



Critical and Strategic Minerals in Marine Environments of the Philippines: Evolving Potential in the Minerals Industry

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An Overview

Critical minerals are defined as elements, minerals, substances or materials that are:

(a) essential to industry and technology, but (b) of high risk of supply chain disruption, and (c) no known alternative material

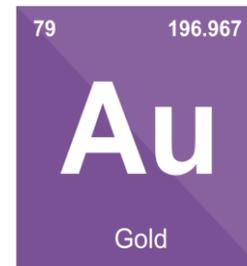
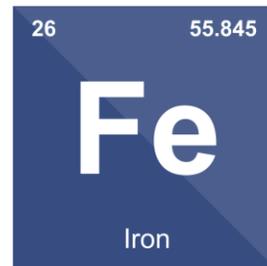
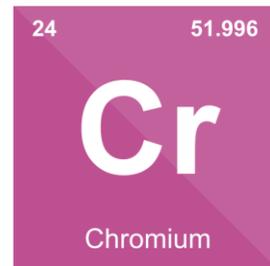
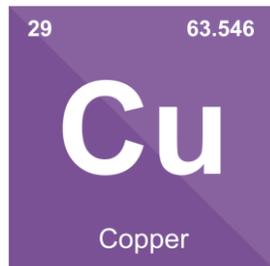
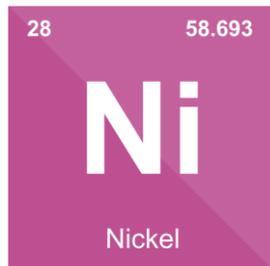
Strategic minerals, meanwhile, may be considered as a subset of critical minerals, but which may imply minerals in:

(a) short supply but important to domestic industries and (b) with high values but with security implications.

An Overview



The demand is threatened by disruption of mineral supplies due to geopolitical conflicts, trade attrition globally, and simply due to dwindling production from mining areas.



construction in progress.

ai. Offshore means the water, sea bottom and subsurface from the shore or coastline reckoned from the mean low tide level up to the two hundred nautical miles (200 n.m.) exclusive economic zone including the archipelagic sea and contiguous zone.

aj. Onshore means the landward side from the mean tide elevation, including submerged lands in lakes, rivers and creeks.

ai. Offshore means the water, sea bottom and subsurface from the shore or coastline reckoned from the mean low tide level up to the two hundred nautical miles (200 n.m.) exclusive economic zone including the archipelagic sea and contiguous zone.

mine industrial waste and tailings as well as eliminating or reducing hazardous effects of chemicals, liquids or other harmful byproducts and gases emitted from any facility utilizing operations for their disposal.

an. President means the President of the Republic of the Philippines.

ao. Private land refers to any land belonging to any private person which includes alienable land being claimed by a holder, claimant, or occupant who has already acquired a vested right in the law, although the corresponding certificate or evidence of title or patent has not been actually

ap. Public land refers to lands of the public domain which have been classified as agricultural subject to management and disposition or concession under existing laws.

aq. Qualified person means any citizen of the Philippines with capacity to contract, or a partnership, association, or cooperative organized or authorized for the purpose of engaging in technical and financial capability to undertake mineral resources development and duly registered in accordance with law at least sixty per centum (60%) of the capital of which is owned by citizens of the Philippines: Provided, That a legally organized foreign-owned corporation shall be deemed a qualified person for purposes of granting an exploration permit, financial or technical assistance agreement, or processing permit.

ar. Quarrying means the process of extracting, removing and disposing quarry resources from underneath the surface of private or public land.

The State shall recognize and protect the rights provided for by the Constitution.

Section 4 Ownership of Mineral Resources

Section 5 Mineral Reservations

When the national interest so requires, such as when there is a need to preserve strategic raw materials for industries critical to national development, or certain minerals for scientific, cultural or ecological value, the President may establish mineral reservations upon the recommendation of the Director through the Secretary. Mining operations in existing mineral reservations and such other reservations as may thereafter be established, shall be undertaken by the Department or through a contractor: Provided, That a small scale-mining cooperative covered by Republic Act No. 7076 shall be given preferential right to apply for a small-scale mining agreement for a maximum aggregate area of twenty-five percent (25%) of such mineral reservation, subject to valid existing mining/quarrying rights as provided under Section 112 Chapter XX hereof. All submerged lands within the contiguous zone and in the exclusive economic zone of the Philippines are hereby declared to be mineral reservations.

A ten per centum (10%) share of all royalties and revenues to be derived by the government from the development and utilization of the mineral resources within mineral reservations as provided under this Act shall accrue to the Mines and Geosciences Bureau to be allotted for special projects and other administrative expenses related to the exploration and development of other mineral reservations mentioned in Section 6 hereof.

Section 6 Other Reservations

Mineral Reservations

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GOVERNMENT MANAGEMENT

The Bureau shall have direct charge in the administration and disposition of mineral resources and shall undertake geological, mining, metallurgical, chemical, and other researches and mineral exploration surveys. The Director shall recommend to the Secretary the granting of mineral agreements to duly qualified persons and shall monitor the compliance by the contractor of the terms and conditions of the mineral agreements. The Bureau may confiscate surety, performance and guaranty bonds posted through an order to be promulgated by the Director. The Director may deputize, when necessary, any member or unit of the Philippine National Police, barangay, duly registered non-governmental organization (NGO) or any qualified person to police all mining activities.



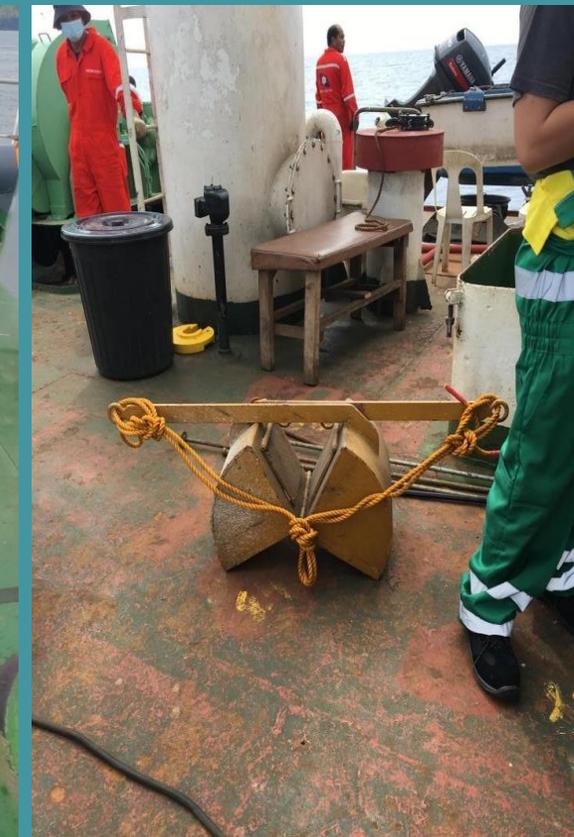
Mining Law

Coastal Geohazard Study

- Makes use of Coastal Vulnerability Index (CVI) coupled with the aid of the Analytical Hierarchy Process (AHP);
- The CVI considers the influence of seven (7) physical coastal parameter: shoreline change, geomorphology and lithology, coastal slope, mean tidal range, natural buffers, coastline alignment relative to dominant wind-driven waves, and human activities;
- The primary activities to complete this study include desktop studies, coastal geohazard and geomorphological mapping, beach profiling, bathymetric survey, natural buffer (i.e., coral reefs and mangroves) assessment, and geological investigation

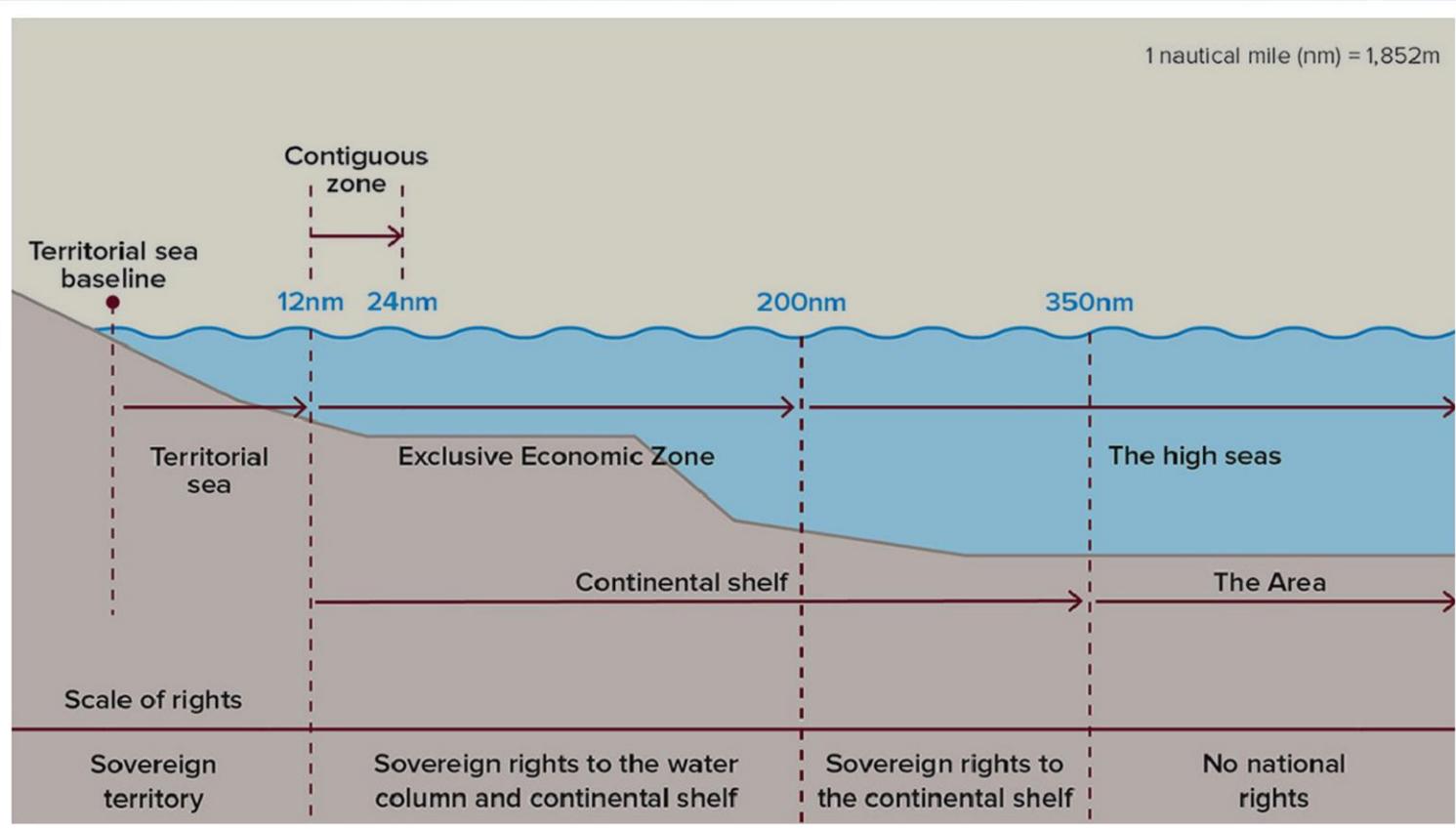
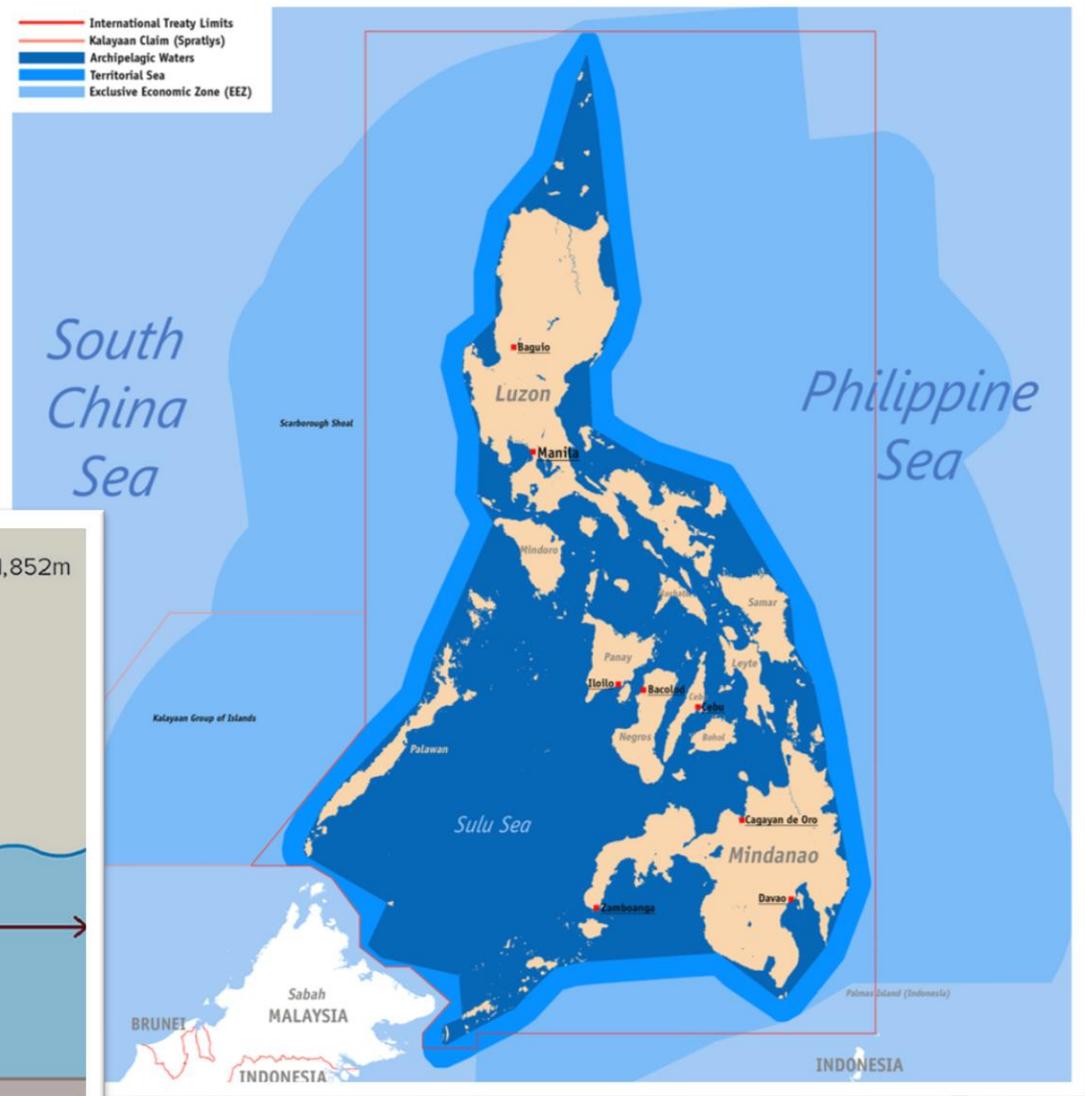


Offshore Mineral Exploration



A Schematic Showing Jurisdictional Zones of the PHILIPPINES

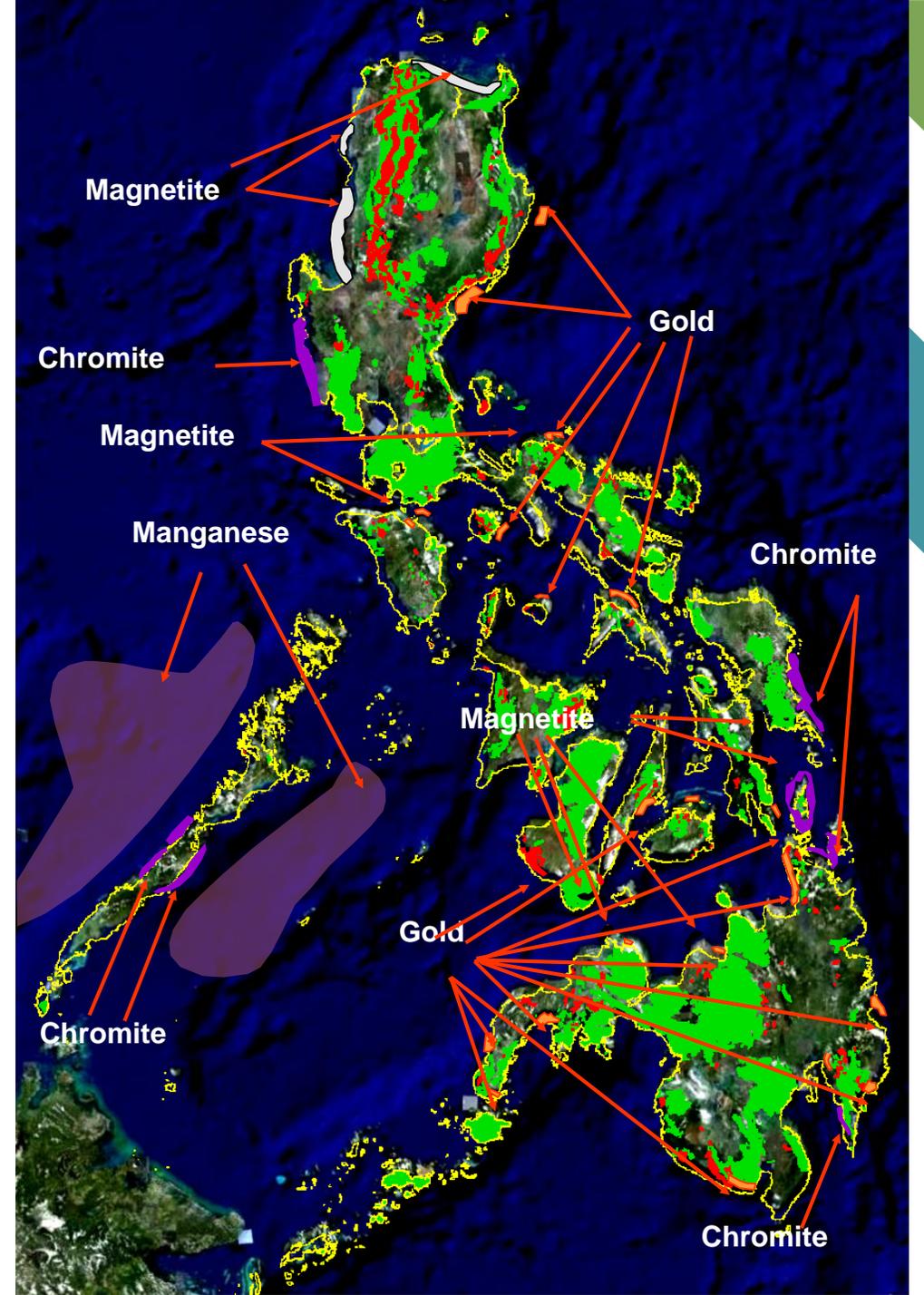
- International Treaty Limits
- Kalayaan Claim (Spratlys)
- Archipelagic Waters
- Territorial Sea
- Exclusive Economic Zone (EEZ)



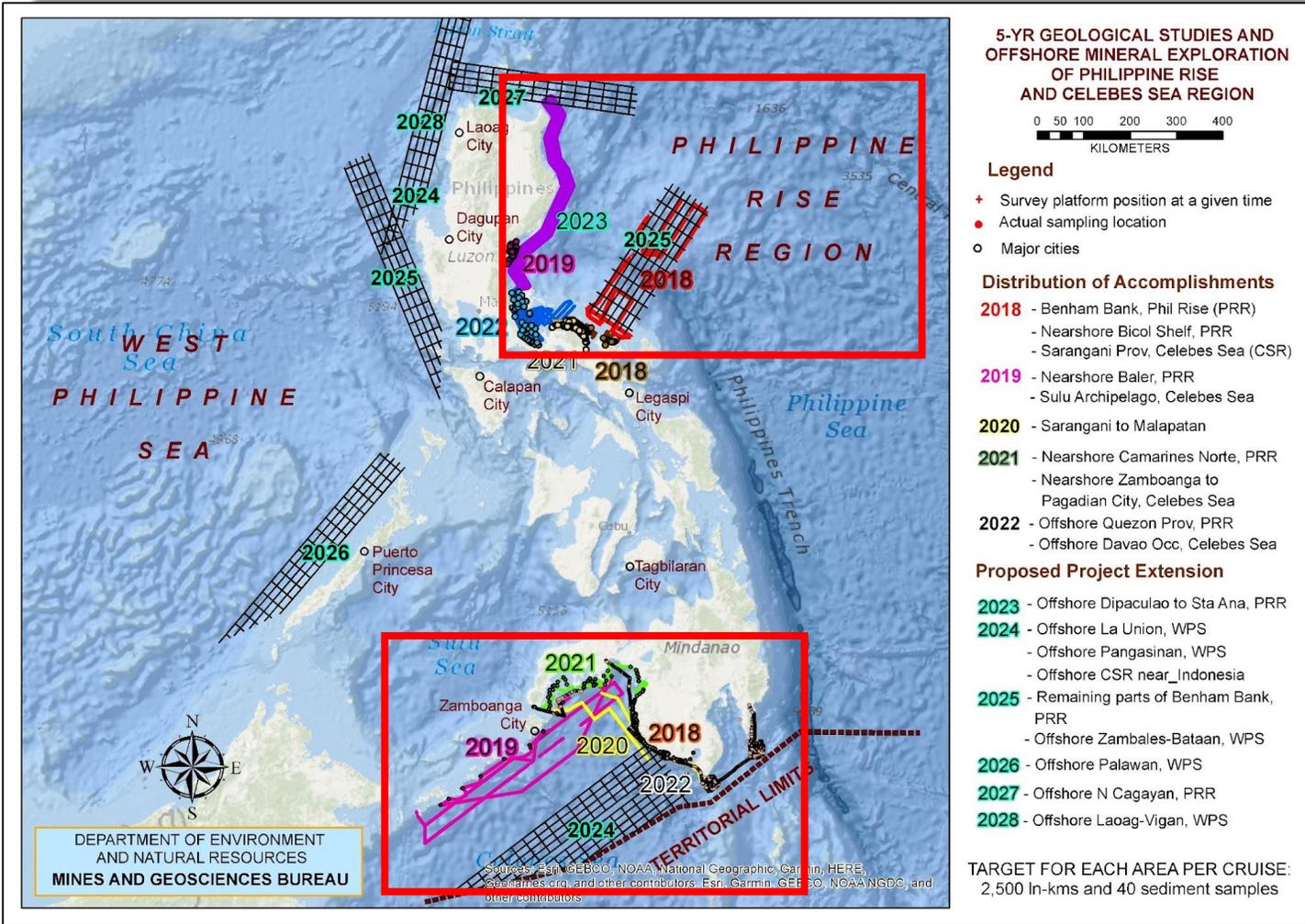
The Offshore Resources

Marine mineral resources in the Philippines:

- Magnetite sand and associated placer metals such as gold, PGEs, and chromite;
- Quarry sand materials for reclamation
- Deep sea manganese nodules and crusts which contain nickel, cobalt, and REEs



Marine Mineral Exploration of Philippine Rise and Celebes Sea Regions Project 2018 to 2023

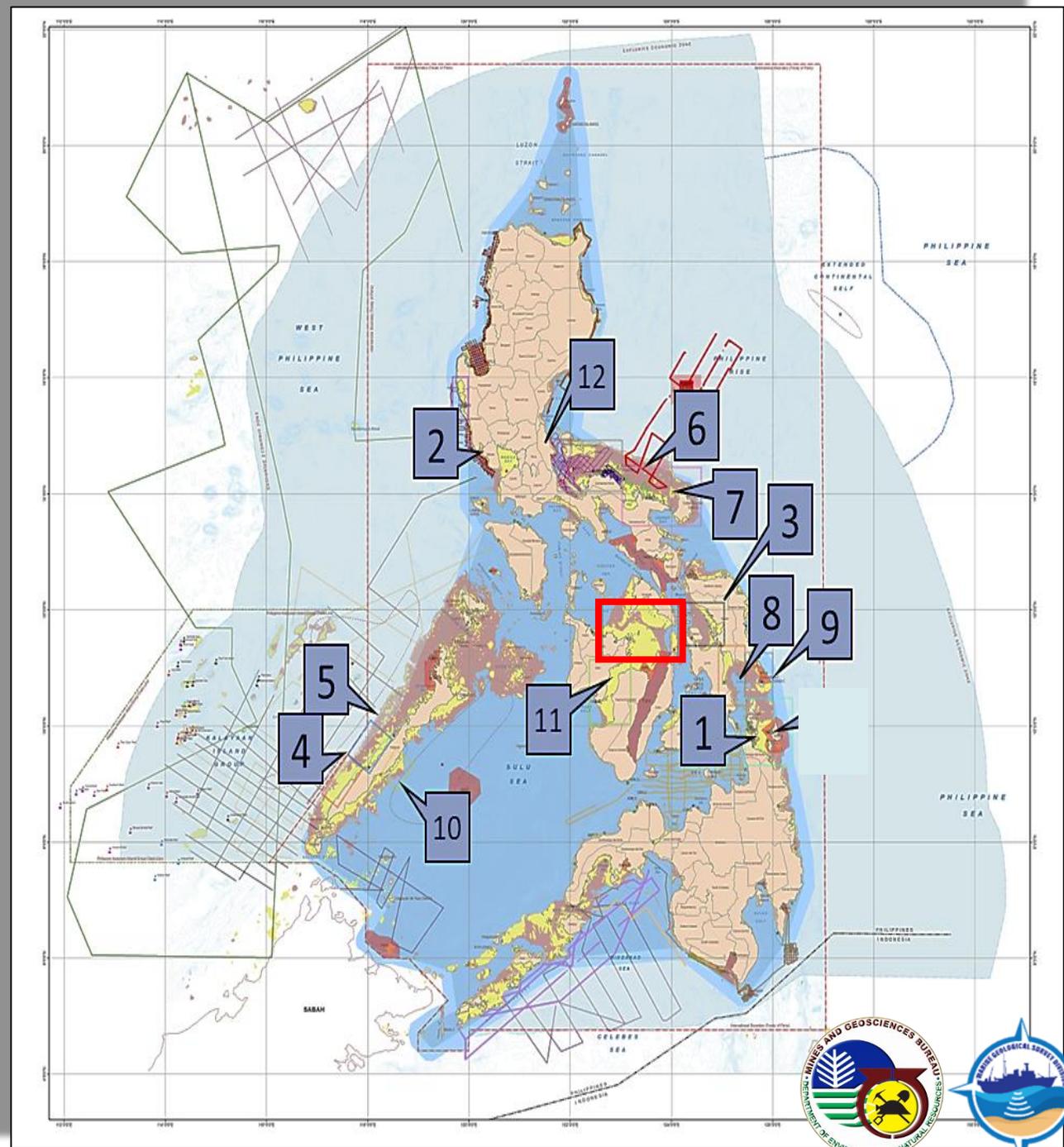


Offshore Resources Targets: the Deep Sea Regions

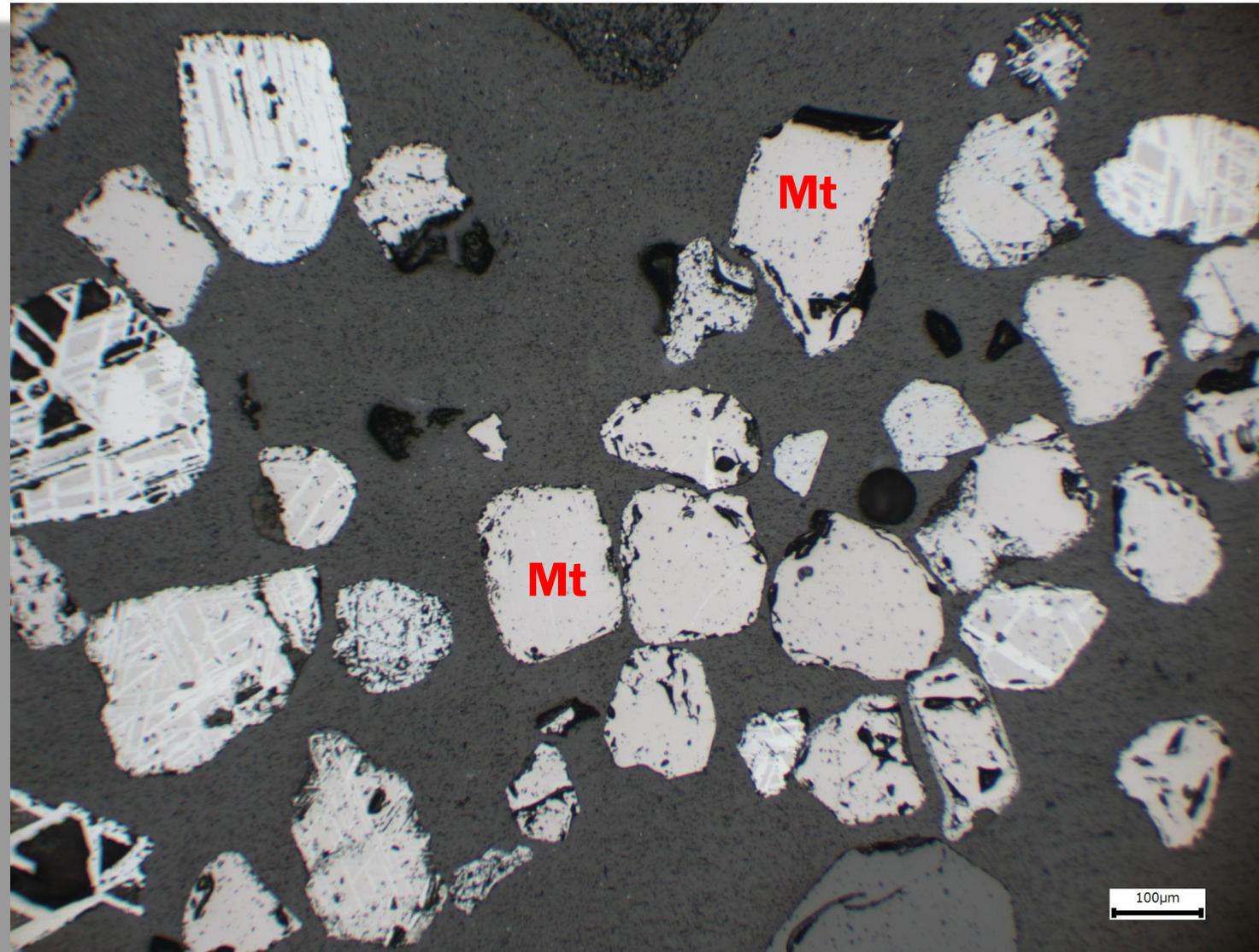
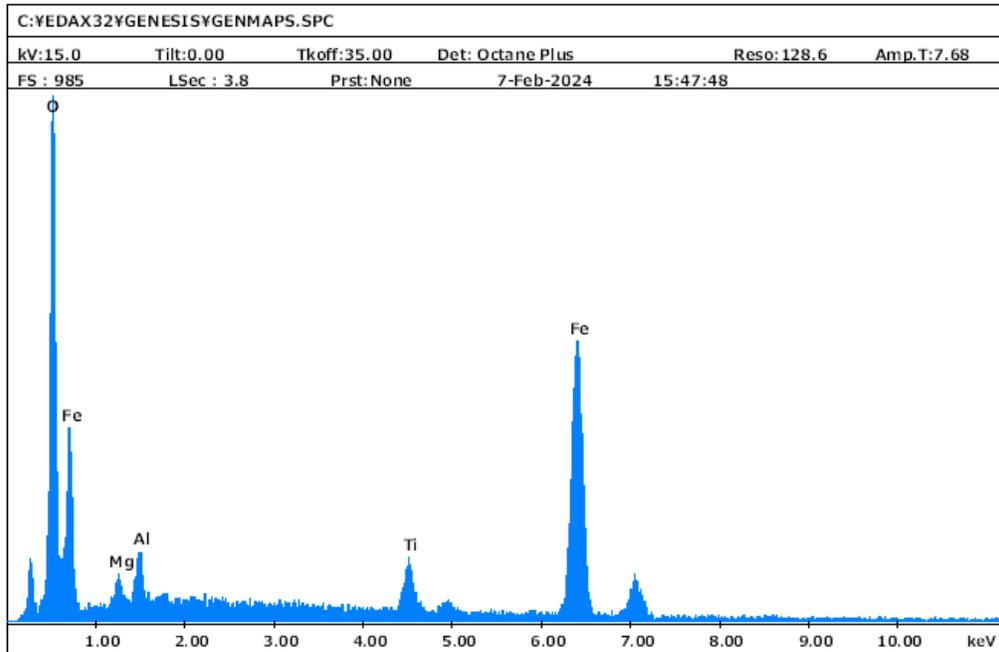


1. Panaon Island – Butuan Bay
2. Western Zambales
3. Dinagat Island – Surigao
4. South Palawan (Rizal-Quezon)
5. West Palawan (Aborlan-PPC)
6. Camarines Norte
7. Camarines Sur – Catanduanes
8. Eastern and Southern Leyte
9. Guian – Homonhon Island
10. East Palawan (Aborlan)
11. Iloilo – Guimaras Is. – West Negros
12. Aurora – Quezon - Isabela

Offshore Resources Targets: Shallow Marine Sediments



Geochemistry of Marine Minerals: Initial Results



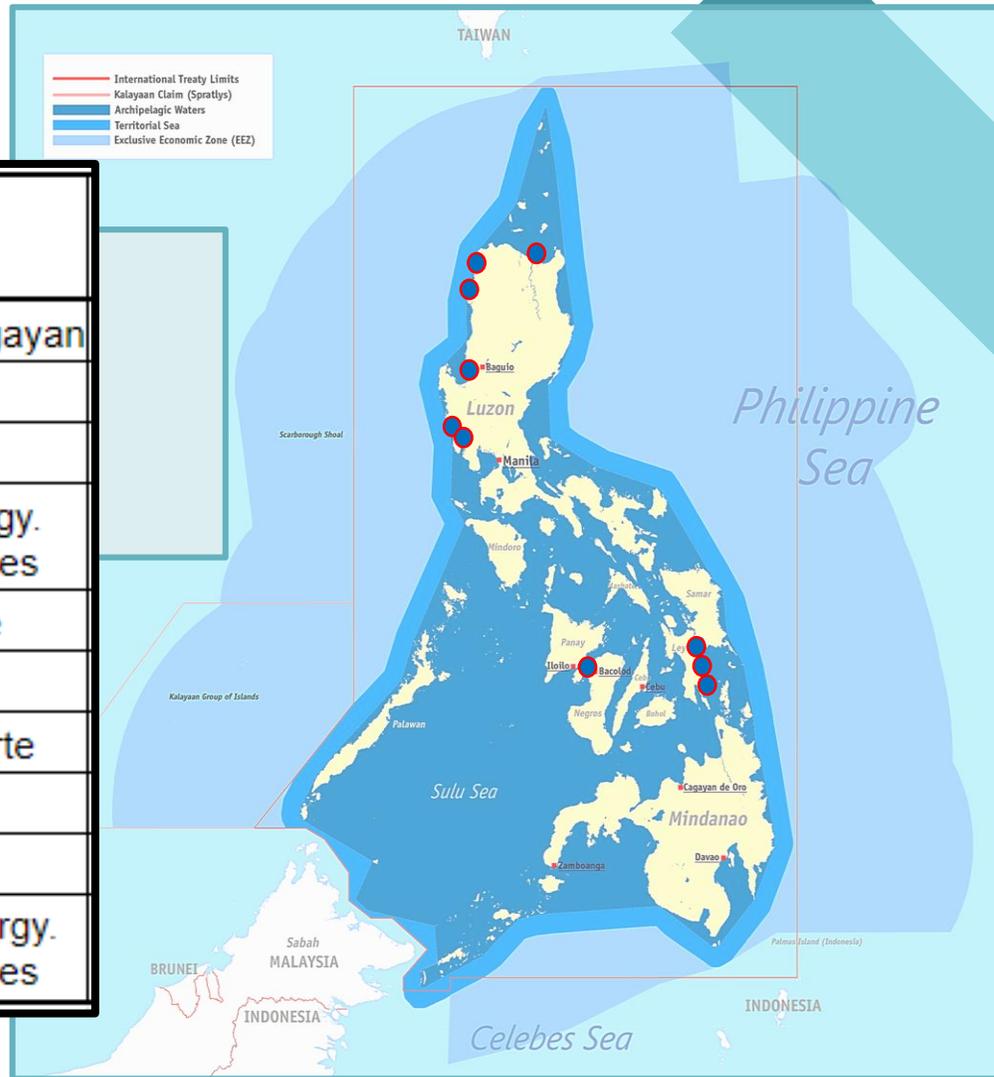
Mag-9, Abuyog, Leyte



Magnetite Mineralogy in Marine Sediments



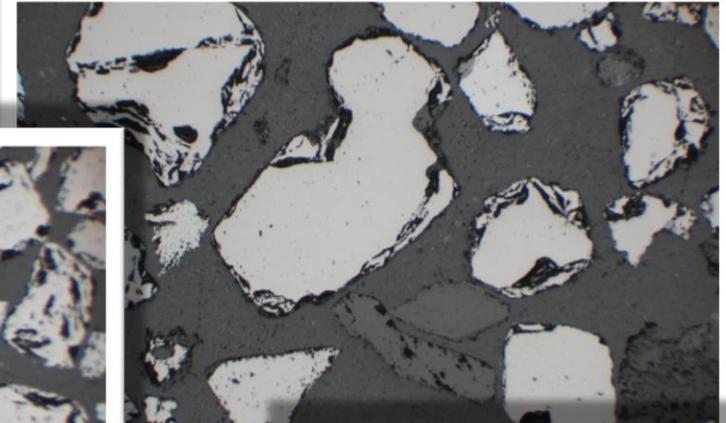
Sample Name	Coordinates		Locality
	Northing	Easting	
Mag-1			Cagayan Valley, Dodan, Appari, Cagayan
Mag-2			Lingayen Gulf, Pangasinan
Mag-3			Caoayan, Ilocos Sur
Mag-4			Upstream of Sto. Tomas River, Brgy. Rabanes, San Marcelino, Zambales
Mag-5	11° 06' 09.4"	125° 02' 17.6"	Brgy. San Roque, Tolosa, Leyte
Mag-6	10° 59.6584"	123° 13.5227"	Negros Occidental
Mag-7			San Vicente, Ilocos Norte
Mag-8	10° 48' 14.9"	124° 59.3"	Brgy. Maya, MacArthur, Leyte
Mag-9	10° 37' 58.3"	125° 08' 38.0"	Brgy. Kikilo, Abuyog, Leyte
Mag-10			Upstream of Sto. Tomas River in Brgy. Rabanes, San Marcelino, Zambales



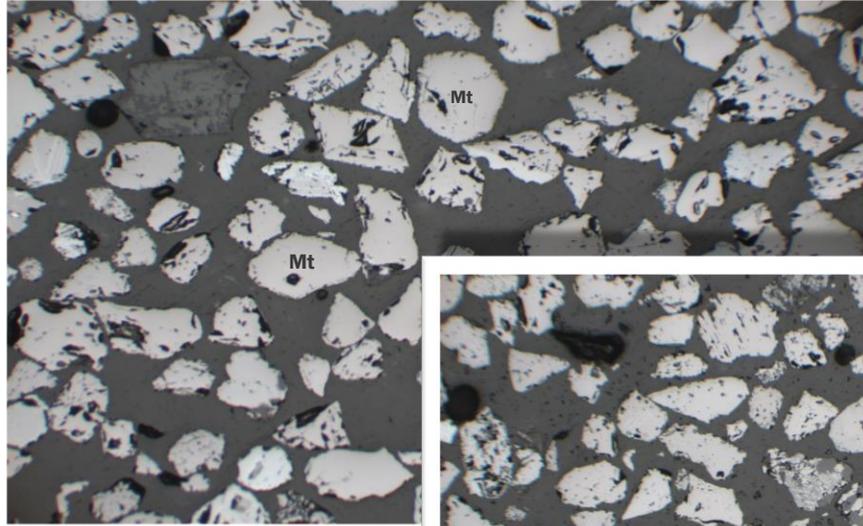
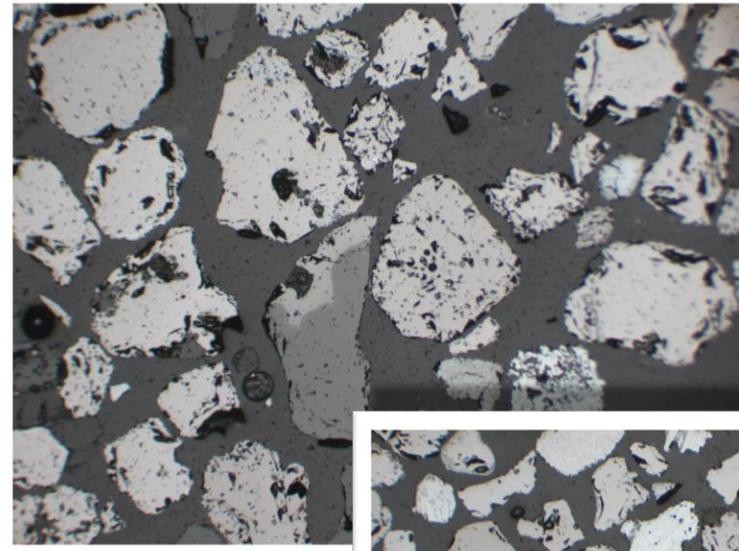
Initial geochemical analysis of magnetite grains conducted under Kyushu Univ and UP-NIGS laboratories using SEM

Philippine Magnetite: Some Representative Samples

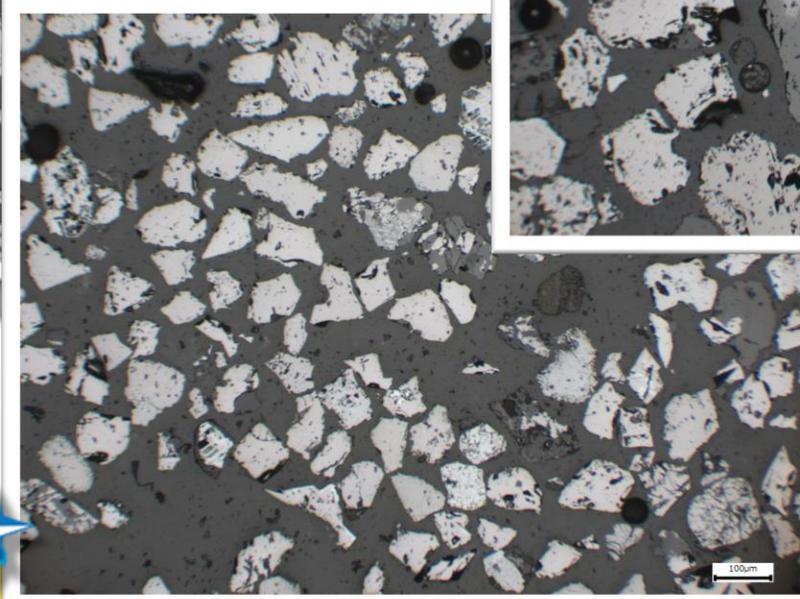
Mag-10, Sto. Tomas River, Zambales



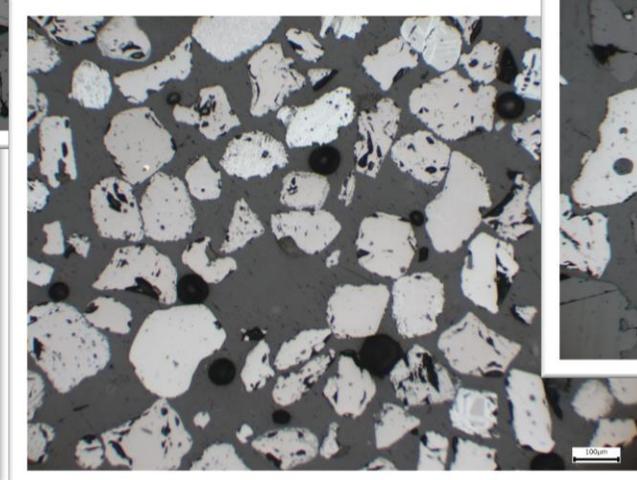
Mag-3, Caoayan Ilocos Sur



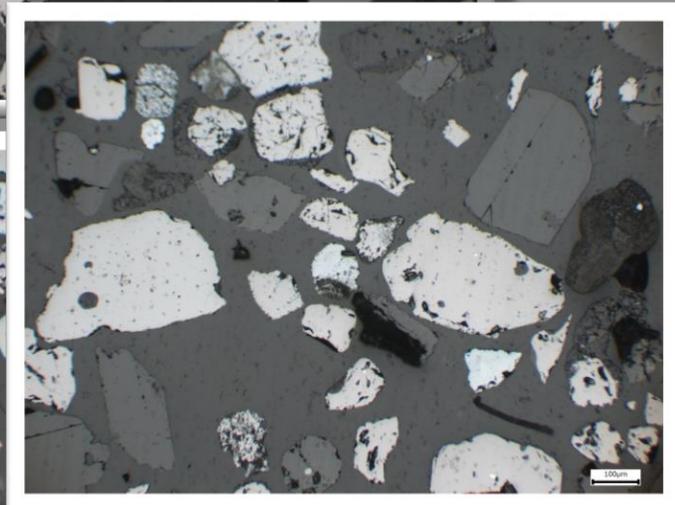
Mag-1, Cagayan Valley



Mag-2, Lingayen Gulf



Mag-6, Negros Occidental



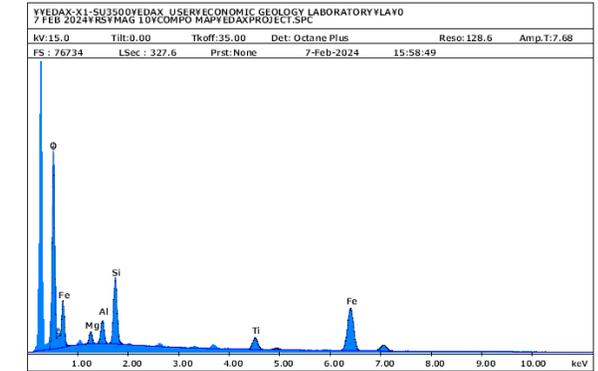
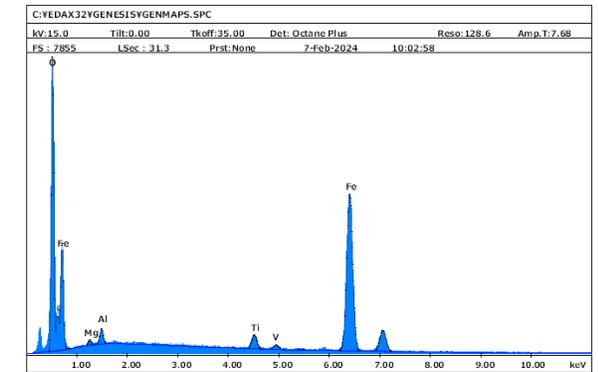
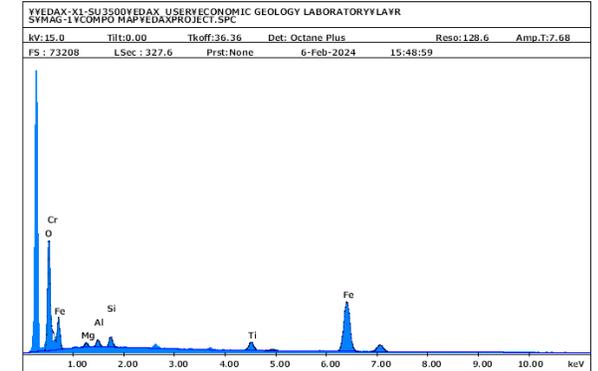
Mag-5, Tolosa, Leyte





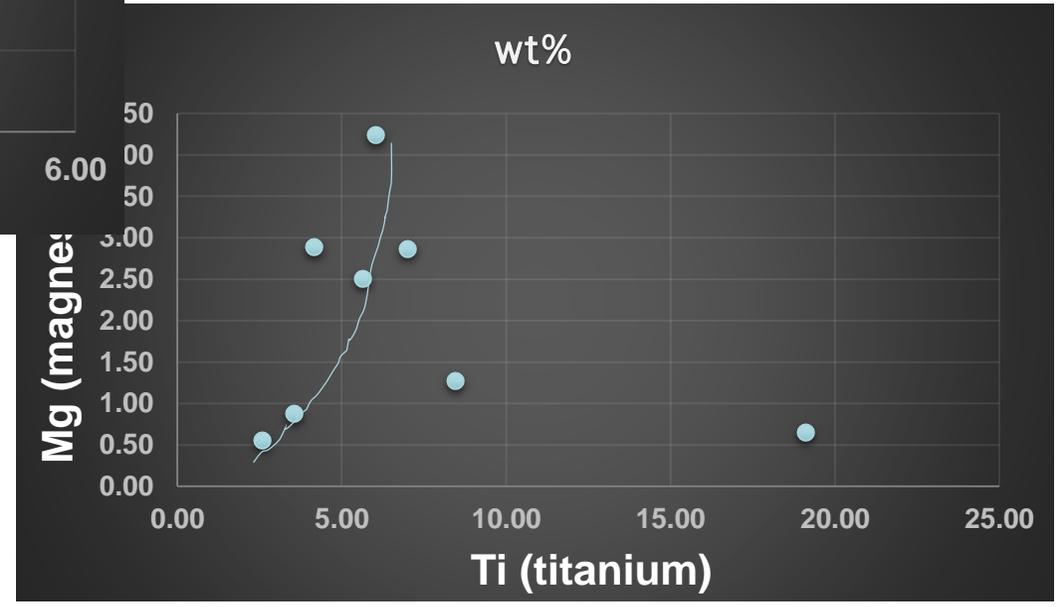
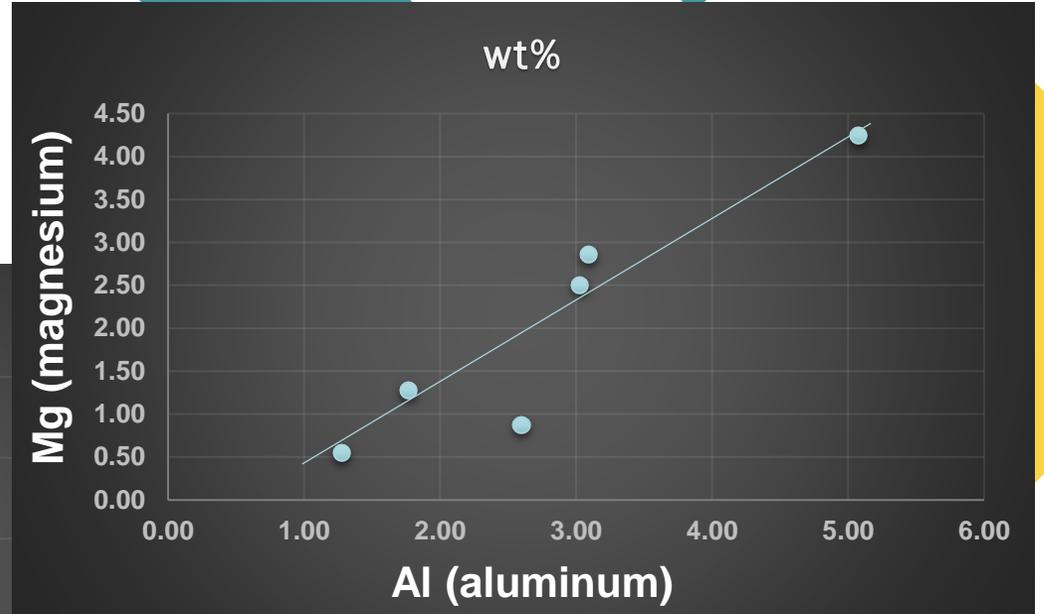
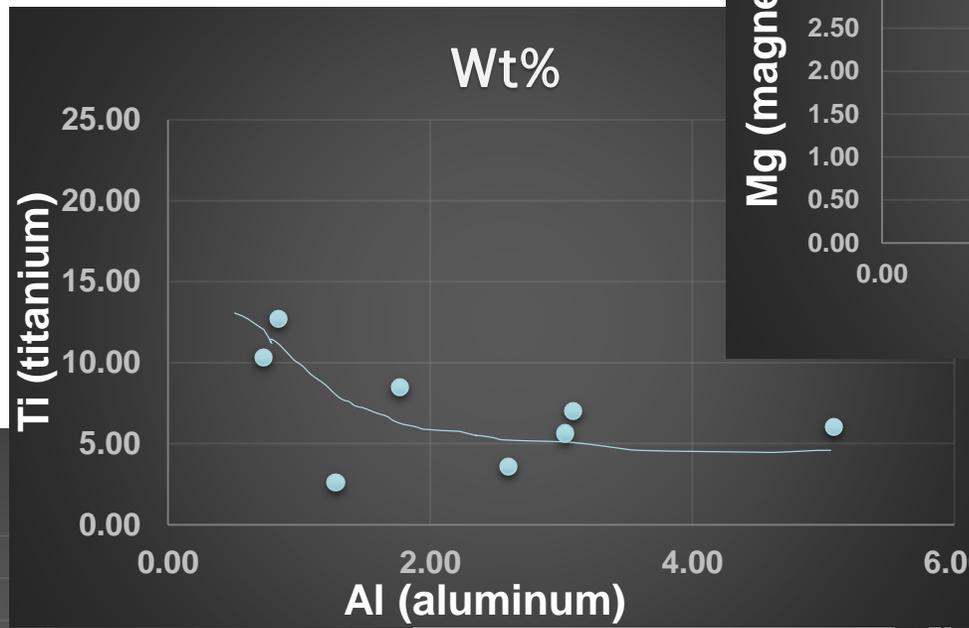
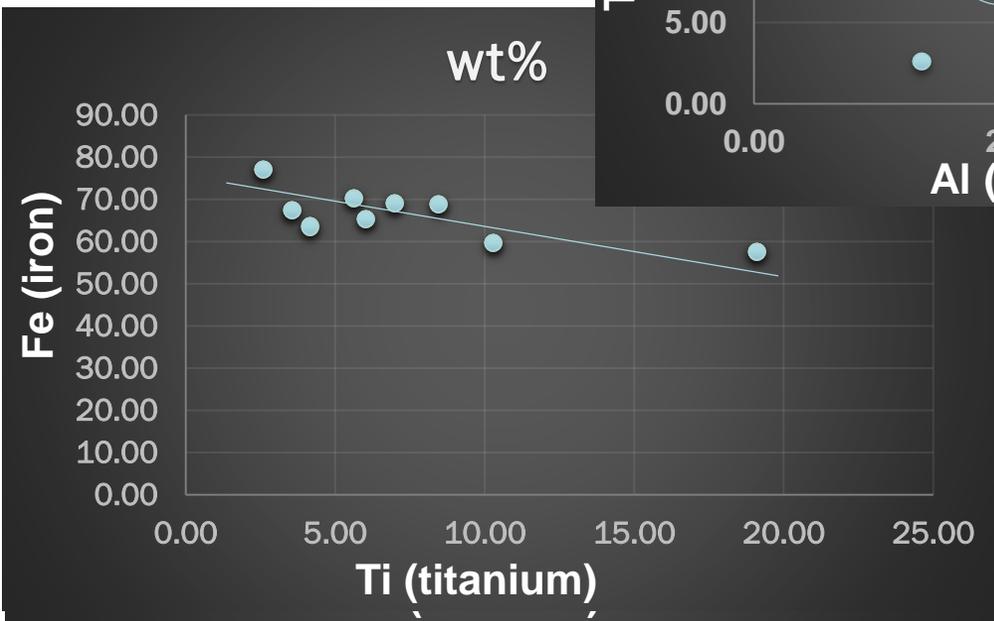
Initial Results using SEM

Sample Code	O		Al		Ti		Fe		Mg	
	Wt%	At%	Wt%	At%	Wt%	At%	Wt%	At%	Wt%	At%
Mag-1	21.26	47.58	0.84	1.11	12.71	9.50	65.19	41.80		
Mag-2	17.93	42.50	1.28	1.80	2.60	2.06	77.10	52.37	0.55	0.86
Mag-3	24.38	51.10	0.73	0.91	10.30	7.22	59.53	35.75		
Mag-4	18.62	41.28	2.60	3.42	3.55	2.63	67.46	42.86	0.87	1.27
Mag-5	19.46	42.34	5.08	6.56	6.04	4.39	65.18	40.64	4.24	6.07
Mag-6	22.64	49.26			19.11	13.89	57.54	35.87	0.65	0.93
Mag-7	19.73	44.69	1.77	2.38	8.47	6.41	68.76	44.63	1.27	1.89
Mag-8	18.04	41.14	3.09	4.18	7.00	5.33	69.01	45.07	2.86	4.29
Mag-9	18.57	42.18	3.03	4.08	5.64	4.28	70.26	45.72	2.50	3.73
Mag-10	29.41	57.78			4.17	2.74	63.54	35.76	2.88	3.72

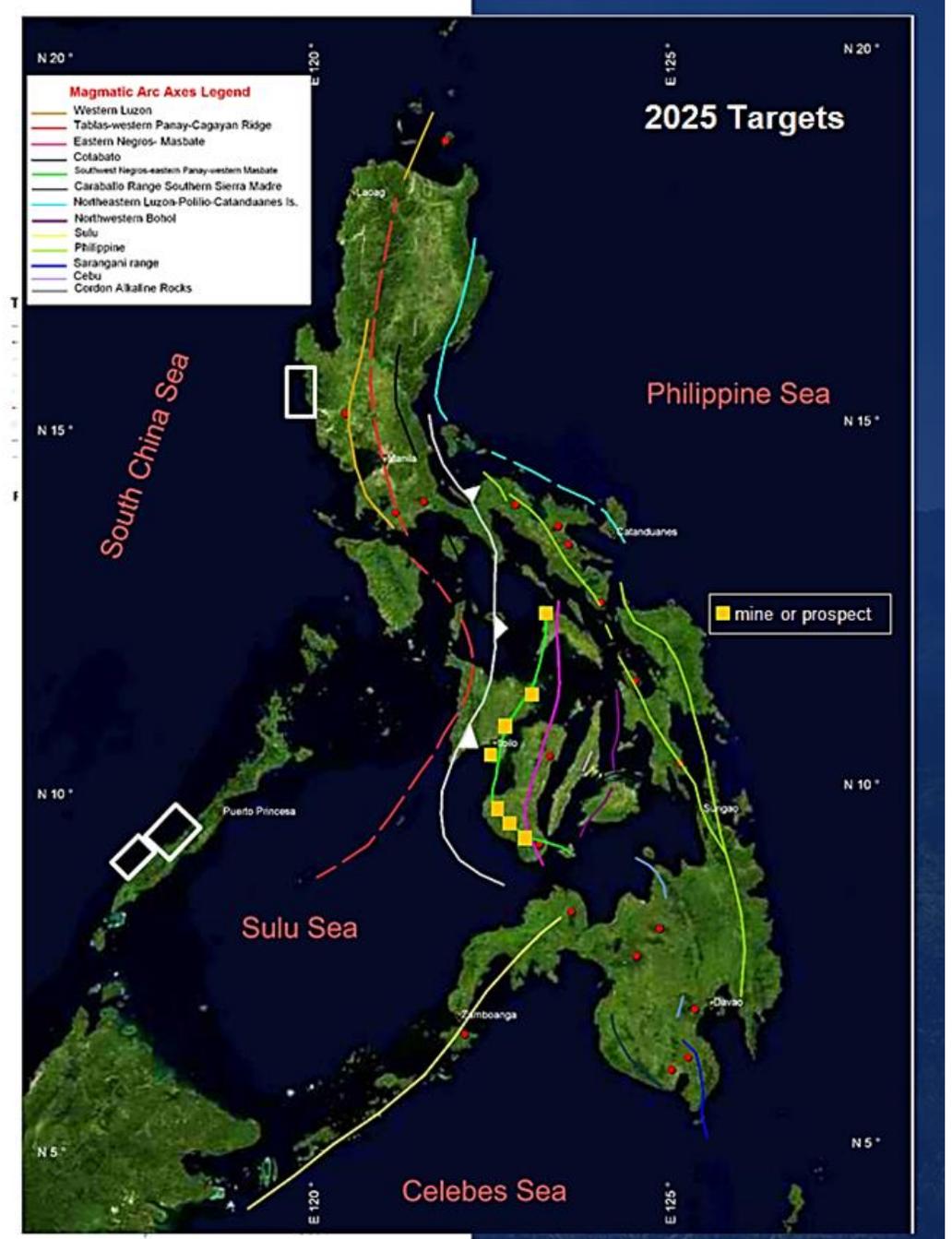
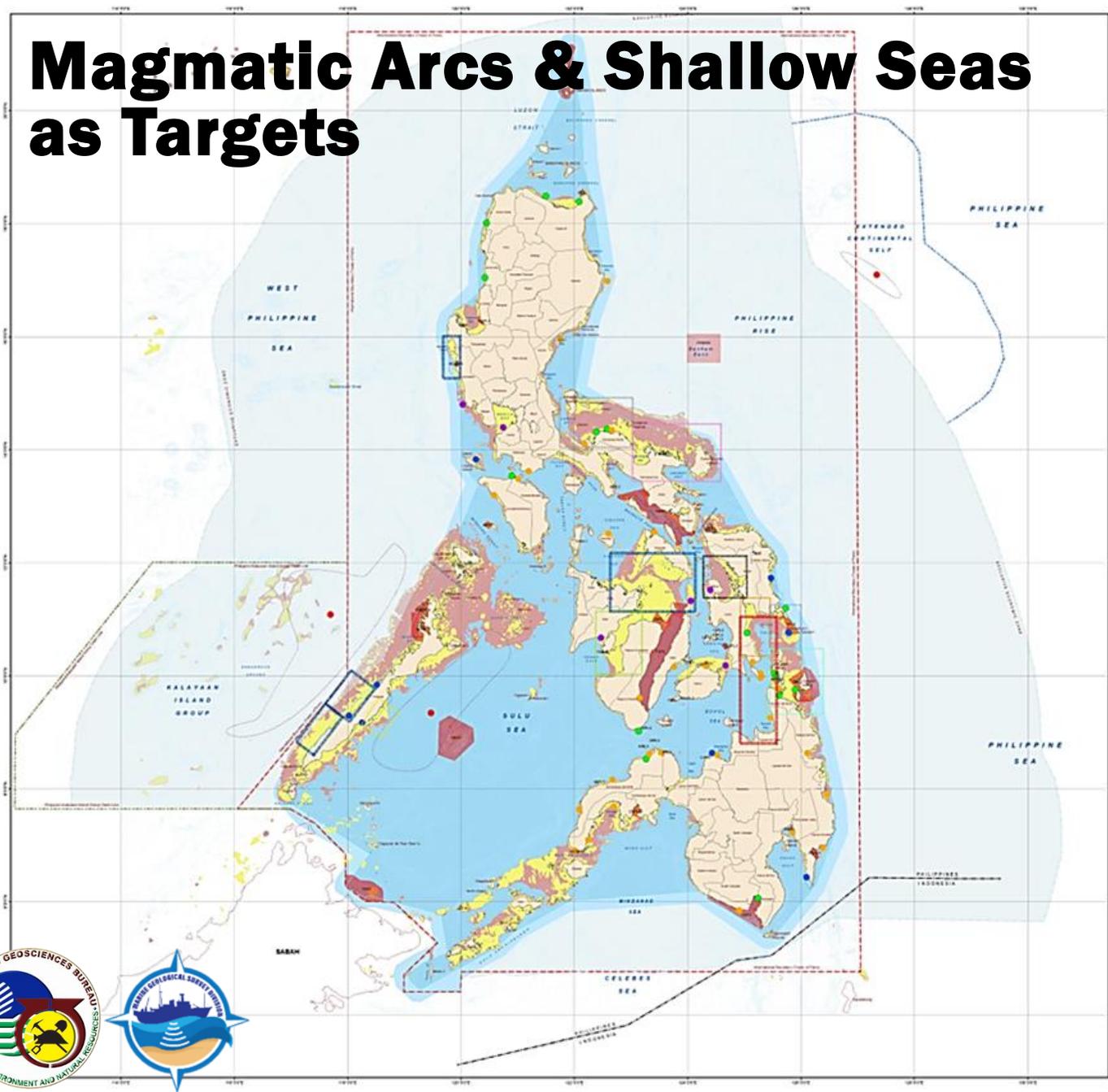




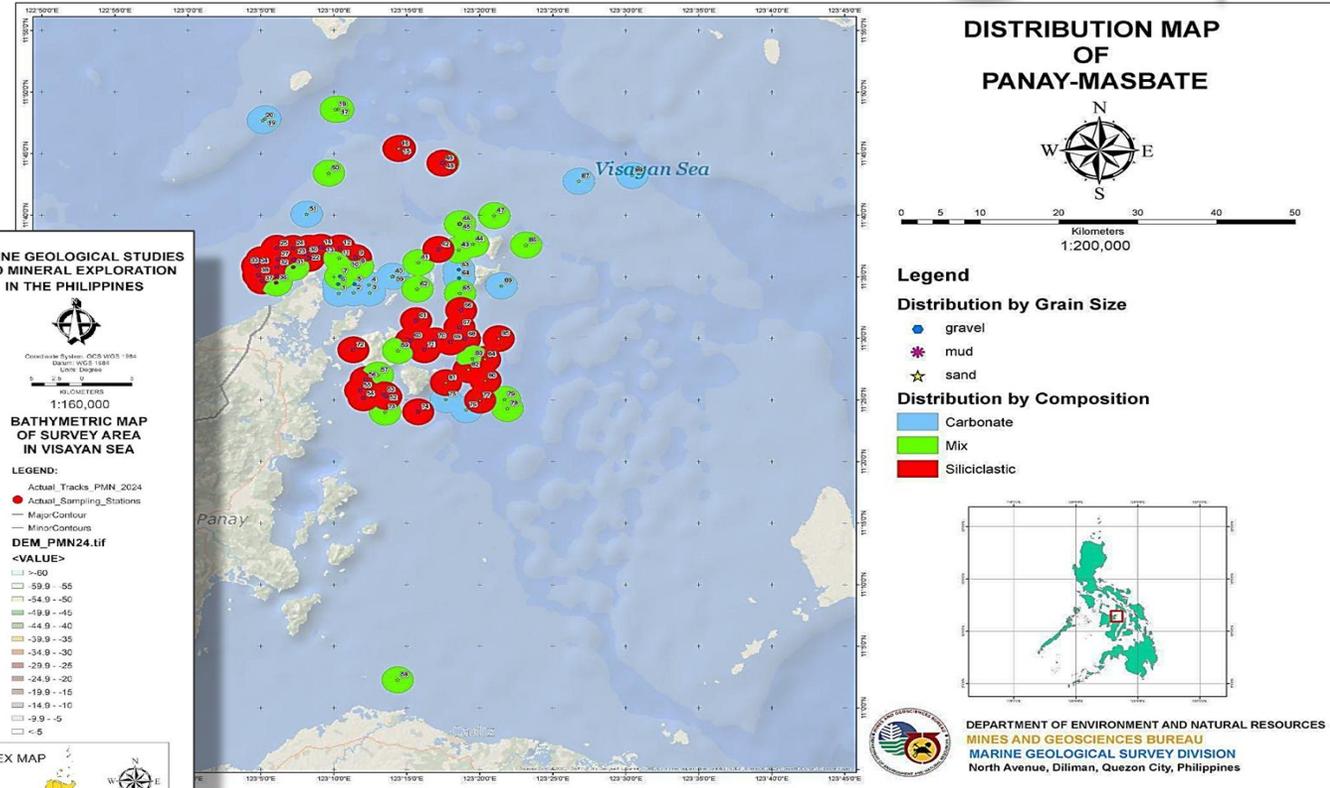
Initial Geochemistry



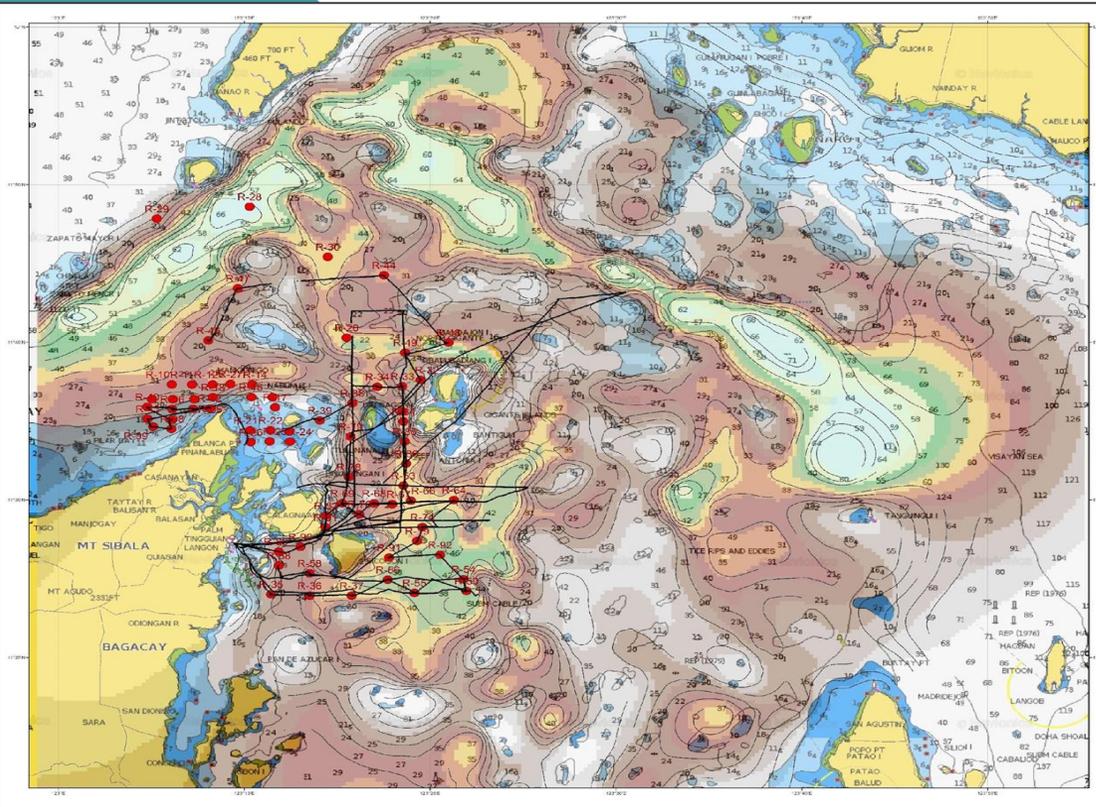
Magmatic Arcs & Shallow Seas as Targets



The Visayan Sea Project 2024

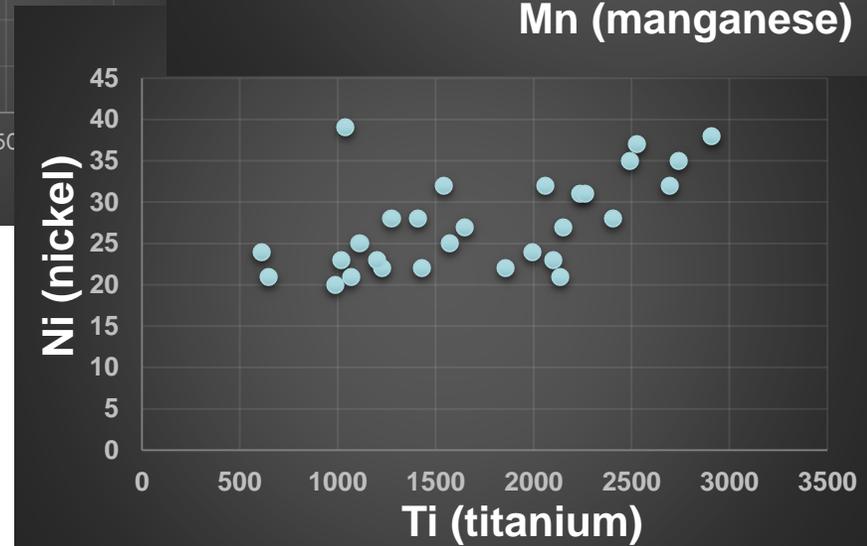
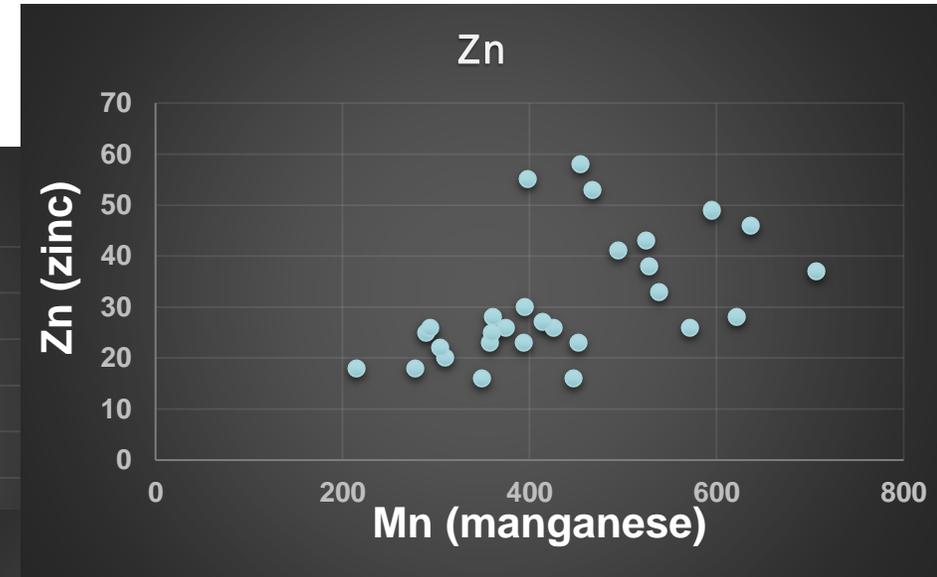
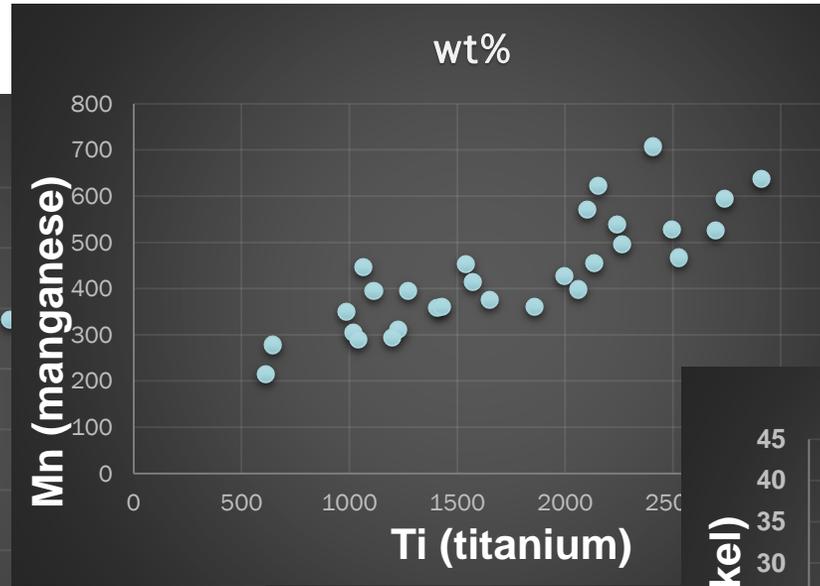
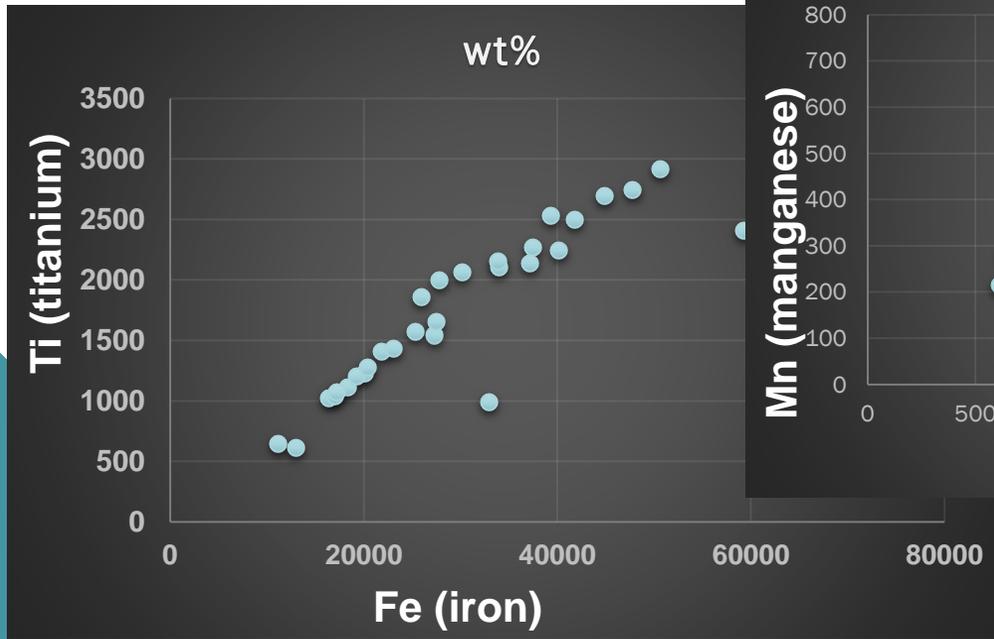


MARINE GEOLOGICAL STUDIES AND MINERAL EXPLORATION IN THE PHILIPPINES

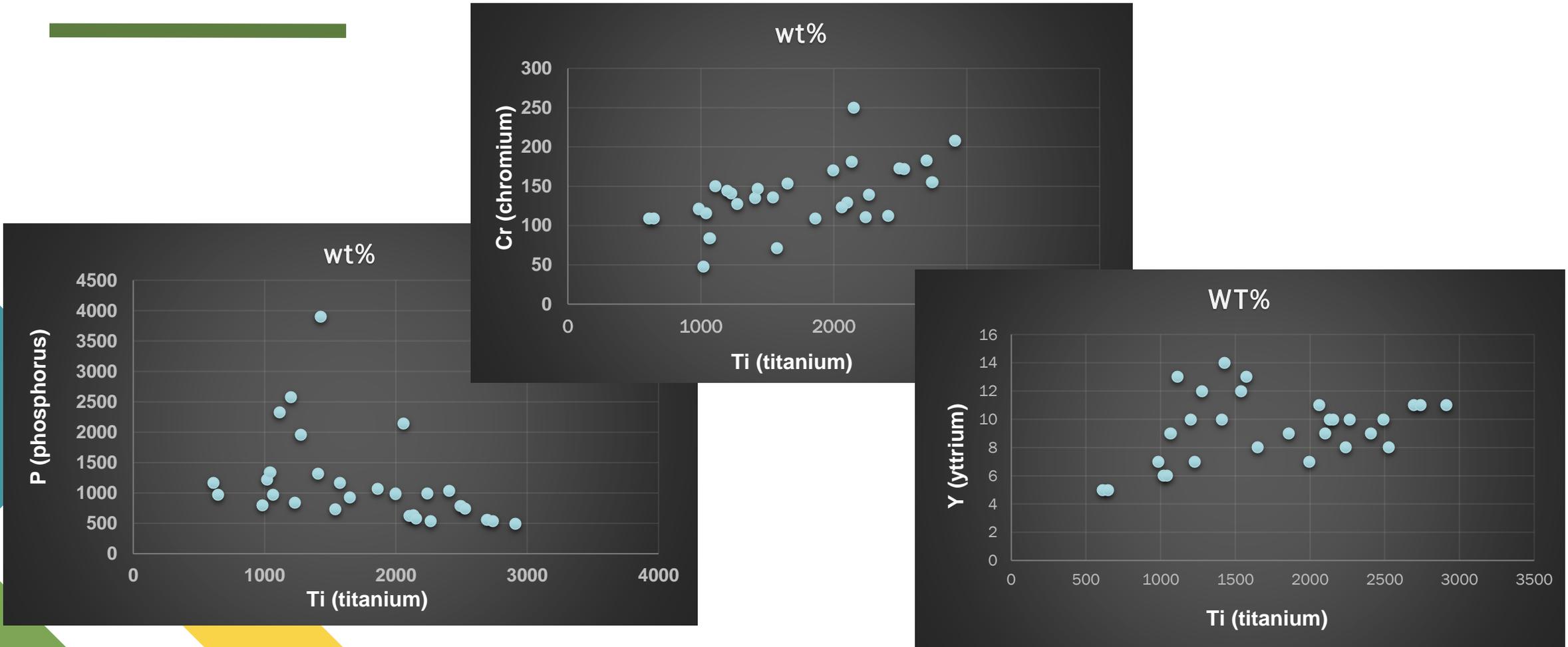


Marine Sediment Collection through Dredge Sampling

The Visayan Sea Project: Initial Geochemistry



The Visayan Sea Project: Initial Geochemistry



Discussion: Point Analysis of Magnetite



Marine mineral resources in the Philippines:

- Magnetite sand which may be associated placer metals such as gold, PGEs, and chromite and quarry sand materials are ubiquitous in marine sediments but workable depths are at 40m – 100m;
- Deep sea manganese nodules and crusts which contain nickel, cobalt, some lithium, and potentially REEs are formed on depths of about 2500m to 4000m and are yet to be determined in Philippine Rise and Celebes Sea Regions;
- Magnetite analysis through SEM:
 - A linear trend between Ti and Fe implying ubiquitous presence of Ti in magnetite structure.
 - Minor presence of Al and Mg in magnetite lattice.



Discussion: Bulk Marine Sediments

Marine mineral resources in the Philippines:

- Initial results of bulk marine sediments analysis show a very linear correlation between Ti and Fe in positive trend; this may imply Ti and Fe exist in a mineral phase or crystal;
- Ti also shows positive correlation with Mn, Ni, Cr, and Y (a REE) in marine sediments;
- Meanwhile, Mn and Zn show positive correlation while P and Ti show a slight negative trend.



Way Forward

Marine mineral resources in the Philippines:

- Establish further the association of PGE, Au, and the REEs in magnetites and magnetite-bearing marine sediments; it seems the 5-6% magnetite presence in marine sediments is the norm;
- Deep sea manganese nodules and crusts which contain nickel, cobalt, and potentially REEs are yet to be proven in the deep regions of the Philippine EEZ and are targets of exploration by the MGSD in the near future;
- The shallow regions (40-100m) are the best potential sources of marine quarry sediments and magnetite sands but extensive exploration is yet to be conducted on target areas;
- Ti, Mn, and V are suggested to be added in the critical minerals list being crafted by the MGB.

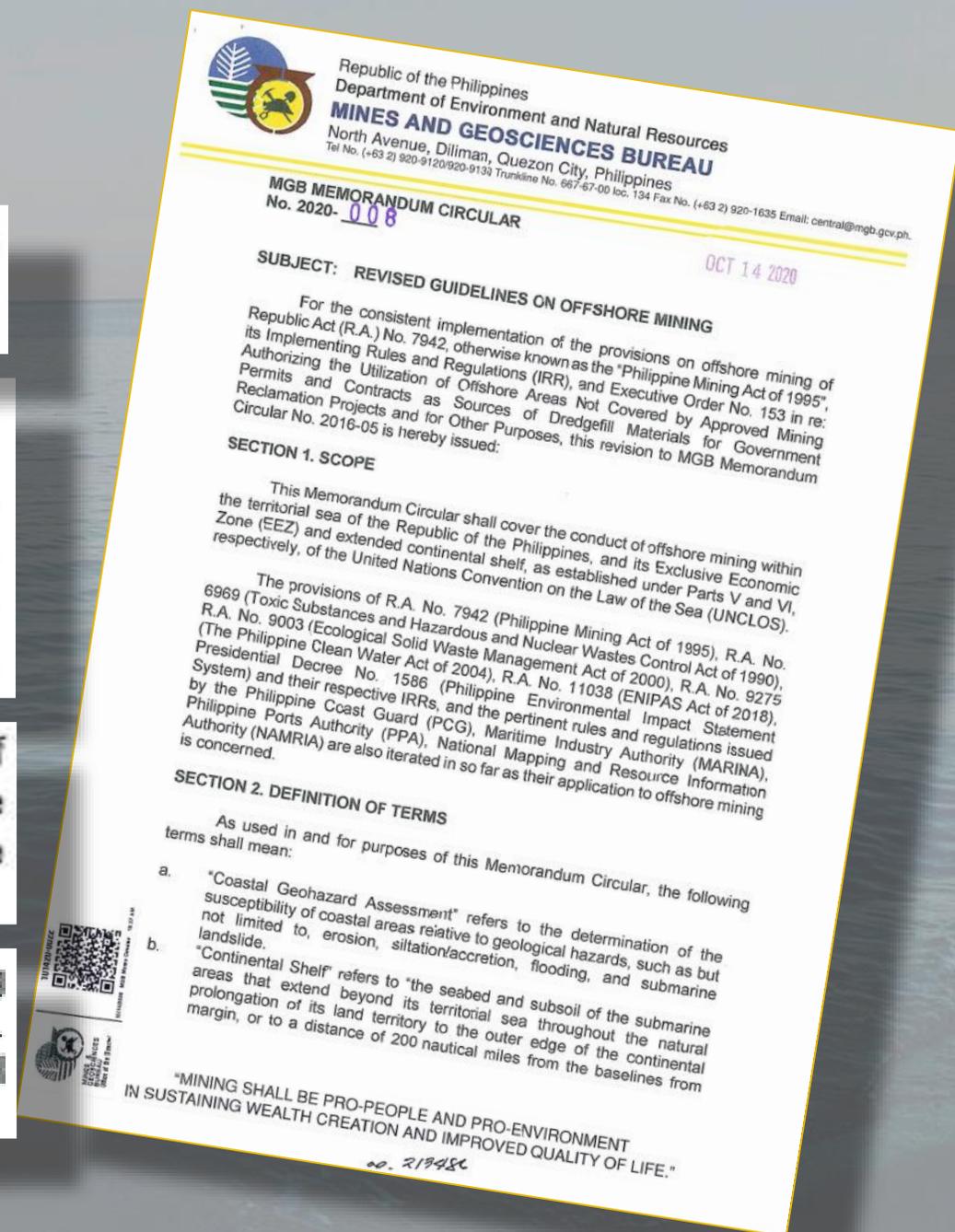
Memo Circular 2020-008: Revised Guidelines on Offshore Mining

3.1. Offshore mining operations shall be conducted in a manner that will not adversely affect biodiversity, the safety of navigation at sea, and other marine activities.

4.1.1. The Permittee/Contractor/Permit Holder shall comply with the Philippine Mineral Reporting Code in the reporting of its exploration results, mineral resources, and ore reserves as prescribed under DAO No. 2010-09. The reports shall be accompanied by raw geologic, geophysical, and geochemical data plotted in a 1:50,000 scale map and cross-sections, at a minimum. It should also state

4.1.6 Exercising the jurisdiction provided by the UNCLOS, the conduct of offshore mining exploration in the EEZ, continental shelf, and the extended continental shelf shall be regulated and carried out by the State.

4.2.1. The Contractor shall utilize the appropriate and efficient mining method with minimal adverse impacts on the marine environment. The use of high-pressure water jet in the extraction of materials shall be prohibited.





Department of Environment and Natural Resources
Mines and Geosciences Bureau
Marine Geological Survey Division



DRAFT GUIDEBOOK

OFFSHORE MINING APPLICATIONS EVALUATION AND OPERATIONS MONITORING

Applications Evaluation

BASELINE CHARACTERIZATION

Offshore mining, being a resource-extractive industry, is considered an Environmentally Critical Project or ECP. Under the Philippine Environmental Impact Statement System, ECPs are required to conduct an Environmental Impact Assessment (EIA) which is a key tool in identifying, quantifying, and assessing the impacts of the proposed project on the environment (Glasson et al., 2013). Key findings from the conduct of EIA is summarized in the Environmental Impact Statement (EIS).

For new and emerging sectors such as offshore mining, the lack of standardized environmental management principles and best practice scientific guidelines may translate to insufficient environmental management practices (Ellis et al., 2017). The need for such guidance arose mainly due to the increasing project applications and knowledge gaps concerning the impact of such projects to the marine environment. The formulation and adaptation of a set of comprehensive technical guidelines that shall be the basis for minimum baseline data requirements against which project impacts are measured is pivotal in the effective impact mitigation and overall preservation of the marine environment.

Ellis et al. (2017) categorizes EIA baseline data requirements based on the receiving environment. For offshore mineral extraction

projects, receiving environments are categorized into: surface, water column, seafloor and shoreline.

The socio-economic environment at the proposed site must also be studied as part of the EIA which details the existing resource utilization including the fisheries, marine traffic, subsea cables and other mineral exploration and exploitation projects in the vicinity along with areas of cultural and/or historical significance is also detailed in this part. Potential socio-economic and socio-cultural issues that may arise during the project must be identified whether it is a direct or indirect effect of the proposed extraction project.

Aside from the offshore socio-economic environment, the onshore socio-economic environment, especially in operations within the municipal waters, is also of importance. Stakeholder consultations must also be a part of the EIA where details of conducted consultation/s with interested parties and stakeholders in the offshore mining application in the period leading up to the preparation of the report is described.

Thank you

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