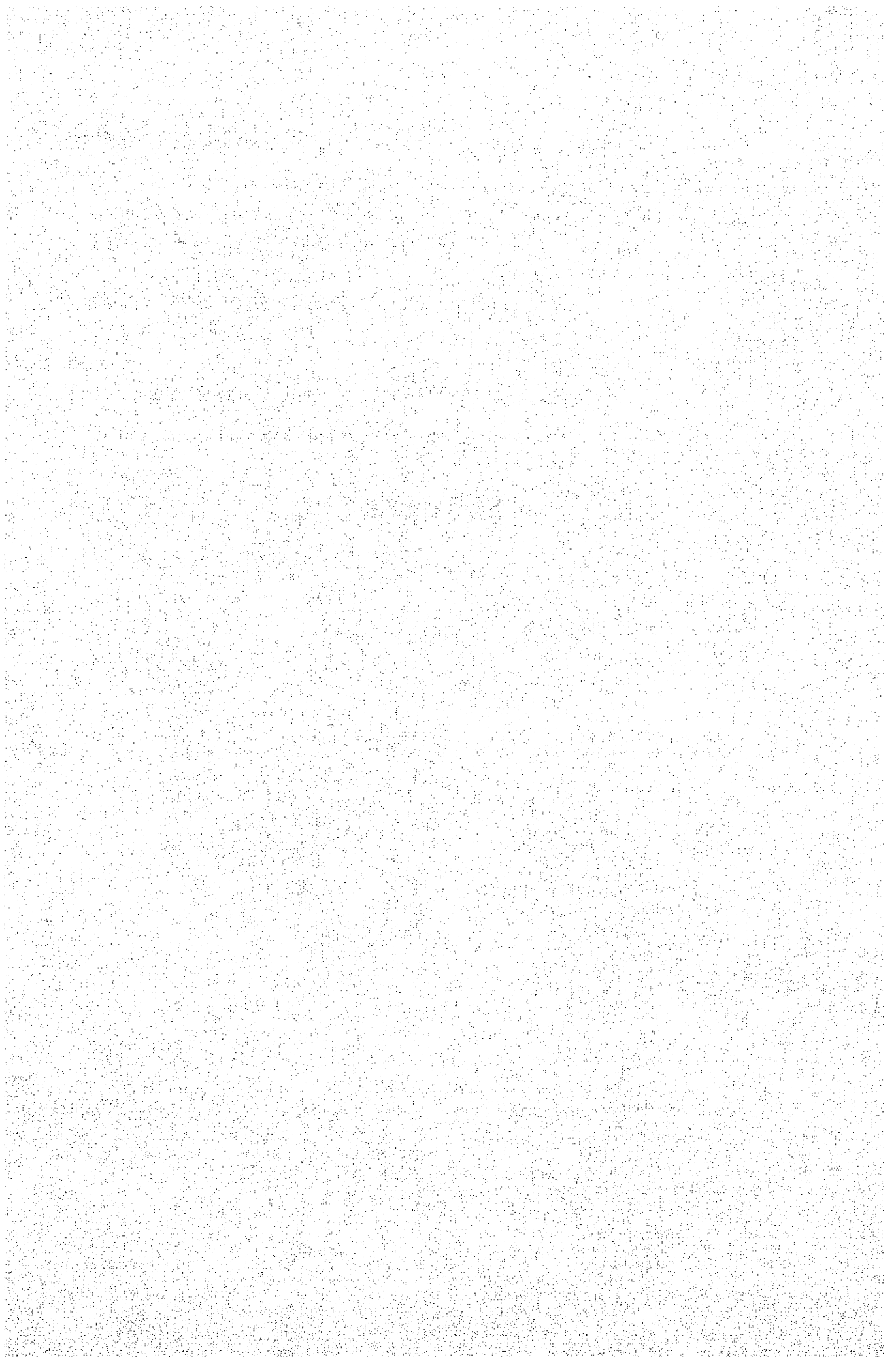
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2. Counterparts of the Project, Philippines Side
3. Basic Design Survey Team Schedule
4. Minutes of Discussions (No.1 & No.2)
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## **SUMMARY**



## SUMMARY

The Government of the Philippines has almost completed the basic geological exploration necessary for natural resources development on land but has only partially undertaken exploration in the continental shelf.

Since it is most urgent and important for the nation to explore and develop the mineral deposits including petroleum in the offshore areas for the growth of the national economy, the Philippines Government has asked the Japanese Government for a grant aid to facilitate the building an exploration vessel.

The Japanese Government, in response to the request, has already dispatched a preliminary survey team. This basic design survey team was dispatched based on the report of the preliminary survey team confirming the request contents and appropriateness of the project.

The basic design survey team has prepared the basic design for the optimum offshore mineral exploration vessel on the presumption of the grant aid, reviewing the appropriateness and prospective effect of the project.

The mining industry's share in the gross national product of the Philippines is about 2.5% (1980 fiscal year).

The amount of minerals exported accounts for 20% (1980 fiscal year) of the total export of the country, playing a very important role in earning foreign currency for the country.

The majority of the minerals are being exported to Japan hence the relation between the two countries is very close.

In the Philippines, basic geological exploration is almost completed on land, but only partially in the offshore areas. Under such circumstances, the Philippines Government has established the mineral resources development plan which places a high priority to the development of offshore mineral exploration.

The implementation agency of the offshore mineral resources exploration is the Bureau of Mines and Geo-Sciences (BMG) of the Ministry of Natural Resources (MNR). However, at present, the bureau does not possess an exploration vessel and exploration is conducted on a small scale by using some chartered vessels. BMG definitely needs its own exploration vessel, and this is the reason for the request for an offshore mineral exploration vessel to the Japanese Government.



The plan of the offshore mineral exploration vessel was made for the purpose of clarifying the location ranges of petroleum and useful minerals by employing the techniques of seismic exploration, magnetic exploration and bottom sampling, in order to develop the mineral deposits in the continental shelf and shallow sea areas of the vast Philippines territory.

The Philippines Government has established a long-term exploration plan effective up until 2000 AD on the supposition of receiving a suitable offshore mineral exploration vessel through a grant aid program from Japan.

The implementing agency of the exploration shall be BMG and the complement of the vessel shall be provided by the Bureau of Coast and Geodetic Survey (BCGS).

The base port of the exploration vessel shall be Navotas Fishing Port. The Petrolaboratories supplied by Japan and other related facilities shall be used for analysis of the exploration data.

The exploration vessel in the scheme shall be equipped with the necessary exploration equipment and its size shall be 500 G.T. Principal dimensions are as follows:

(1) Principal dimensions

Length, overall	about 53.00 m
Length, b.p.	45.00 m
Breadth, moulded	10.00 m
Depth, moulded	4.80 m
Planned draught, moulded	3.60 m
Gross tonnage	about 500 tons
Complement	31 persons
Service speed (15% sea margin)	11 knots

(2) Exploration equipment

Hybrid navigation equipment  
Seismic reflection equipment  
Proton magnetometer  
Bottom sampler  
Scuba diving gear

This exploration vessel will be constructed by a Japanese shipbuilder in the following procedures:

The tender will be conducted about 4 months after exchange of the official documents between the authorities of Japan and the Philippines. The shipbuilding contract will be concluded one and half months after the tender. The estimated period of the shipbuilding is about 14 months, and the vessel will be brought to the Philippines.

Since highly advanced techniques are required in building the exploration vessel, contracting with a distinguished shipbuilder is preferable.

The responsibility of implementing this project is with the division chief of the Marine Mineral Resources Division (MMRD). The division chief is under the direct supervision and control of the Director of Bureau of Mines and Geosciences (BMG) and he is to manage the vessel crew dispatched from the Bureau of Coast and Geodetic Survey (BCGS) and BMG scientists.

Operation, maintenance and management of the vessel will be attended by the pertinent division of BMG.

Annual operation expenses are estimated as shown below:

Operation expenses:	about ¥150,000,000 (about P5,000,000)
Data and samples analysis expenses:	about ¥111,000,000 (about P3,700,000)
Total:	about ¥261,000,000 (about P8,700,000)

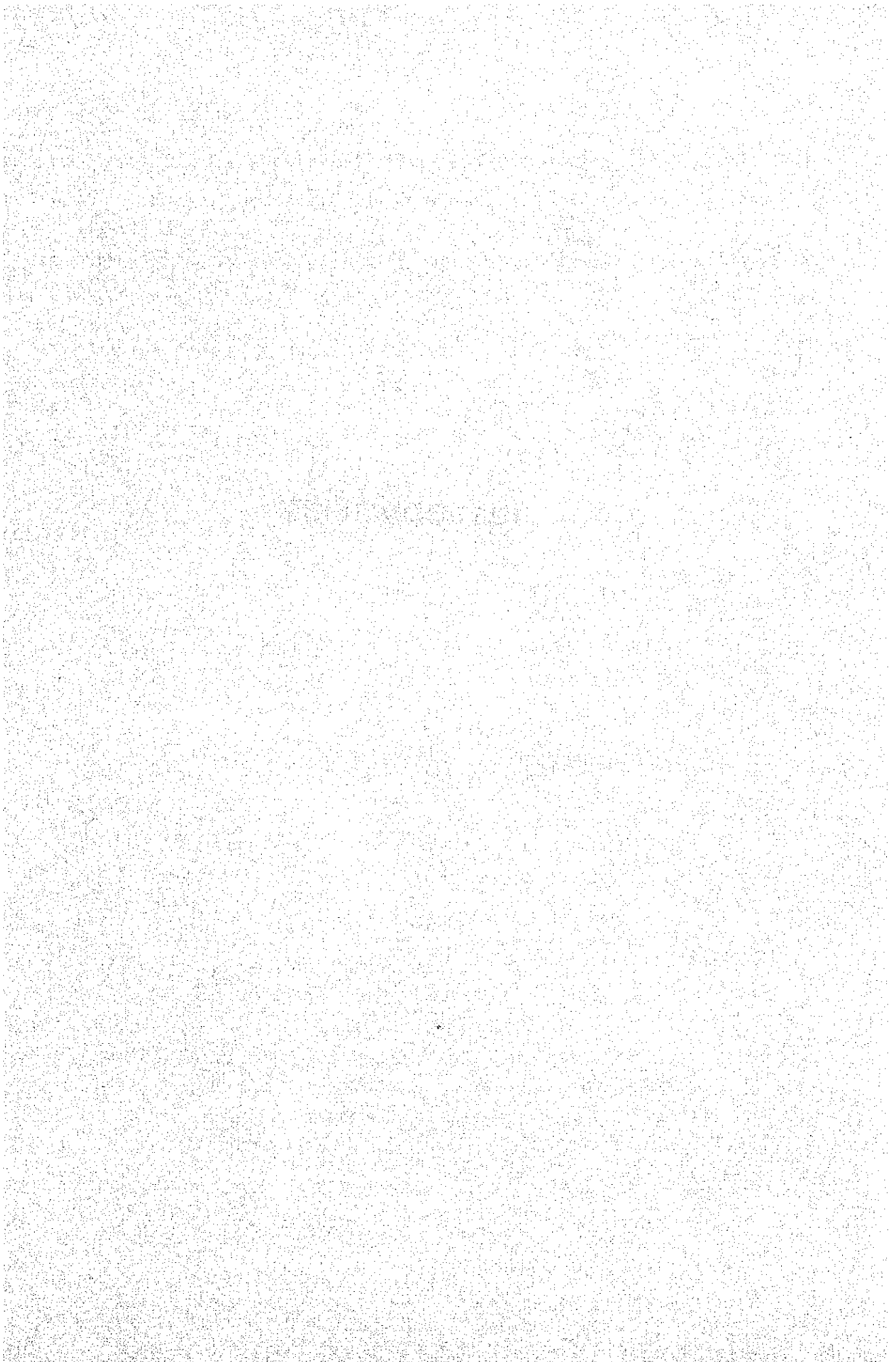
While the Philippines Government must arrange a budget to implement the exploration project, there is no problem in the operation of the ship itself. However, since most of the equipment is of the latest type, like seismic reflection system, we consider that sufficient technical help from foreign countries including Japan is essential for the operation, maintenance and management of these devices and techniques on analysis. Also, the computer system must be improved to the extent of being usable for analysis of seismic reflection exploration data.

Since this development of new marine mineral resources is very important, we consider it very significant to realize the required exploration vessel project.

The following must be realized for smooth implementation of the project:

- (1) The Philippines Government should extend a sufficient financial arrangements to BMG.
- (2) Technical training assistances of exploration techniques to the scientists are needed.

# **INTRODUCTION**



## INTRODUCTION

The Republic of the Philippines is an insular country consisting of about 7,000 islands, with the total land area of about 300,000 square kilometers, and situated on a continental shelf which is said to be about 4 times as large as the national land area.

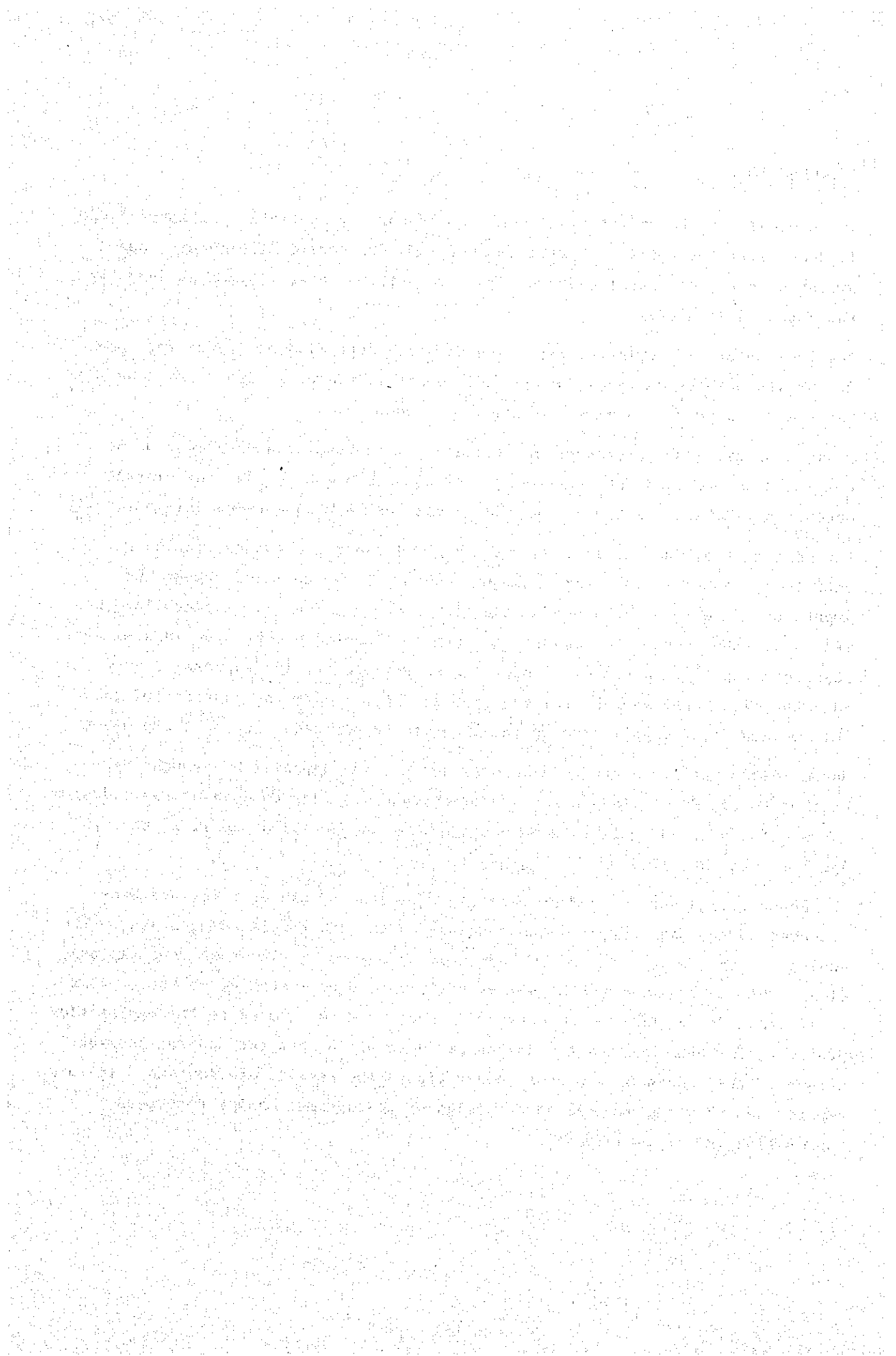
The Philippines is a mineral exporting country, depending on mining for about 20% of its foreign currency income, and recently strenuous effort has been made for the development and mining of mineral resources.

Basic geological surveys necessary for mining development have almost been completed on the land, but surveys to collect basic data needed for mineral deposit development in the continental shelf has been undertaken only partially.

Recognizing that the exploration and mining of mineral deposits, including petroleum, in the offshore areas of the country to be the most urgent and important subject for growth of the national economy, the Philippines Government asked the Japanese Government for a grant fund in order to build a mineral resources exploration vessel. The Japanese Government, in response to the request, dispatched a preliminary survey team to confirm the contents of the Philippines Government's request and to evaluate the necessity of the project.

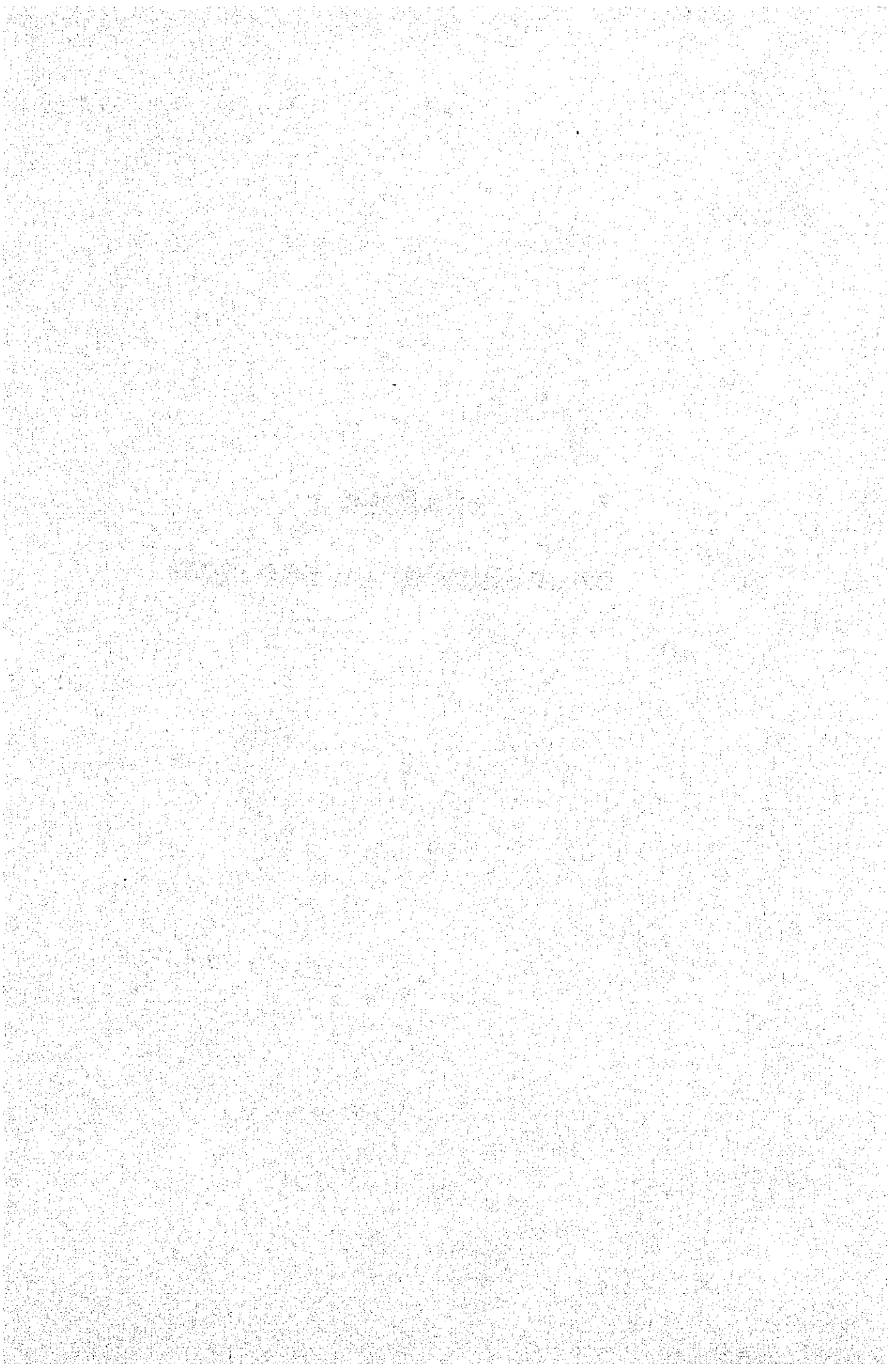
Based on the results of the preliminary survey, the Japanese Government dispatched to the Philippines a second survey team in order to conduct basic design surveys for a 500-GT exploration vessel during the period of April 10 through April 24, and August 8 through August 14, 1982.

The basic design survey team had meetings with the Bureau of Mines and Geosciences of the Ministry of Natural Resources and other related agencies on the subject of the current situation and future plans for marine resources exploration. They also discussed the survey equipment to be installed on the exploration vessel, and conducted surveys on various matters related to the exploration project. The team studied the appropriateness of the project and the possible effect of the requested Japanese cooperation. The results are contained in this report, and they explain the basic design of the optimum marine resources exploration vessel established.



**CHAPTER 1**  
**BACKGROUND OF PROJECT**





## CHAPTER 1 BACKGROUND OF PROJECT

### 1-1 Position of Mining in Philippines Economy

The mining industry's share in the gross national product of the Philippines is about 2.5%, which is extremely high when compared with Japan's 0.5% share.

76% of the mining production are metallic ores. Some information on mining is given in Tables 1 and 2 below.

Table 1 Gross Domestic Product

(at constant 1972 prices) (Unit: P 1 billion)

Year	GDP	Mining	Mining/GDP (Percent)
1979	87.74	2.13	2.4
1980	91.95	2.35	2.6

(Source: Minerals News Service, No. 74, Sept. 1981, BMG)

Table 2 Mining Production

(at current prices) (Unit: P 1 billion)

Year	Total	Metallics	Non-metallics
1979	9.11	6.86 (75.5%)	2.25 (24.5%)
1980	12.82	9.78 (76.3%)	3.04 (23.7%)

(Source: Minerals News Service, No. 74, Sept. 1981, BMG)

The share of exported minerals in the total export of the Philippines is about 20%, greatly contributing to earning foreign currencies.

Table 3 shows the share of minerals in the export.

Table 3 Share of Minerals in Export

(Unit: US\$ million)

Year	Total export	Mineral export (share %)
1975	2,294	326 (14.0%)
1976	2,574	358 (14.0%)
1977	3,151	488 (15.5%)
1978	3,425	532 (15.5%)
1979	4,537	810 (17.6%)
1980	5,686	1,155 (20.3%)

(Source: Minerals News Service, No. 76, Sept. 1981, BMG Mining in Economic Development, May 1981 The national income accounts, CY 1978~80, NEOA)

About half of the exported minerals is copper, and copper is the second largest export item after centrifugal sugar.

The contents of these tables indicate that mining is substantially contributing to the development of the national economy of the Philippines.

The majority of these mineral exports are exported to Japan, as shown in the Table 4, hence the relationship between the two countries is very close.

Table 4 Ratio of Mineral Export to Japan

Year	Total of minerals	Copper along
1979	67%	83%
1980	62%	73%

(Source: Minerals News Service, No. 76, Sept. 1981, BMG)

## 1-2 Mineral Resources Development Plan

The Philippines Government established a mineral resources development plan (1979 ~ 1988) in 1979, citing three major objectives of mineral resource development and ten strategical points of accomplish these objectives.

(1) The objectives of the mineral resource development plan are to:

- a. Accelerate the production volume of traditionally exported minerals and promote the development of those minerals;
- b. Encourage the development and exploitation of mineral resources in all regions; regional development will follow mineral exploitation;
- c. Expedite geological surveys and the search for economic mineral deposits and disseminate such information to investors interested in developing marketable products therefrom.

(2) To sustain the upward movement of the mining industry, it is necessary to:

- a. Accelerate the mapping of rocks and the search for economic minerals in promising prospect areas inland (in selective depressed provinces) and offshore;
- b. Expedite the adjudication of cases of mining conflicts, adverse claims and complaints of illegal mining, and the granting of mining rights such as leases, permits, licenses, and service contracts to claim owners and mine developers;
- c. Grant tax exemption privileges to operators to import equipment and machinery necessary for prospecting, exploration, development, and exploitation, and others;
- d. Undertake more extensive exploration and evaluation of promising mineral deposits by drilling, trenching, and test pitting;
- e. Encourage mining companies to develop infrastructure, such as seaports, transportation access, communication and power systems, etc.;
- f. Implement the specific provisions of the new law to maintain ecological balance in mining operations;
- g. Improve amenities of mining communities and promote schemes for extending social services and the general betterment of workers in the industry;

- h. Inspect, review, and evaluate operations of mining companies, particularly those listed in the stock market;
- i. Undertake metallurgical researches to evaluate the technical and economic possibilities of promising ore reserves, and determine the viability of producing marketable products therefrom; and
- j. Up-date the system of administration and disposition of mineral lands in response to changing situations.

Items contained in this program are being implemented by the Bureau of Mines and Geo-Sciences of the Ministry of Natural Resources. The bureau is preparing a rolling plan every year in the form of "5 and 10 Year Integrated Mineral Resources Development Plan".

On the land, geological exploration maps have been completed covering 93% or more of the area, but the exploration of the offshore areas has been conducted only in extremely limited areas.

Accordingly, high priority is given to offshore mineral development in the entire program and urgent implementation of basic exploration is being planned. Table 5 shows the 10-year plan for exploration related to the offshore mineral development project. Naturally, the plan is drawn up with the assumption that an exploration vessel can be obtained.

Table 5 Plans for 1980 - 1981

BUREAU OF MINES AND GEO-SCIENCES  
PLANNING WORKSHOP  
FEBRUARY 22-23, 1980

PROJECT 1.2 Geological Surveys

REGION/DIVISION/SECTION Marine Mineral Res. Division

ACTIVITY (PRIORITY)	MEASURABLE	ANNUAL TARGET	LOCATION	COMMODITY	D U R A T I O N				
					1980	1981	1982	1983	1984
1.2.1.3 Marine Seismic, Ship-borne Magnetic and Gravity Survey and Submarine Geological Studies/Sea-Bottom Sampling.	800 line-km (860,000 Has)	800 line-km (860,000 Has)	Boya Gulf, Pangasinan, Ilocos Sur						
	300 line-km (320,000 Has)	300 line-km (320,000 Has)	Boya Gulf, Pangasinan, Ilocos Sur						
	1,255 line-km (1,255,000 Has)	1,255 line-km (1,255,000 Has)	Boya Gulf, Pangasinan, Ilocos Sur						
	1,000 line-km	1,000 line-km	Boya Gulf, Pangasinan, Ilocos Sur						
	5,000 line-km	5,000 line-km	Boya Gulf, Pangasinan, Ilocos Sur						
	1,255 line-km	1,255 line-km	Boya Gulf, Pangasinan, Ilocos Sur						
	2,700 line-km	2,700 line-km	Boya Gulf, Pangasinan, Ilocos Sur						
	725,000 Has	725,000 Has	Boya Gulf, Pangasinan, Ilocos Sur						
	440,000 Has	440,000 Has	Boya Gulf, Pangasinan, Ilocos Sur						
	150,000 Has	150,000 Has	Boya Gulf, Pangasinan, Ilocos Sur						
	1,100 line-km	1,100 line-km	Boya Gulf, Pangasinan, Ilocos Sur						
	1,200 line-km	1,200 line-km	Boya Gulf, Pangasinan, Ilocos Sur						
	1,400 line-km	1,400 line-km	Boya Gulf, Pangasinan, Ilocos Sur						
	1,700 line-km	1,700 line-km	Boya Gulf, Pangasinan, Ilocos Sur						
Note: Activity depends on availability of survey vessel.	5,000 line-km	5,000 line-km	Boya Gulf, Pangasinan, Ilocos Sur						

General mapping & non-magnetic

1012: Please review your 5-10 year Plans (Yellow Book) where activity will be undertaken, or where samples will be taken, or what mine/mill/property will be involved.

Division Chief  
OLC, Marine Mineral Res. Division

### 1-3 Current Situation of Offshore Resources Exploration

#### 1-3-1 Exploration conducted in the past

While BMG is the implementation agency of the offshore mineral resources exploration, the bureau has no exploration vessel of its own and is conducting some exploration using chartered vessels. For example, the bureau conducted exploration of heavy metals distribution in the Leyte Gulf, Surigao Straits, and Dinagat sound chartering MV Atyimba, a vessel owned by the Bureau of Coast and Geodetic Survey (BCGS) of the Ministry of Defence, during the period of May 14 through June 30, 1981. The sparker used in this exploration was borrowed from CCOP (Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas, stationed in Bangkok) of UNESCAP.

Table 6 shows the offshore mineral resources explorations conducted up to present.

Table 6 Offshore Mineral Resources Exploration Results

Survey	Area	Local Agencies Involved	Year/Duration	Survey Vessel	Technical Assistance
Marine Magnetometer Survey and Bottom Sampling	Zambales & Ilocos Offshore	BMG & BCGS	1973/ 2 weeks	MV Atyimba of BCGS	UNDP Experts
Marine Seismic Survey	Tayabas Bay - Mompog Pass	BMG	1974/ 1 month	RPS Resuarcher of BFAR	Experts provided by Government of Japan
Marine Seismic Survey	Leyte Gulf - Dinagat Sound	BMG & BCGS	1981/ 1 month	MV Atyimba	Equipment & experts provided by UNDP Regional Off-shore Prospecting in East Asia

#### Accronyms

BMG: Bureau of Mines and Geo-Sciences  
 BCGS: Bureau of Coast and Geodetic Survey  
 BFAR: Bureau of Fisheries and Aquatic Resources  
 UNDP: United Nations Development Program

In addition to the above, existence of heavy minerals was explored by small boats in limited sections of the coast area (up to water-table level and some extremely shallow area).

### 1-3-2 Current situation of exploration implementation system

- (1) Bureau of Mines and Geo-Sciences (BMG) of the Ministry of Natural Resources (MNR)

This is the implementation agency for exploring offshore mineral resources, and further explanation is given in Chapter 2, 2.4.1.

- (2) Bureau of Coast and Geodetic Survey (BCGS) of the Ministry of Defence

BCGS undertakes preparation of topographical maps of the land, level point measurement and preparation of nautical charts, and it owns 3 survey vessels, as shown below.

Vessel name	Built in	Overall length	×	Breadth	×	Draught	F - IN
Atyimba	1969	49.1 m	×	10.1 m	×	9 - 1	
Arlunya	1964	28.4 m	×	6.7 m	×	9 - 4	
Arinya	1961	ditto	×	ditto	×	ditto	

BCGS has the following number of people on navigation services:

- 100 commission officers
- 250 civil service staff (shore service)
- 400 enlisted seamen

Since the exploration complement is expected to be dispatched from BCGS, this configuration of manpower seems to be enough. Some of them have exploration experience on the MV Atyimba, therefore have no problem in maneuvering the exploration vessel.

The organization diagram of BCGS is shown in the next page.



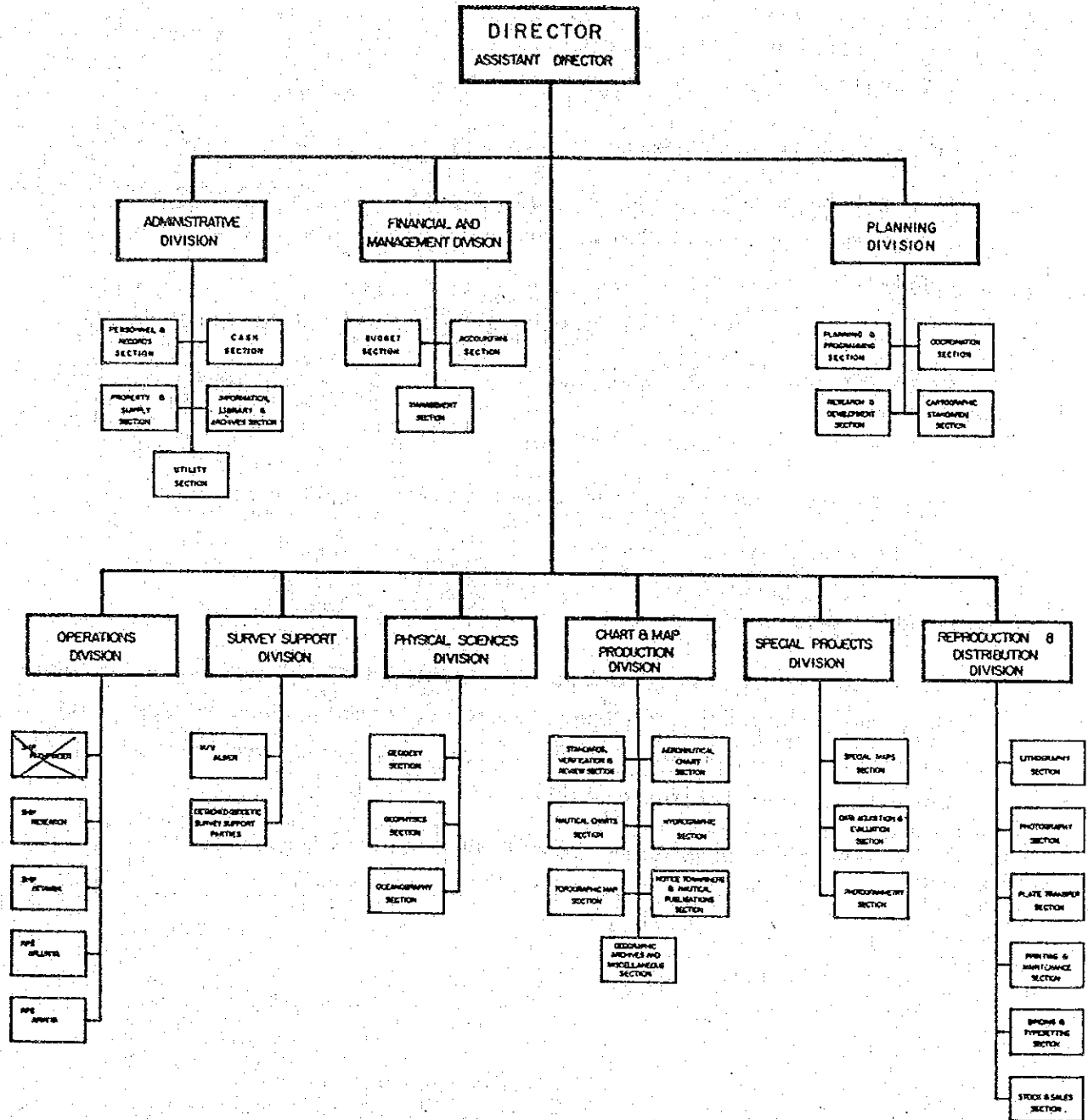


Fig. 1 Organization Diagram

The major particulars of MV Atyimba, a survey vessel owned by BCGS are as listed below:

Construction	in 1969
Overall length	49.1 m
Overall breadth	10.1 m
Gross tonnage	680 tons
Draught	F: 9'-0", A: 9'-1"
Speed	9.5 knots
Water tank	113,550 liter
Fuel tank	75,700 liter
Living quarters	
Officers	8
Seamen	46
Main engines	2 sets and 2 shafts Lister Blackstone, 900 RPM, 800 HP 4-cycle, 6-cylinder, non-supercharged diesel
Main generator	2 diesel generators General Motors, Model 4151, 3-phase, 440 V, AC 2-cycle, 4-cylinder, 1800RPM, 75 KW
Auxiliary generator	1 diesel generator General Motors, Model 2151, 2-phase, 440 V, AC 2-cycle, 4-cylinder, 1800 RPM, 25 KW
Survey boat	2 boats (1 boat is damaged)

The complement of this vessel consists of officers and seamen belonging to BCGS, and since they all have ample experience in the maneuvering and surveys that are conducted as daily duties, we do not foresee any problem in the ability of the exploration vessel operation.

We are told that the annual operation rate is about 70%. Since the vessel does not operate at night, the calculated operation hours are 2,500 to 3,000 hours per year. The vessel has been maintained fairly well even though the vessel is already 13 years old. However, because of an insufficient budget for repair, dry-dock repair, ordinarily conducted once a year, is conducted only once in two years. This practice overlooks many problem such as the fouling and wearing of the bottom. Also, the availability of parts is limited, a common problem in developing countries.

## 1-4 Current Situation of Vessel Operation and Maintenance

### 1-4-1 Seamen training institutes in Phillipine

In order to learn the ship operation techniques currently taught at training institutes in the Philippines, the survey team has investigated the seamen training institutes. The Philippine Merchant Marine Academy (PMMA), located in Manila, is the only national academy which provides training to navigation officers and engineers.

There are several other private institutes for Deck officers and engineering officers. But there is no training institute for the crew, and generally the crew is screened from volunteers of high school graduates.

An outline of PMMA is shown below based on the hand book and curriculum table obtained.

#### Philippine Merchants Marine Academy

The academy is nationally founded and students are supported by governmental funding.

##### Qualification for entry

Age	17 to 22 years old
Education background	High school graduates

##### Education period

4 years	Students of the 1st, 2nd and 4th years are given lessons in the school. Students of the 3rd year conduct practical on board training. Navy training twice, 2 months each time, during the summer vacation is compulsory.
---------	--

##### Number of students

About 200 students are permitted to enter every year.  
The statistics of the preceding year indicate that the graduation rate is about 70%.

##### Qualification given upon graduation

Bachelor of Science in Marine Transportation, third officer, 4th Engineer

##### Employment

Shipping companies, Navy, Coast Guard, other governmental agencies, insurance companies, and ship brokers

1-4-2 Fisheries survey vessel, "Sardinella", provided by Japan as a grant aid. The current situation of "Sardinella", a fisheries survey boat granted by the Japanese Government in May, 1981, was investigated in order to obtain reference data on the operation and maintenance of the vessel.

"Sardinella" is being operated under leadership of the marine biologists of the Fisheries Dept. of the Philippines University. The vessel is well maintained and there are no particular problems. However, when the survey team visited the vessel the compressor for air conditioning happened to be out of order and the team felt that it was taking too much time to fix it. Therefore, the team has become anxious as to the maintenance of the new equipment and electrical instruments on the exploration vessel once it is delivered to the Philippines.

"Sardinella" employs a system of bridge control with CPP, and the team was told that there was no problem in the maneuverability and maintenance.

A problem in relation to the complement is that the salary level of the complement on governmental vessels is generally lower than that of private ships. Therefore, after the seamen work for a certain period of time to accumulate experience, they retire and find employment with private ships. Thus, the seamen do not work for a long period of time in government owned vessels, creating difficulty in securing skilled seamen.

#### 1-4-3 Vessel repair facilities

Since proper maintenance and repair work must be provided for the exploration vessel, once the Philippines Government owns it, the team investigated the actual situation of Bataan Shipyard and Engineering Co. This company has been repairing government owned vessels and is said to be well equipped. (refer to Fig. 2).

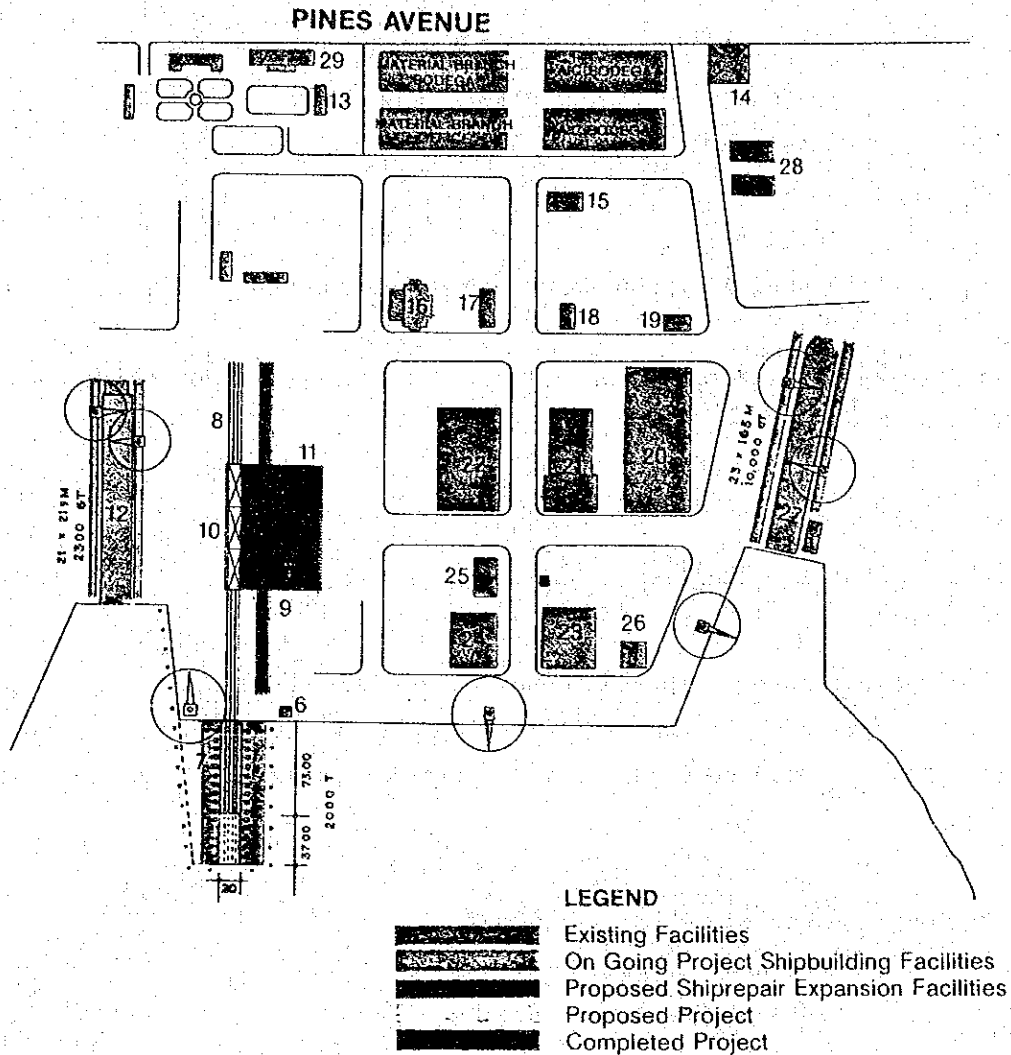
The company's shipyard is located in Mariveles city, close to the tip of Bataan peninsula at the entrance of Manila bay. It takes about one and half hours from Manila by boat and two and half hours by car. As shown in the attached table, the shipyard has sufficient facilities.

Many Navy vessels are being repaired in this yard as well as vessels of other governmental agencies. They can repair hulls and also have facilities to repair engines and related equipment of large vessels. (The number of employees is 470 at present.) However, it is too much to expect that repair of parts and electrical instruments related to engines and electrical instruments for exploration can be done at this shipyard. Therefore ordering channels for spares and the arrangement of repair engineers must be considered carefully.

In addition to Bataan Shipyard and Engineering Co., there are other shipyards, such as Vardero de Manila, Philippine National Oil Co., and Keppel shipyard, in the outskirts of Manila, all of which can repair the exploration vessel. It is quite possible that minor repairs could be done on the exploration vessel when she is in Manila port. Fig. 3 and Fig. 4 shows the shipyards and their locations in the Philippines for reference.



# BASECO



- |                             |                                      |  |
|-----------------------------|--------------------------------------|--|
| 1. Building Berth No. 1     | 11. Transfer System                  | 21. Foundry Shop                             |
| 2. Fabrication Shop         | 12. Slipway                          | 22. Machine Shop                             |
| 3. Assembly Shop            | 13. Infirmary                        | 23. Shiprepair Dept.                         |
| 4. Outfitting Shop          | 14. NPC Sub-Station                  | 24. Electrical Shop                          |
| 5. Temporary Facilities     | 15. Paint Storage                    | 25. Mold Loft Building                       |
| 6. Syncrolift Control House | 16. Main Sub-Station and Power Plant | 26. Pipe Shop                                |
| 7. Syncrolift               | 17. Oxygen Plant                     | 27. Repair Dock No. 1                        |
| 8. Heavy Berth              | 18. Acetylene Plant                  | 28. Transient Houses                         |
| 9. Light Berth              | 19. Repair Dock Sub-Station          | 29. Administration Building and Other Office |
| 10. Transfer Carriage       | 20. Plate Shop                       |  |

Fig. 2 Mariveles Yard Layout Plan

## PRINCIPAL FACILITIES

### MARIVELES SHIPYARD

#### Graving Dock:

Capacity : 10,000 GT  
Length Overall: 164.63 m  
Width Bottom : 23.16 m  
Depth : 12.19 m  
Cranes : 2-40 T American Hoist and Derrick Company Travelling Portal Cranes

Equipped with steam, water, air and electrical facilities for ship-repair operations.

#### Syncrolift Drydock:

The lift is a 20-Hoist facility with a platform size of 20 m × 73 m and nominally rated at 2000 tons.

The programmed purchase of 10 additional hoists and the lengthening of the platform to 109 meters will increase lifting capacity to 3000 tons. Syncro-Piers built for the full 3000 tons capacity. Construction of the Transfer System is in progress.

Marine Railway: Capacity ; 1,000 T  
Length of Cradle; 63.40 m  
Width of Cradle ; 8.53 m  
Cranes ; 2-40 Ton Travelling Portal Cranes

#### Support Shops & Facilities

##### Facilities:

Plate and Angle Shop, Foundry Shop, Machine Shop, Pipe & Sheet Metal Shop, Elect. Shop, Mold Loft, Carpentry Shop, Oxygen and Acetylene Plants, Power Plant, Air Compressor Plant.

##### Power:

3000 KVA NPC Substation and 1600 KVA Diesel Electric Plant.

**GREATER MANILA & VICINITY AREA**

1. A. G. & P. Co., of Manila
2. Asian Pacific Shipping Co., Inc.
3. Bangor-buhay Mech. & Mar. Serv. Corp.
4. (E. I. S. BASECO)
5. Engr'ng. Equipment, Inc.
6. Filipino Shipyard & Iron Works, Inc.
7. Florida Filtrage, Inc.
8. Jao & Co., Inc. Shipbldg.
9. Lord Shipyard Phil., Inc.
10. Pacific Seacraft (Phil.), Inc.
11. P. B. Engr'ng. Co.
12. Sealink, Inc.
13. Veterans Shipyard Corp.

**BICOL AREA**

1. Interfarm, Inc.
2. Filipinas Shipyard & Ship Repair
3. Bannaco Shipping & Shipbldg.
4. Mayon Docks, Inc.

**CEBU-MACTAN AREA**

1. Colorado Shipyard Corp.
2. Hijos de F. Escano, Inc.
3. Industrial Supply & Engr'ng. Corp.
4. Kasamban Engr'ng.
5. L. Nor Marine Services, Inc.
6. Milagrosa Shipyard & Shipbldg. Corp.
7. Republic Drydock Corp.
8. Phil. Tripson Shipyard Corp.
9. Sandoval Shipyard, Inc.
10. Sweet Lines, Inc.
11. Yrasport Drydock Co., Inc.
12. Cebu Shipyards & Engr'ng. Works

**MISAMIS ORIENTAL AREA**

1. Phil. Iron Const. & Marine Works

**LANAO DEL NORTE AREA**

1. National Steel Corp.

**DAVAO AREA**

1. Bucana Repair Works
2. Davao Shipyards, Corp.
3. Davao Engr'ng. Works & Supply
4. Liang Cook Carpentry Shop
5. Mindanao Marine Works & Services, Inc.
6. Pacific Marine Harvester, Inc.
7. Philippine Marine Industries
8. Pioneer Shipbuilder, Inc.

**ZAMBOANGA AREA**

1. DMC Shipbuilders, Inc.
2. Vencedero de Record

**MALABON-NAVOTAS AREA**

1. David Shipyard
2. D & M Shipbuilding, Inc.
3. E. E. Engr'ng. & Marine Const.
4. Frabelle Fishing Corp.
5. Inland Industrial & Const. Corp.
6. Luzon Sillways & Drydock Corp.
7. Marceio Fiberglass Corp.
8. JM Shipyard, Inc.
9. Navotas Industrial Corp.
10. R. Vallecron & Sons
11. San Diego Fishery Enterprises
12. (Sandoval Shipyards, Inc.)
13. V. L. Shipyard
14. Western Shipyard Services, Inc.

**BATAAN-ZAMBALES AREA**

1. Phil. Dockyard Corp.
2. Bataan Shipyard & Engr'ng. Corp.
3. Marsteel Corp.

**CAVITE AREA**

1. Arm & Hammer Engr'ng.
2. Cavite Sillway & Mar. Engr'ng. Works, Inc.
3. Delgado Brothers Shipyards Corp.
4. El Varadero de Manila
5. Superior (SG) Shipyard Corp.

**BATANGAS AREA**

1. E. E. I. (Dynamarine)
2. Kappel (Phil.) Shipyard, Inc.
3. PNOC Shipyard Corp.

**QUEZON AREA**

1. Viva Shipping Lines, Inc.

**ILOILO-GUIMARAS AREA**

1. Iloilo Dock & Engr'ng. Corp.
2. RIL Martinez Fishing Corp.
3. Buenavista Dock & Shipbldg. Corp.
4. Guimaras Dock & Repair Works, Inc.
5. Sta. Elita Dockyard, Inc.

**NEGROS AREA**

1. Rafael Bont Building & Supplies
2. F. B. Estevanes Const.
3. Ferro-cement, Phil., Inc.
4. Solomon Desamparado (Boatbuilder)
5. Alenar Shipbuilding Corp.
6. Cebu Shipbuilders Consultant Engrs.
7. H. V. Agus Industries
8. Venlegra Boatbuilder



Fig. 3 Location of Marina Registered Shipbuilder-ship Repairers (As of 11-27-79)



**MALABON-NAVOTAS AREA**

1. E. R. Escobar & Co.
2. Navotas Shipyard & Fishing Corp.
3. Pedasco Marine Works Co., Inc.
4. Ponce Shipyard
5. Polcarolo Drydock & Shipbldg. Corp.
6. RBL Fishing Corp.
7. Tangas Shipyard
8. VES Enterprises

**BATAAN-ZAMBALES AREA**

1. Philisco

**CAVITE AREA**

1. BEA Maintenance Services & Gen. Contractor
2. Marine Technical Corp.

**BATANGAS AREA**

1. Chemical Bulk Carrier, Inc.

**ILOILO-GUIMARAS AREA**

1. J & H Industrial Corp.

**NEGROS AREA**

1. Victoria Milling Co., Inc.

**GREATER MANILA & VICINITY AREA**

1. Aguilar Machine Shop & Engr'g. Works
2. Aben Navigation, Inc.
3. Bernardino Marine & Industrial Corp.
4. B. P. Maiz & Co.
5. Capitan Engr'g. Corp.
6. Citadel Carrier
7. Even Development Corp.
8. Floating Mar. Repair Services, Inc.
9. F. M. Apolinario & Co., Inc.
10. International Marine-Land Services, Inc.
11. L. V. Sanchez Engr'g.
12. Malayan Towing & Salvage Corp.
13. Silangan Marine Engr'g. Corp.
14. Sta. Mesa Sillways & Engr'g. Co.
15. Terramar Equipment Corp.
16. Top Service, Inc.
17. Reconnor, Inc.
18. Trident Marine Services, Inc.
19. Visayan Engr'g. Services
20. Wellworth Mar. Services & Const., Inc.

**CEBU-MACTAN AREA**

1. Abottiz Engr'g. Services
2. Boston Industries, Inc.
3. Caslag Engr'g. Corp.
4. F. S. Builders & Sales, Inc.
5. Lioan Repair Shop, Inc.
6. Marmalec Works, Inc.
7. Sea Transport Co., Inc.
8. Sulplido Lines, Inc.
9. William Lines, Inc.
10. Waterline Industrial Corp.
11. Cebu United Marine Works, Inc.
12. H. R. Engr'g. Services, Inc.

**DAVAO AREA**

1. Davao Gear Rebuilder
2. R & R Enterprises
3. Sealand Engr'g. Services

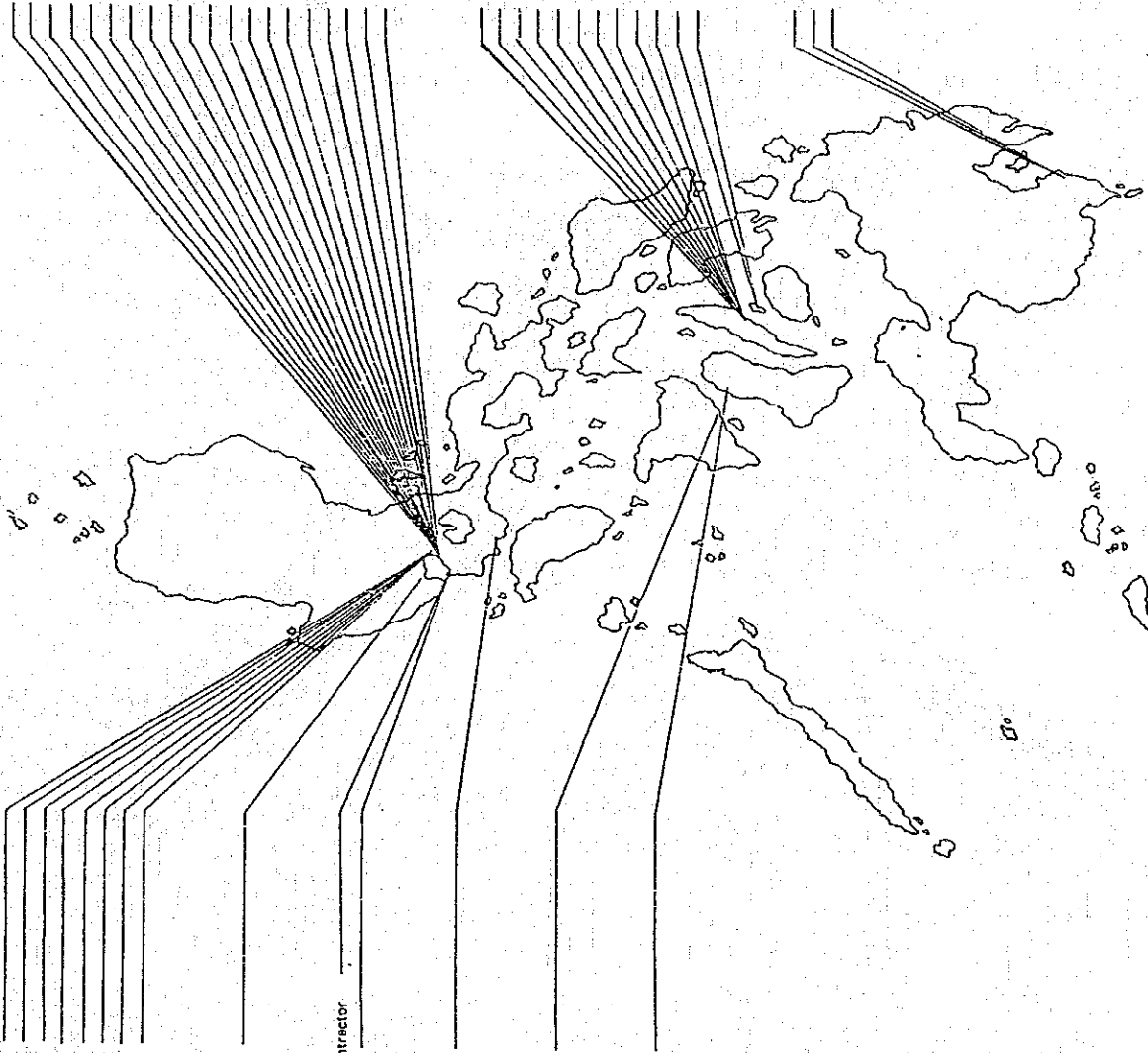


Fig. 4 Location of Marina Registered Ship Repairers  
(As of 11-27-79)

## 1-5 Current Situation of Computer Analysis Division

A computer system is required to analyze data obtained from seismic reflection exploration and submarine magnetic exploration. The survey team visited and studied the following agencies which BMG plans to co-ordinate in this project.

- a. Bureau of Lands (Ministry of Natural Resources)
- b. Technology Resources Center (Ministry of Human Settlement)

It was found through the investigation that both of these computer systems were inadequate for the purpose since they did not have the graphic display which would be essential for analysis of seismic reflection exploration data, nor would their capacity be large enough. (The computer center at Philippines University and the National Computer Center were also investigated, but both of them were found to be inadequate, either.)

While countermeasures could be found by improving the equipment of the Bureau of Lands, there would be some problems concerning software when trying to connect the different systems. Accordingly, a plan was drawn-up to install a computer system on the exploration vessel for on-board processing of the seismic exploration data.

The investigation results concerning these two agencies are shown below.

### Bureau of Lands

#### IBM S/360 Model 40

CPU (2040-G) 256K bytes

5 magnetic tape drives, 9 tracks, 1600 BPI

Magnetic tape drive control unit (2804)

9 Disc units (2314), 7.2M Bytes

Disc control units (2841)

Printer (1403), 1100 lines/min.

16 SST Terminals

Data entry system (Entrex 380)

Out of the 40 technicians for this system, 4 are programmers. The system is operated for 180 hours per month.

The system was installed in 1980 on a rental contract of a 5-year basis. The rental charge is 1,980,000 Pesos, including repair charges.

The system is being used by BCGS for other projects.

While the memory of this system is not large, since it has a large number of SST terminals provided with tapes for data entry, the system can be conveniently used.

Technology Resources Center

UNIVAC 1100/10

CPU 256K bytes

9 discs, 200M bytes

5 tapes, 1600 BPI

We were told that the system was purchased and installed in 1977.

A problem here is that the memory is too small, consequently it may cause some troubles to make the memory capacity bigger.

Another problem with this center is the format difference.

Line printer, 1400 lines/min.

6+ SST terminals

An additional 6 remote terminals (including BMG)

This system is operated for 24 hours every day, except Sunday, and 50 governmental agencies are using the system. 60 people are working in this center.

## Bureau of Lands

The following is a brief description of the characteristics of the components of the IBM S/360, Model 40 Computer and the Entrex 380 Data Entry Systems which are installed in the EDP Staff, Ground Floor, Bureau of Lands Building, Plaza Cervaites, Manila.

A 2040 Model G Central Processing Unit with 256 KB memory, decimal arithmetic, floating-point arithmetic, storage protection, multiplexor channel, selector channel and a 1052 Model 7 printer keyboard.

One 1403 Model NI Printer with 1100 lines per minute printing speed

One 2540 Model I Card Read/Punch reading at 1000 cards/minute

One 2804 Model II Tape Control Unit

One 2821 Model I Control Unit

One 2841 Model I Storage Control Unit

Nine 2314 Model I Direct Access Storage Devices 7.2 Million Bite

Five Magnetic Tape Drives consisting of 2401, 2402 and 2404, Models II and V for 9-track tapes

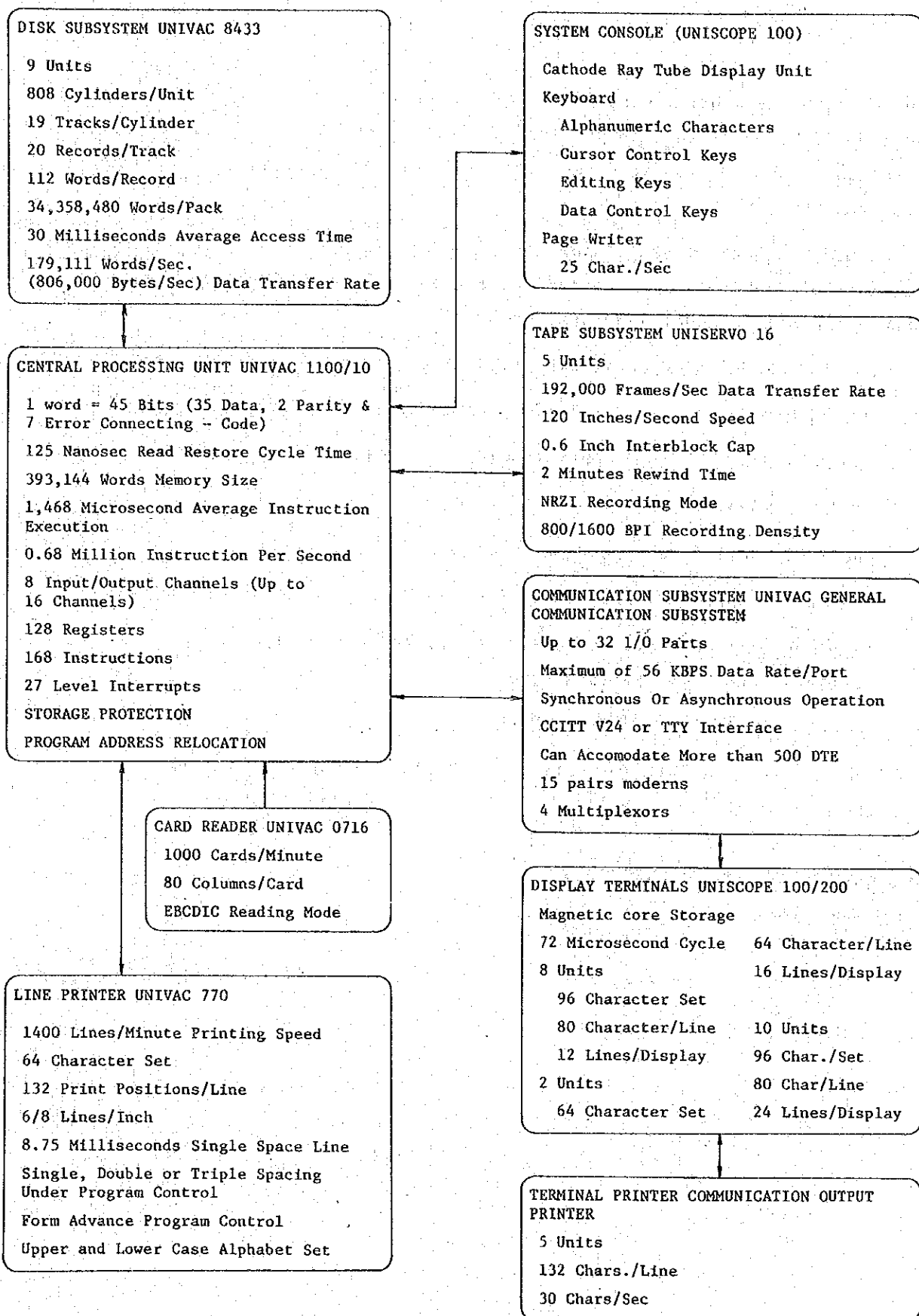
One 029 Model A22 Card Punch Machine

One Key-to-Disk Data Entry System CPU with 16 Key Stations and Model I Serial Printer

ELECTRONIC DATA PROCESSING STAFF

TEL: 46-17-66

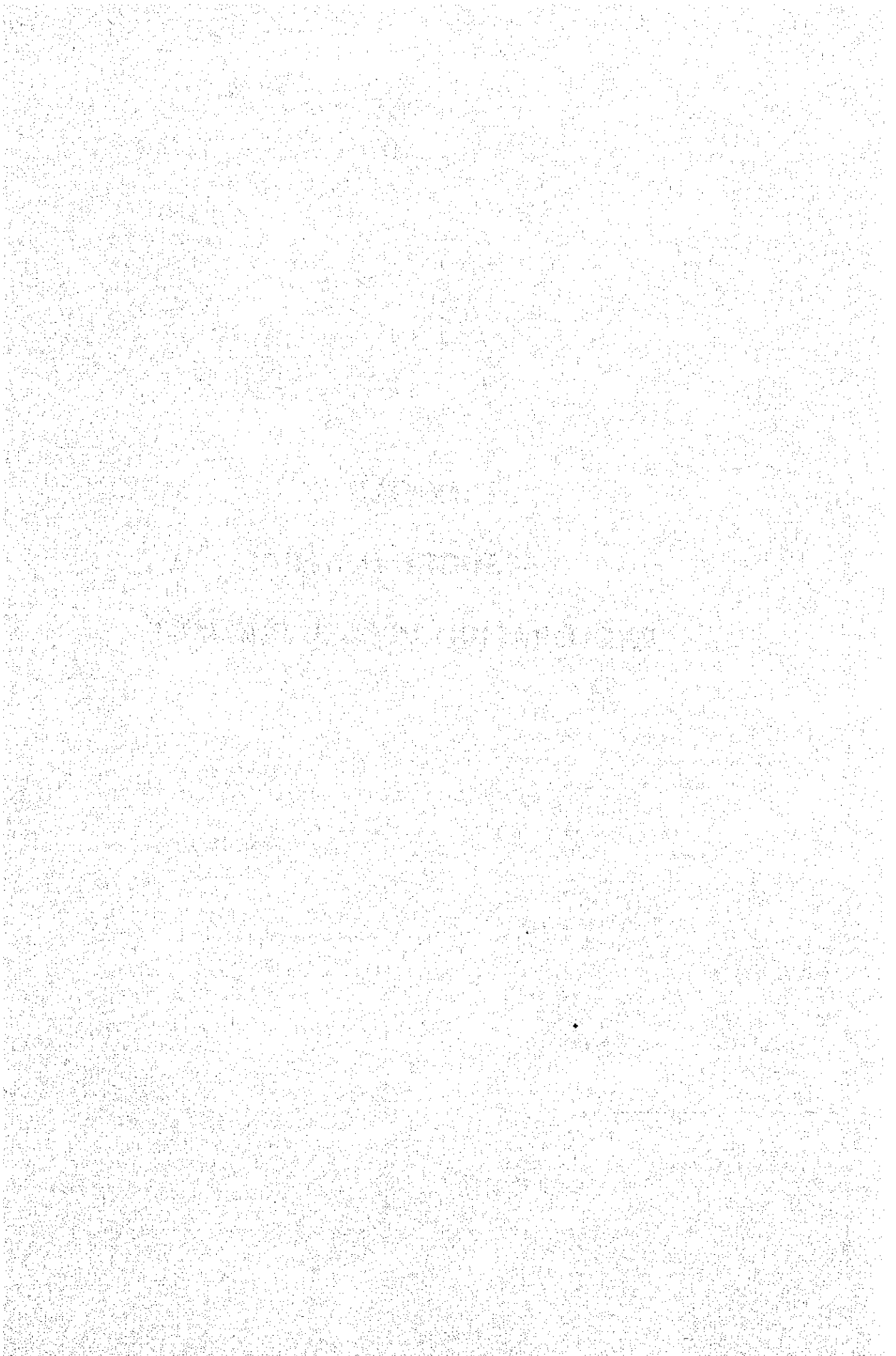
# TECHNOLOGY RESOURCE CENTER CENTRAL SITE CONFIGURATION



**CHAPTER 2**

**OFFSHORE MINERAL**

**EXPLORATION VESSEL PROJECT**



## CHAPTER 2 OFFSHORE MINERAL EXPLORATION VESSEL PROJECT

### 2-1 Purpose of Exploration

It is considered that there are undeveloped mineral deposits in the vast territorial seas of the Philippines. The purpose of this exploration project is through the use of the exploration vessel to conduct seismic exploration, magnetic exploration and bottom sampling, thereby clarifying the location range of petroleum and useful minerals.

### 2-2 Exploration Contents

Obtained data and samples are processed through three major channels and analyzed by pertinent divisions, as shown in the flow chart, and the results are ultimately publicized in the form of reports and maps (1:100,000 and 1:250,000) by MMRD. The following analysis is being conducted in the three channels:

- o Formation cross sections drawings from seismic exploration data
- o Residual magnetization maps from magnetic exploration data
- o Analysis of rocks and sediments of the sea bottom (estimation of ages and judgement of useful minerals)

The ranges of works to be conducted on the exploration vessel and on the land for this project are classified in the flow chart.



### 2-3 Long Term Plan of Exploration

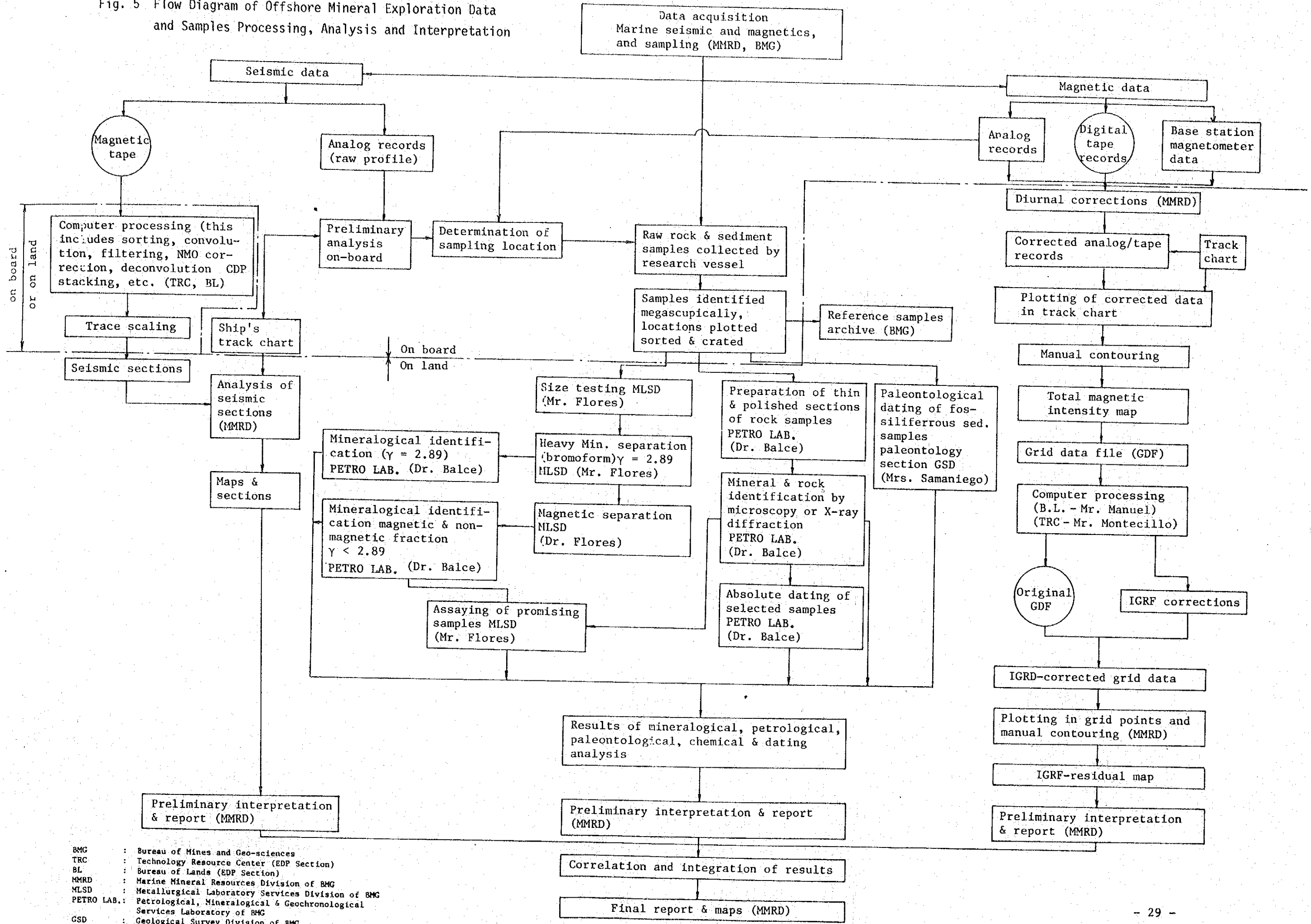
Exploration will be conducted in 14 sea areas which have been selected as promising areas to which top priority should be given based on various geological or geophysical data items of the neighboring land. Exploration plans have been made up to 2000 AD, as shown in Table 7.

Table 7 Target Dates for Exploration Survey

Area	Date of Exploration	Potential Mineral Deposits
1. Offshore Southern Mindoro-Palawan	1983 - 1985	Heavy Minerals (magnetite, ilmenite, chromite, hematite, gold), construction materials (gravel & 52nd), refractory mud, gemstones, hydrocarbon.
2. Lamon Bay, Quezon	1986	Same as above
3. Ragay Culf, Quezon	1987	Heavy Minerals (magnetite, ilmenite, chromite, hematite, gold)
4. Lingayen Gulf, Off-shore Ilocos Region	1988	Same as above
5. Offshore Northern Luzon	1989	Same as above
6. Offshore Northeastern Luzon	1990 - 1991	Same as above
7. Visayan Sea	1992 - 1993	Heavy Minerals, Hydrocarbon gemstones, refractory mud
8. Offshore West Palawan	1994	Same as above
9. Offshore East Palawan	1995	Same as above
10. Offshore Eastern Mindanao	1996	Heavy Minerals (magnetite, ilmenite, chromite, hematite, gold)
11. Offshore Negros and Panay	1977	Heavy Minerals (same as above) hydrocarbon
12. Offshore Zambales-Bataan	1998	Heavy Minerals (magnetite, ilmenite, chromite, hematite, gold)
13. Offshore Southeastern Luzon	1999	Same as above
14. Offshore Northern Mindanao	2000	Same as above



Fig. 5 Flow Diagram of Offshore Mineral Exploration Data and Samples Processing, Analysis and Interpretation





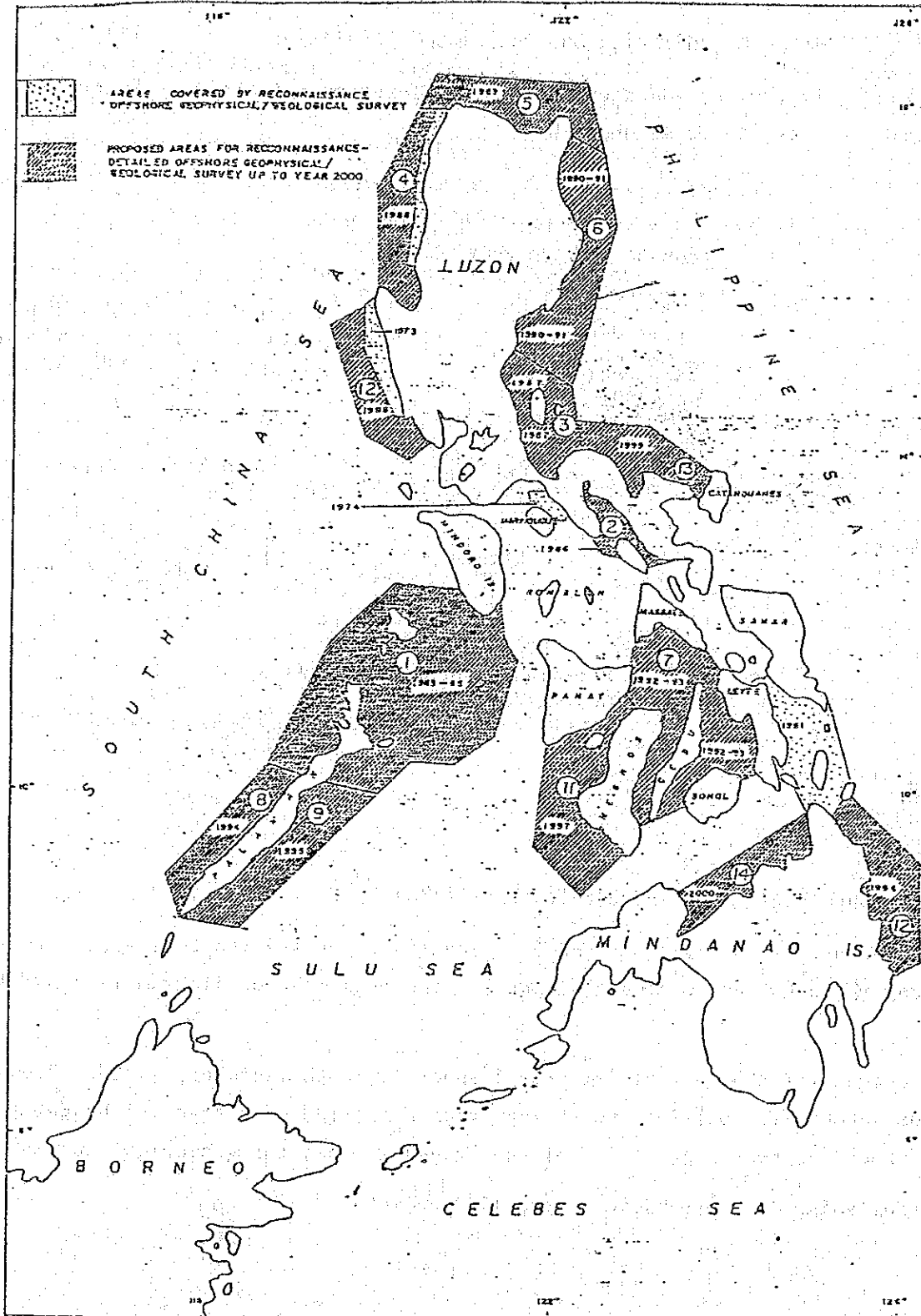
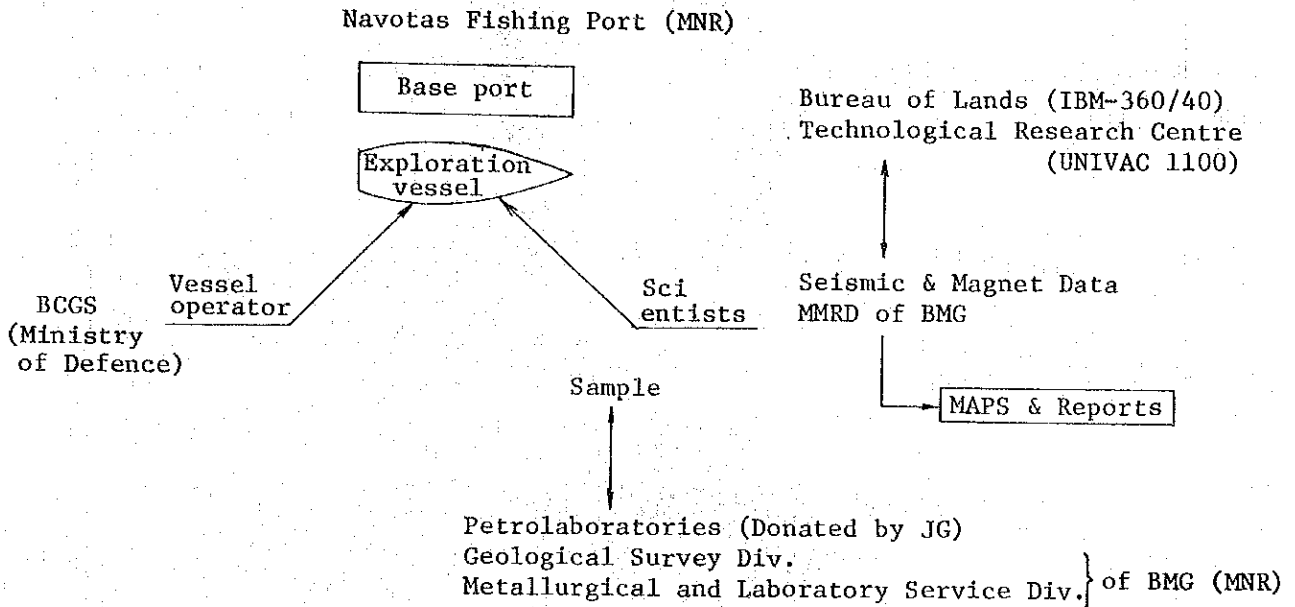


Fig. 6 Map Showing Offshore Areas (1) Covered by Reconnaissance Offshore Geophysical/geological Survey and (2) Proposed Reconnaissance Detailed Geophysical/geological Survey of the Bureau of Mines and Geo-sciences

## 2-4 Exploration Organization and Associated Facilities

BMG is the implementation agency of the exploration but there are many other agencies related to it as shown below.



### 2-4-1 Bureau of Mines and Geo-Sciences (BMG)

BMG consists of 10 divisions and 5 regional offices and its total staff is 1,300 (among which 600 are mining engineers). The organization diagram is shown in Fig. 7.

The budget for the 1982 fiscal year (January through December) is 63,072,000 Pesos (about ¥1.9 billion) which increases about 12% more than the budget for the preceding year. About 55% of the budget is used for geological survey.

The following is a breakdown of the 1982 budget.

1.1 Research .....	P1,290,000
1.2 Geological Surveys .....	P34,669,000
1.3 Mineral and Land Surveys and Management .....	P4,152,000
1.4 Mining Services .....	P9,357,000
1.5 Metallurgical and Chemical Services .....	P3,486,000
1.6 General Administration and Support Services .....	P10,128,000
<b>Total New Appropriations (All Current Operating Expenditures), Bureau of Mines and Geo-Sciences .....</b>	<b>P63,072,000</b>

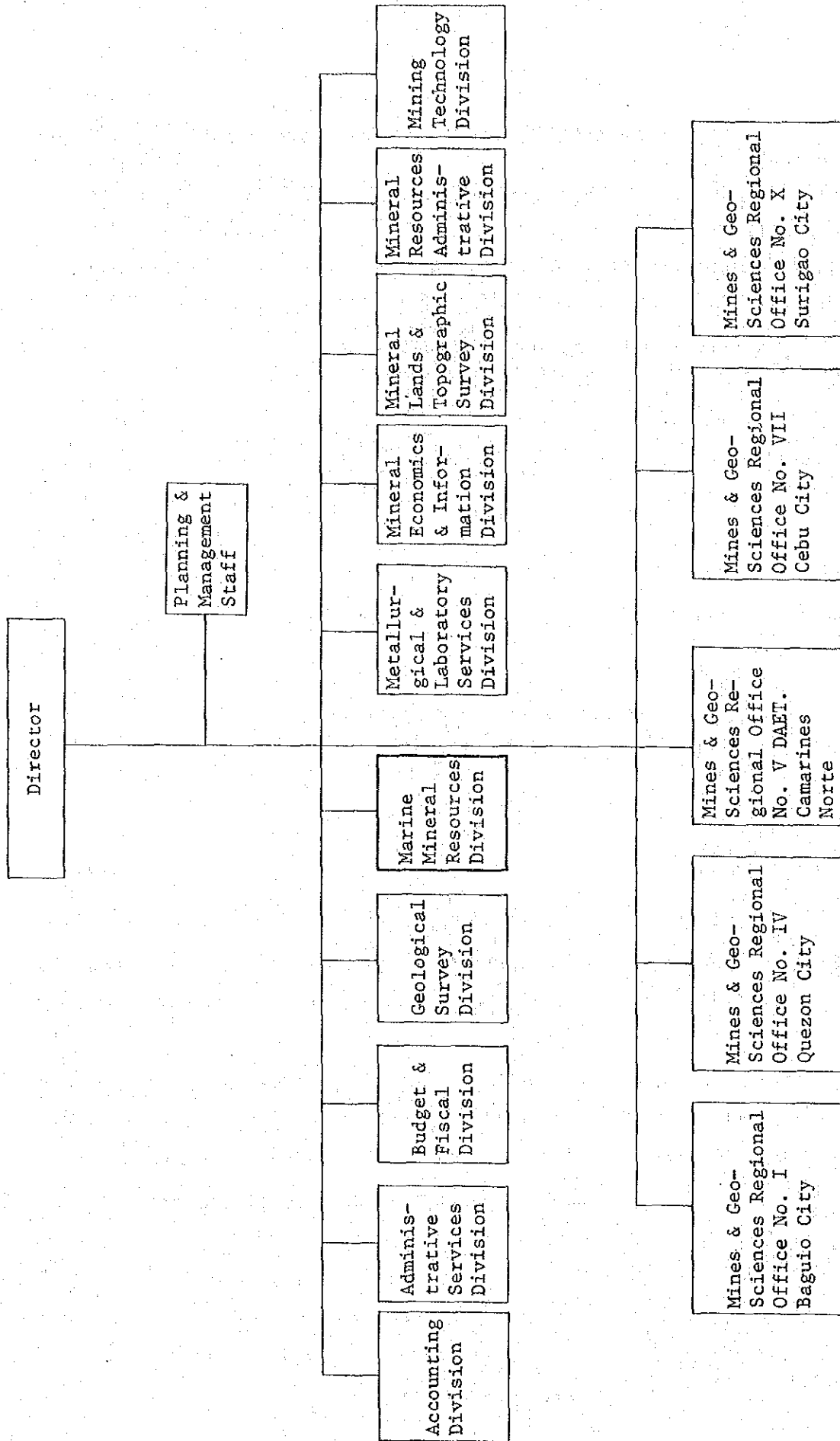


Fig. 7 Organizational Chart



## 2-4-1-1 Marine Mineral Resources Division (MMRD)

Exploration for this project of which we are concerned will be conducted by scientists of this division on board the exploration vessel, and data analysis and interpretation will mainly be conducted by this division. The 32 scientists listed below will take part in the project exploration. Some of them have experience of exploration on board foreign survey vessels:

◦ Carlos F. Teodoro	Chief, Marine Mineral Resources Division
◦ Salvador G. Martin	Supervising Geologist II
◦ Dominador A. Muriel	Supervising Geologist II
◦ Panfilo O. Montero	Supervising Geologist I
◦ Angel A. Bravo	Supervising Geologist I
◦ Leonardo Kalinisan	Sr. Mining Engineer
◦ Octavio C. Daclison	Sr. Geophysicist
◦ Edgardo V. Gonzales	Sr. Geologist
◦ Neoman dela Cruz	Sr. Geologist
◦ Jose R. Bustamante	Sr. Geologist
◦ Eduardo R. Nuevo	Sr. Geologist
◦ Macario del Rosario	Geophysicist
◦ Alexander M. Lacanilao	Geophysicist
◦ Wilfredo T. Ica	Geophysicist
◦ Reynaldo L. Villela	Geologist
◦ Leonardo C. Madayag	Geologist
◦ Anselmo Abungan	Geologist
◦ Danilo M. Octaviano	Geologist
◦ Renben M. Raval	Geologist
◦ Heliton delor Santos	Geologist
◦ Cesar Cabrera	Geologist
◦ Gerardo G. Abarquez	Geologist
◦ Eduardo Alforte	Geologist
◦ Herminio G. Taquiqui	Geodetic Engineer
◦ Rodolfo A. Bantista	Computer II
◦ Honcrio Cabanban	Electronic Technician
◦ Enrico B. Zuno	Electronic Technician
◦ Saturnino Camangonan	Cartographer I
◦ Arthur Cayamanda	Cartographer I
◦ Ramon Macabuhay	Geologic Aide
◦ Godofredo Tolentino	Geologic Aide
◦ Elmer Amo	Geologic Aide

2-4-1-2 Geological Survey Division (GSD)

Samples collected through the exploration will be geologically studied by GSD and the Petro Laboratories granted by the Japanese Government (Exchange of Notes in 1981, completion scheduled in April, 1983). The division has 23 scientists.

2-4-1-3 Metallurgical and Laboratory Service Division (MLSD)

This division metallurgically studies collected samples.

## 2-4-2 Bureau of Coast and Geodetic Survey (BCGS)

BCGS normally engages in preparation of nautical charts. The bureau owns 3 survey vessels and the complement has ample experience of survey operation. The 21 members listed below, will take part in the project.

### Deck Officers

- |                                 |                      |
|---------------------------------|----------------------|
| ◦ Ceferino Pascual, Captain     | Captain              |
| ◦ Renato B. Fier, Comdr         | Chief Mate           |
| ◦ José Galo P. Isada, Jr. Lieut | 2nd Mate             |
| ◦ Enrique A. Mascaspac Lieut    | 3rd Mate             |
| ◦ Basiliso Pebenito             | Chief Radio Operator |

### Engine Officers

- |                        |                     |
|------------------------|---------------------|
| ◦ Feliciano Y. Aguirre | Chief Engineer      |
| ◦ Jorge Caneto         | 2nd Marine Engineer |
| ◦ Rogelio Ocampo       | 3rd Marine Engineer |
| ◦ Teodoro Vidallo      | 3rd Marine Engineer |

### Deck Crew

- |                     |                      |
|---------------------|----------------------|
| ◦ Renato Pamating   | Chief Quarter Master |
| ◦ Eugenio Terencio  | Boatswain            |
| ◦ Rogelio Solis     | Quarter Master       |
| ◦ Domingo Cortun    | Seaman               |
| ◦ Apolonio Literano | Seaman               |

### Engine Crew

- |                       |                  |
|-----------------------|------------------|
| ◦ Vicente Penado      | Marine Engineman |
| ◦ Armando Sayong      | Marine Engineman |
| ◦ Antonio Pajarillaga | Marine Engineman |
| ◦ Alvin Alim          | Electrician      |
| ◦ Ruben Denaga        | Machinist        |

### Steward

- |                  |               |
|------------------|---------------|
| ◦ Apolinar Donor | Chief Steward |
| ◦ Rolando Indoc  | Asst. Steward |

### 2-4-3 Navotas, exploration vessel mooring site

The Navotas Fishing Port is scheduled as the mooring site of the exploration vessel in Manila Bay.

The existing port facilities were constructed by Toyo Construction Co. (before called Hanshin Port Construction Co.) of Japan on a loan assistance from the Asian Development Bank, and is presently controlled by the Fishery Development Authority. (refer to Fig. 8)

#### [Land facilities]

Pier 1 is exclusively used for supplying diesel oil. All other piers are for fishing boats and they are crowded. The pier's width is just enough for two cars to pass.

Water can be supplied directly at Pier 1. At other piers, water pipes are installed up to the foot, from which water can be supplied by means of a hoses. The water supply capacity is 20 to 30 tons per hour.

At present, electricity cannot be supplied however installation supply facilities are scheduled to be realized in piers, No. 2 through No. 5, by the end of 1982. The voltage on the land is 220 V.

It would be desirable if the supply facilities for 440 V are completed and in a usable state by the time the exploration vessel is delivered.

Currently, bits are placed at appropriate intervals and two layers of used tyres are hung at the side of the bit as shock absorbers. This looks a sufficient arrangement for mooring of small vessels.

A telephone connection is installed at each pier and the telephone system installed in the vessel can be hooked up and used for communication with outside lines.

The foot areas of Piers 2 through 5 are vacant at present. Warehouse construction is scheduled in these areas and a part of these warehouses will be used exclusively by BMG.

Based on the results of these investigations, there are no problems with the land facilities.

#### [Other matters related to harbor]

Breakwater : As shown in Fig. 8, there are breakwaters in the south and west, blocking the wind and waves from those two directions. The area is very suitable for mooring of small vessels.

The outside of the breakwaters is Manila Bay having a depth of 5 m or greater under Mean Lower Low Water (MLLW) level. The exploration vessel, the full draft of 3.60 m + 0.60 m (sonar dome), can sail freely in this depth. The narrowest part of the opening between the two breakwaters is about 110 m, or about twice the exploration vessel's length, so that no problem is anticipated.

Depth : At present, the south edge of Pier 3 is scheduled to be the berth of the exploration vessel. The depth from the entrance at the breakwater to the berth is generally 5.20 m, with an exception of one spot which has the depth of 4.40 m. The depth at the berth is 5.50 m. Since the draft of the exploration vessel is 3.60 m + 0.60 m, a depth of 4.70 m or greater should cause no trouble for the sailing of the exploration vessel.

[Other items]

Typhoon : Manila and the vicinity is located in the path of typhoons during the period of July to September, and an urgent and adequate harbor management is essential in a port like Navotas where fishing boats crowd together. An arrangement must be set up to issue alarms and let all vessels anchor in Manila Bay when a typhoon is forecasted.

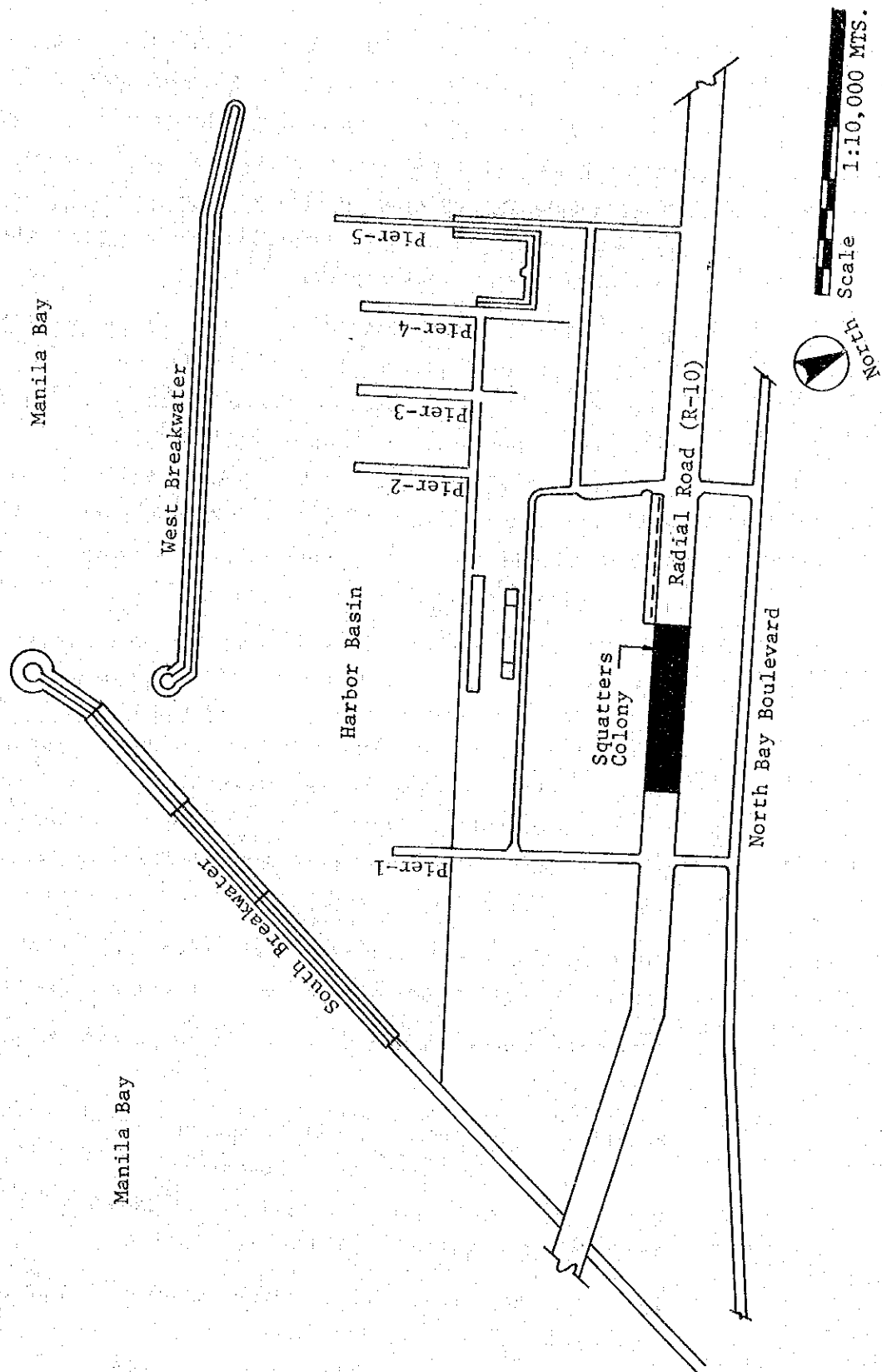
Robbery prevention: Since fishing boats moor very close together, sufficient precaution and measures should be taken to prevent robbery.

Supplies : Available supply items and their prices in Navotas port are as follows:

Water	Ex-pipe	6.00 Pesos/ton
	Ex-barge	15.00 Pesos/ton
Diesel oil		3.11 Pesos/liter (=3,110 Pesos/KL)
Electricity		1.10 Pesos/KWH

The berth charge has been confirmed as being 6 Centavos/G. ton/day.

Fig. shows the outline of Navotas port.



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Fig. 8 Navotas Fishing Port Complex