L. F. ABAD;1948;*Notes and resume of studies on Surigao Iron Ores*;The Philippine Geologist;2;4;
<u>Metallic Mineral Deposits;</u>
No abstract

L. F. ABAD;1948;*A study on the disposition of Philippine iron ores*;The Philippine Geologist;3;1;
<u>Metallic Mineral Deposits;</u>
From the facts and figures one may reasonably conclude that the Republic will do well to reserve its high grade iron ores for the proposed Philippine iron and steel industry as conceived in connection with the government industrialization plans and the development of its hydro-electric power resources particularly that of Maria Cristina Falls.

D. B. ABIOG;1963;*Geology of Bulacan iron deposits*;BL-527;24
<u>Metallic Mineral Deposits;</u>
The Bulacan iron deposits, probably the earliest known deposits of iron in the Philippines, lie along a north-northeast trending belt of Tertiary volcanic and sedimentary rocks intruded by quartz diorite on the western flank of Sierra Madre Mountain Range. The deposits consist of several outcrops of magnetite with subordinate amounts of hematite, pyrite and chalcopyrite. As a whole, the Sierra Madre Mountain Range is characterized by northerly trending cuestas and hogbacks. A cross section of the mountain shows younger rocks on the west which overlie progressively older formations towards the east. Intercalated volcanic and sedimentary rocks of pre-Miocene age make up most of the eastern portion of the area, Miocene to Quaternary deposits composed of clastic sediments, coralline limestone, bedded tuff, pyroclastics, terrace gravel and stream deposits occupy the western portion. Located near the axis of the mountain range are several bodies of diorite. These diorite bodies were intruded after the deposition of limestone and may have become the source of iron mineralization. Among the iron deposits visited, the Camaching deposit is the largest and was studied in detail with geologic and topographic mapping, supplemented by dip needle survey. Other small iron prospects were encountered during the course of the survey. Geologic findings showed that the iron deposits are mainly of the high temperature emplacement type. Magnetite with subordinate amount of hematite replaced calcareous sedimentary rocks and probably volcanic rocks. The ore in places conform with primary bedding structures of the host rock.

D. B. ABIOG;1970;*Report on the geological inspection of copper-gold deposits in Concepcion, Iloilo and iron deposit in Nueva Valencia, Guimaras sub-Province,Iloilo*;IL-1349;4
<u>Metallic Mineral Deposits;</u>
Gold and copper mineralizations occur as vein-filling and disseminated types in volcanic host rock related to the intrusive and the major fault. Iron is a product of

a residual weathering and disintegration of iron bearing host rocks that accumulated in favored site.

D. H. ALMOGELA;1974;*Geologic environment and economic possibilities of "porphyry copper deposits" in the Philippines*;Journal of the Geological Society of the Philippines;28;3;
Metallic Mineral Deposits;
No abstract

L. R. ANTONIO;1963;*Preliminary report on the geology of the Claveria iron prospects, Claveria, Cagayan*;CA-405;1-7
Metallic Mineral Deposits;
No Abstract

L. R. ANTONIO;1969;*Verification of iron mineralization Baluk-Bahan, Sibuguey, Bu-ug Zamboanga del Sur, Mindanao*;ZM-901;4
Metallic Mineral Deposits;
The occurrence of favorable host rock, structures and the proximity to existing iron ore deposits in the adjacent areas all suggests to the presence of iron mineralization occurring within the group of claims visited. Exploration program presently being conducted by ZMBI consisting if trenching, diamong drilling, and mountain side cutting led to the discovery of a huge or sizeable deposit of an iron orebody.

L. R. ANTONIO, L. E. J. ANDREWS, E. G. LIBATIQUE and A. E. PADERES;1979;*Geology of Santa Ines iron deposits, Antipolo, Rizal, Philippines*;RZ-2040;1-20
Metallic Mineral Deposits;
The iron deposits at Santa Ines, Antipolo, Rizal are replacement bodies in metamorphosed sedimentary rocks. Limestone and (or) other calcaerous rocks were preferentially replaced by massive magnetite-pyrite-pyrrhotite-chalcopyrite ore. The diorite, responsible for the metamorphism of the host rocks and the source of mineralizing solutions may have been emplaced at least in part, as a sill intruded along a synclinal axis. The Santa Ines iron deposits are pyrometasomatic in origin. The main deposit probalbly represents a large xenolith of limestone and calcareous sedimentary rocks thoroughly replaced by magnetite. Ore minerals in the order of decreasing abundance are magnetite, pyrite, pyrrhotite and chalcopyrite. Minor occurrence of bornite, chrysocolla (?) and specularite are present in fresh ore specimens. Some hematite and limonite are present on surface exposures. The principal gangue minerals are calcite, epidote, garnet and quartz. Chlorite, fibrous amphibole, sphene, zeolites, apatite and biotite are also recognized. Unusual texture of the ore is manifested by straight to gently curved lamillae of alternating pyrite and magnetite, calcite and magnetite, calcite and specularite, and chalcopyrite and magnetite, either appearing to join along a line as the tufts of a feather or as radiating aggregates. This texture is suggestive of exsolution phenomena. There are approximately

30,000,000 metric tons of beneficiating ore averaging 32 to 33 percent iron as magnetite, about 0.098 percent copper as chalcopyrite and 2 to 3 percent sulfur. Additional 12,000,000 metric tones of ore, of the same tenor, maybe extracted in the area.

G. B. AREHART, S. L. CHRYSSOULIS and S. E. KESLER;1993;*Gold and arsenic in iron sulfides from sediment-hosted disseminated gold deposits:Implications for depositional processes*;Economic Geology and the Bulletin of the Society of Economic Geologists;88;1;
<u>Metallic Mineral Deposits;</u>
Secondary ion microscopic elemental distribution maps and quantitative measurements of Au and As concentrations in samples from five sediment-hosted disseminated gold-deposits in Nevada present a consistent picture of the location and nature of gold in these samples. Gold is present in arsenian pyrite that forms overgrowth rims on, and narrow veinlets in, gold-free pyrite (and possibly other minerals, but only to a minor extent). Auriferous overgrowth rims that may exhibit compositional zoning, either simple or oscillatory, range from approximately 25 microns in thickness to the limits of microscopic resolution. Because all of the observed gold-bearing pyrite contains sufficient As to be metastable (i.e., in excess of aprrox.0.5%), it is suggested that small native gold grains occasionally observed in unweathered sediment-hosted disseminated gold ores resulted from exsolution of gold from the arsenian pyrite lattice.

W. P. ARGAÑO and F. VILLANUEVA;1977;*Report on the ocular inspection of the reported environmental disturbances caused by quarry operations at San Mateo Rizal*;RZ-1774;8
<u>Environmental Geology;</u>
The efforts of certain quarters of San Mateo to protect their environment is laudible, the environment being the concern of everybody. The representatives of Rizcon Inc. and Skyline Builders, inc. have also shown their willingness to solve environmental problems that may arise from their quarry operations.

M. J. B. AUSA;1995;*Geophysical Environment of Davao Del Sur*;DA-3085;8
<u>Applied Geophysics;Stratigraphy</u>
The oldest rock formation in the province is composed of volcanic flows and agglomerate of andesitic composition intercalated with highly indurated clastics. This formation occupies the north-central and eastern parts of the province.

M. J. B. AUSA and D. L. DELA PAZ;1995;*Assessment of geomorphological factors affecting coastal environment at Pujada Bay Mati, Davao Oriental*;DA-3084;8
<u>Environmental Geology;</u>
Based on the factors and conditions identified, mitigation of unstable slope conditions and necessary corrective measures are suggested to lessen or minimize its effects to the environment.

T. F. BAILEY;1948;*Method of reducing iron ores*;PHIL-144;7
Geochemistry;
The method of reducing iron ores containing nickel oxide and chromium oxide which consist in subjecting the ores to the action of sufficient reducing agent to reduce all the nickel and only a portion of the iron, but none of the chromium at a temperature sufficient to melt the reduced metal and in the presence of sufficient lime to produce a fluid slag, leaving the remainder of the iron oxide and all the chromium oxide in the slag and then separating the fluid slag from the fluid metal, and finishing the fluid nickel steel to specifications, then subjecting the fluid slag to sufficient reducing agent at a sufficient temperature to reduce the chromium oxides and the remainder of the iron oxides in slag.

G. R. BALCE;1972;*Geolgical Verification of Claims Applied for Lease by Agusan Iron Mines, Inc.*;AG-1253;1-7
Metallic Mineral Deposits;
The group of claims for lease is mineralized with iron and copper. A systematic exploration may unravel the lateral and vertical extension of the mineralization.

BUREAU OF MINES;1966;*Possible sources of mineral raw materials for the Iligan Iron and Steel Plant.*;LN-671;1-9
Metallic Mineral Deposits;
The possible sources of raw materials for the Iligan Integrated Steel Mills is based on the planned use of electric smelting furnaces to produced 267,000 metric tons of steel products annually.

N. L. CAAGUSAN, C. S. SAMONTE and J. C. FERNANDEZ;1968;*Report on the geological-geophysical canvassing of the iron deposits of Camarines Norte*;CN-749;25
Metallic Mineral Deposits;
The region has a large iron ore potential although the ores are generally characterized by deleterious high sulfur content. Presently, there are only three producing deposits aside from the Philippine Iron Mines, The Felisa Group, the Oguis deposit and the Nacalnao Iron Mines. The most promising deposits are those in Dawahan, Agusan Mine and Babel. The other deposits are likely small or minor ones and chances of finding large extension of orebodies are not indicated by geology nor by the magnetic survey. Small-scale selective mining may be done in these places.

P. C. CALEON;1964;*Magnetometric investigation of Bonawan iron deposit,Timbaboy,R. Magsaysay,Zambonga del Sur*;ZM-425;17
Metallic Mineral Deposits;
A ground magnetometer survey was conducted on the Bonawan area with the purpose of finding blinde orebodies.The results of the survey has been interpreted using available knowledge of the physical properties of the rocks and known geology. Based entirely on the magnetometer and geological data, a calculation of reserves in the known orebodies is placed at 3,377,900 tons, while

on the blind orebodies the reserve is estimated to be 709,500 tons. Several drill holes sites are recommended for further exploration. The interpretation was hampered by a number of complexities, foremost among which is the remanent magnetism found in the rock samples, which are either normal or reversed. Added to this, is the fact that all the theoretical calculation of the anomalies could not be done on a horizontal ground surface and was thus carried out for the actual points on the ground. By and large, the results of the investigation is fairly encouraging.

P. C. CALEON;1964;*Report on the magnetometric investigation of Bonawan Iron deposits Timbaboy,Ramon Magsaysay,Zamboanga del Sur*;ZM-443;19
<u>Metallic Mineral Deposits;Applied Geophysics</u>
Several magnetic anomalies were found in the area and were interpreted to have been caused by blind iron ore bodies.These anomalies are recommended for drilling to verify iron mineralization.The corresponding computed ore reserve is 709,500 tons. The 9-points square grid system was adapted in preparing the residual map. The Cook(1950) method was used in all calculations of the possible size of ore bodies with trend,width, and susceptibility contrast of rock and ore samples.It was assumed that the direction of magnetization of the deposits is that of the earth's present field at the location in question.

P. C. CALEON, O. E. ABARQUEZ and E. M. MANALANG;1966;*Geophysical survey of the iron prospects in Paracale, Camarines Norte*;CN-591;19
<u>Metallic Mineral Deposits;Applied Geophysics</u>
Two alternative proposals are presented in order to work out the significant anomalies: Firstly, closer grid spacing of 25 meters or less should be instituted with the base line parallel to the magnetic contours elongation. This would provide sufficient data to permit a thorough analysis of the anomalies, and secondly drilling could be started to obtain early and faster information about the causative magnetic bodies in these anomalies.

P. C. CALEON;1970;*Geological investigation of the mining property of Century Iron Mines Company, Inc. situated at barrio Mataque,Capalonga,Camarines Norte*;CN-1075;9
<u>Metallic Mineral Deposits;</u>
Copper mineralization exist in the mining property of Century Iron Mines Company, Incorporated. The minerals of interest consist essentially of chalcopyrite, sooty chalcocite, bornite with substantial amount of pyrite. Copper mineralization occurs as pockets and stringers within the magnetite-hematite orebodies, insignificant copper values are probably contained in silicified wallrocks and gougy portion of the fault structures.

P. C. CALEON;1974;*Verification of geologic reserves of the Bessemer pit area of Philippine Iron Mines, Inc. in Larap, Jose Panganiban, Camarines Norte*;CN-1494;1-23
<u>Metallic Mineral Deposits;</u>

The mineralization in the Bessemer Pit Area of the Phil. Iron Mines, Inc., at Larap, J. Panganiban can be classified as a pyrometasomatic replacement type. It is mostly confined along calcareous horizons of the meta-sedimentary rocks and to a certain extent, structures such as faults, folds and shear joints. Local concentration of values are likewise present along the contact between the metasedimentary and metavolcanic rocks. The known orebodies generally follows the position and trend of the bedding structures which assumed a northwesterly trend with northeast dips. Favorable lithology and structures contributed largely to the deposition of the ore values, acting as channelways for ascending hydrothermal solutions. The ore minerals are mailnly chalcopyrite and molybdenite, with subordinate amounts of magnetite, pyrite and probably gold. Garnet, epidote, apatite and secondary biotite are among the gangue minerals present. Skarn constitute as the most pervasive alteration products observed in the mineralized zones. Silicification, argillization and chloritization are the common alteration effects noted towards the intrusive contact.

P. M. CAPISTRANO;1952;*Preliminary report on the geology and ore deposits of the Camalaniugan iron prospect in Cagayan Province*;The Philippine Geologist;6;3;
Metallic Mineral Deposits;
Almost everywhere within the prospect area, but apparently in more discriminate concentration along the northeastern slopes of Proctor and Gumanongong, sub-rounded to angular boulders in appreciable individual dimensions and aggregate volume litter the ground surface. Boulder sizes range from a fraction of a meter to almost three meters , probably averaging about half a meter across. Individually, the boulders are composed of either vuggy hematite, well-bedded massive magnetite, or vuggy hematite lined by thin interbeds of magnetite, mentioned in the order of decreasing preponderance, probably indicating qualitatively as well as quantitatively the nature of their source in place.

P. M. CAPISTRANO;1952;*Preliminary report on the geology and ore possibilities of the Camalanuigan iron prospect in Cagayan Province*;CA-274;1-12
Metallic Mineral Deposits;
No Abstract

A. V. CAROZZI;1971;*Interpretation of ancient oolitic environments and petroleum exploration*;Journal of the Geological Society of the Philippines;25;4;
Fossil Fuels (Coal,Oil and Gas);
Ancient oolitic environments consists of a typical suite of microfacies among which predominate high-energy oolitic calcarenites. These well-sorted carbonate sands, generated through the action of shallow agitated waters saturated in calcium carbonate, are either deposited *in situ* or transported to a variable extent and redeposited. In both instances they are essentially devoid of a micrite matrix and characterized by a variable amount of interstitial cavity-filling sparite. These particular rocks may become important oil reservoir either by preservation of primary intergranular porosity or through secondary porosity following different

diagenetic solution involving the interstitial cement or the oolites themselves. In fact the association of primary and secondary porosity in these rocks is known and increases their economic interest. It is, therefore, important to understand the environmental conditions which generated these bodies of oolitic calcarenite, their geometry, their space and time distribution, and to establish comparisons with modern analogs. The present paper deals with the environmental interpretation of a classical oolitic sequence, the Sto. Genevieve Limestone (Mississipian), producer of 26% of the oil in the Illinois Basin, called the McClosky oil "sand" and whose porosity appears mainly due to differential solution affecting ancient systems of oolitic bars.

B. B. CHAVOOSHIAN, G. H. NIESWAND and M. E. SINGLEY;1977;*Land for vegetative use in an urban environment*;Journal of Environmental Management;5;1;

Environmental Geology;

The competition for land for development often leads to the elimination of appropriate spaces for the vegetative component to be included in the urban landscape. Methods have been developed to incorporate various sized parcels in new developments including purchase of land, zoning of green belts on the periphery of urban areas, clustering of development to accumulate residual parcels, and planned unit development where green spaces are designed into the development itself. None of these is completely satisfactory where the preservation of land for large scale use such as farming and forestry is desired. For these a new method has been devised called the transfer of development rights (TDR). TDR separates the development potential from an area to be preserved and transfers it to an area to be developed thereby protecting the natural area from encroachment. The transfer implies that, with the purchase of development rights from the preserved area, development can be intensified on an area that has a higher capacity for development.

O. CRISPIN, G. GANZON, E. PUZON and D. MALICDEM;1957;*Report on the geological investigation of the Gold-Titanium-Iron Placer deposit at Sta. Maria, Bulacan*;BL-229;18

Metallic Mineral Deposits;

A geological investigation of placer deposit was conducted along the upper Bocaue River. The geology consist of gravel and sand beds of tuffaceous sediments. Aside from the gravel and sand beds magnetite sand, ilmenite sand and placer gold are also present as placer deposit. Test pitting was conducted which suggest that the source of the gold and black sand have come in part if not wholly from the bed rock. The presence of the gold and black sand increases the economic value of the sand and gravel deposit.

O. A. CRISPIN;1960;*Memorandum report on the preliminary geological investigation of Iron Prospects in Lamit Bay Area, Camarines Sur, Manganese Prospects and Iron Titanium Deposit in Albay and Copper and Iron Prospects in Camarines Norte*;CN-318;6

Metallic Mineral Deposits;

The Taloto prospect contains very low manganese but contains 28.62 percent P_2O_5 or 62.5 percent tricalcium phosphate, $Ca_3(PO_4)_2$. Commercial phosphate rock range from 68 to 77 percent tricalcium phosphate and with guarantee of 4 percent maximum iron plus alumina. The Taloto phosphatic rock maybe upgraded to within commercial limits and actual beneficiation tests should be done. Whether the phosphate material is a truly bedded horizon in limestone or localized along fractures or other geologic features remains to be proven. It is therefore recommended that the phosphatic horizon or orebody be traced on the surface and underground.

O. A. CRISPIN;1960;*Meomorandum report on the geological investigation of iron ore prospects at Tigbinan, Labo, and at Pinagbirayan, Paracale, Camarines Norte*;CN-340;6

Metallic Mineral Deposits;

The geological study of the iron prospects at Labo and Paracale, in the province of Camarines Norte, was made upon the request of the AMOCO Mines Inc. of Manila so that the geological findings may be used as a guide in the prospecting and exploration of the iron prospects. Fieldwork was done during the month of November 1960 by the undersigned assisted by Mr. Bascanio Bargas, both geologist of the Bureau of Mines.

O. A. CRISPIN and J. E. PILAC;1961;*Memorandum report on the geological investigation of iron prospects in Calaburnay, Tabas, Napangasan-Pinagbirayan Area and Ores Incorporated (San Felipe Mines) in Paracale, Camarines Norte*;CN-342;5

Metallic Mineral Deposits;

The iron prospects occur in an area underlain by intercalated metasedimentary and metavolcanic rocks. Quartz diorite intruded and metamorphosed the above-mentioned rocks. In the vicinity of the intrusives, the metasedimentary rocks believed to be originally pyroclastics turned to hornfels. Some of the volcanic rocks were altered to amphibolite. At San Felipe Mines the wall rock is well bedded metamorphosed tuff.

B. V. CRUZ;1969;*Geological investigation and evaluation of Long Beach Mining Corporation's iron sand deposits at Morong, Bataan*;BA-944;6

Metallic Mineral Deposits;

It was noted at P-7 that the waste areas could give additional reserve provided that mining is confined up to water table. It has been observed in this area that the zone above the water table has a higher magnetite content. The average magnetic fraction in this zone is 11%. Apparently, the low values observed by the Corporation were due to the fact that the depths of sampling were too deep. In this particular case, their depth of sampling averaged 5 meters. With this finding, it is expected that the other waste areas could still be potential areas and therefore may warrant resampling up to water table. It was mentioned in the project study of the Corporation that aside from magnetite other important minerals are present. Rutile and vanadium were mentioned. Similar deposits in Northern Luzon also contain vanadium. This is quite interesting because the price of iron sand concentrates could be higher if our buyers would pay for the vanadium content. The bulk density of the iron sand varies from 1.631 to 1.774 metric tons/cubic meter. The thickness of the deposit ranges from 2.3 to 4.7 meters. Based on these observations the estimated ore reserve of the areas covered is roughly 1,549,800 M.T. Adding the Corporation's proposed annual production of 150,000 tons, the ore reserve alone on the claims investigated is enough to guarantee a ten (10) year life of the Corporation's iron sand mine. It is therefore recommended that proper action be done on the application of Long Beach Mining Corporation for tax exemption under R.A.3823.

R. S. DE LUNA;1968;*Geologic investigation of Manganese and iron prospects at Ivisan, Capiz*;CZ-786;6
<u>Industrial Mineral Deposits;</u>

B. B. ESCANDOR;1978;*Report of the evaluation of the iron property of Yolanda Vidal At Pinagbirayan Malaki, Paracale, Camarines Norte*;CN-5001;5
<u>Metallic Mineral Deposits;</u>
Evidently, iron mineralization occurs in the claim area. The ore consists mainly of hematite, magnetite and minor amount of associated chalcopyrite and pyrite. This occurs as floats along Dalnac creek and at the southeast portion of the claim.

H. E. FERNANDEZ and E. Y. VALLESTEROS;1960;*Accomplishment report for the month of September 1960 in the geological survey of 1939 Surigao iron mineral reservation and the northern peninsula of Surigao Gold District*;SR-300;1-16
<u>Metallic Mineral Deposits;</u>
The report is in three parts: Part I -- semi-detailed work on the northern part of Surigao covering six square kilometers. Investigation was made to obtain a vivid description of the place. Part II -- reconnaissance work on the adjoining islands of Dinagat. The total area is about 28 sq.km. Part III -- semi-detailed work on Melgar, Tag-abaka and Osmeña areas.

J. FERNANDEZ, C. SAMONTE and M. VERA CRUZ, B.;1964;*Geology of the Lammin iron deposits Piddig, Ilocos Norte*;ILN-454;10
<u>Metallic Mineral Deposits;</u>
Geologic studies reveal that the Lammin Iron Deposits were directly influenced by several interrelated factors: (1) The structure and form of iron bodies is closely related to bedding and/or banding of country rocks. Fault control was a secondary factor in localizing mineralization in some places. (2) Metamorphosed volcanic and sedimentary rocks intercalated with limestone were the most favorable host rocks. These rocks, selectively replaced in the more calcareous zones by iron-bearing fluid, provided a favorable structural and chemical environment for the deposition of iron. (3) Iron bodies were probably forced

during or after emplacement of diorite, the source of iron-bearing solutions. (4) In general, most of the bigger iron bodies occur within skarn zones. Iron minerals corrode and embay skarn zones following bedding planes. (5) The mineral suite is simple. Massive primary magnetite is the principal iron mineral, and massive hematite is found along fracture zones and on the surface. Common gangue minerals are garnet, quartz, hedenbergite (pyroxene), epidote, and calcite. (6) On the basis of rough measurements made along the surfaces of outcrops, the iron ore reserve is estimated at about 850,000 metric tons. However, there is reasonable evidence that somewhat larger tonnage could be uncovered.

J. C. FERNANDEZ;1964;*Geology and magnetic survey of iron deposits at Bos. San Roque and Patricia, Libertad, Antique*;AN-458;11
<u>Applied Geophysics;Metallic Mineral Deposits</u>
The geology and magnetic survey of iron deposits at Bos. San Roque and Patricia, Libertad, Antique are presented. The rocks in the area are metamorphic complex including marble and Patria quartz diorite. Iron mineralization is genetically related to quartz diorite intrusion as a replacement of the skarn. Magnetic work by dip needle and magnetometer indicate that the iron bodies are shallow and relatively small for commercial consideration. Estimate of iron ore is about 1,000 tons.

J. C. FERNANDEZ;1964;*Geology of the Lammin Iron deposits Piddig,Ilocos Norte*;The Philippine Geologist;18;1;
<u>Metallic Mineral Deposits;</u>
The iron deposits at Lammin,Piddig,Ilocos Norte, are replacement bodies in metamorphosed volcanic and sedimentary rocks. Calcareous horizons were preferentially replaced. Metamorphism of host rocks and eventual mineralization were caused by late ore solutions genetically related to diorite intrusion. Quartz, calcite, epidote, pyroxene, magnetite, and hematite are the chief minerals. Primary magnetite replaced altered rocks along grain boundaries and cleavage planes. Hematite generally occurs along fractures and intergrowths with magnetite. The mineralized belt, 1 3/4 kilometers long, contains 13 groups of magnetite outcrops which average about 3 meters in width. Base upon surface indications, the estimated iron reserve is about 850,000 metric tons. Analyses indicate from 50 to 71% Fe and 0.085 % S in outcrops.

J. C. FERNANDEZ;1964;*Geophysical investigation of Lammin iron deposit,Piddig,Ilocos Norte*;The Philippine Geologist;18;2;
<u>Metallic Mineral Deposits;</u>
This report presents briefly and qualitatively the result of geophysical work on the Lammin iron deposits in Piddig, Ilocos Norte as follow-up to the apparently encouraging results of the survey conducted by Hunting Geophysics Limited (1954) and the geological investigation done by the Philippine Bureau of Mines, respectively. These factors have initiated the ground magnetic survey as the basic and indispensable technique to help the area with magnetometer and dip.

J. C. FERNANDEZ;1964;*Geophysical investigation of Lammin iron deposits, Piddig, Ilocos Norte*;RI-54;1-22
Applied Geophysics;
This report presents briefly and quantitatively the result of geophysical work on the Lammin iron deposit in Piddig, Ilocos Norte as a follow-up to the apparent encouraging result of the survey conducted by Hunting Geophysics Limited (1954) and the geological investigation done by the Philippine Bureau of Mines (J.C. Fernandez, 1962), respectively. These factors have inititated the ground magnetic survey as the basic and indespensable technique to help in the scientific exploration of the area with magnetometer and the dip needle.

J. C. FERNANDEZ;1965;*Geology of the iron and copper prospects, New Manila, Ilog, Negros Occidental*;NG-546;1-9
Metallic Mineral Deposits;
The deposit is locared at the center of the widest bulge of southern Negros island about 3 kilometers west of Sitio Manila, barrio Pinggot, Ilog, Negros Occidental.

J. C. FERNANDEZ and C. S. SAMONTE;1965;*Geology of the Talamban iron deposits, Cebu City, Cebu*;CE-599;20
Metallic Mineral Deposits;
The Talamban iron deposits at Cebu City, Cebu, are small replacement bodies located principally along calcareous horizons in slightly metamorphosed volcanic and sedimentary rocks of Early to Middle Miocene age, intruded by the quartz diorite of Middle Miocene or younger age. Iron deposits also occur as narrow, non-persistent veins localized at fracture intersections. Magnetometer work revealed two small anomalies not represented by iron outcrops. Analyses indicated 42.9% to 50.57% Fe and from 23.8% to 33.72% $SiO2$. No attempt was made to estimate iron reserves from the small and irregular outcrops.

J. C. FERNANDEZ;1976;*Iron resources of the Philippines*;Phil-1692;14
Metallic Mineral Deposits;
Filmag Inc. and Inco Mining Corporation both beach sand mining operators stop production in 1976 due to the ban on mining operations on beaches. Philippine iron mines stop production in 1975 due to financial difficulties. The government is presently rehabilitating the mine and does drilling exploration work in search for uranium and other related minerals including iron.

J. C. FERNANDEZ , E. MANALANG and C. SAMONTE;1965;*Geology of the Labo Iron Deposits, Labo, Camarines Norte*;CN-552;17
Metallic Mineral Deposits;
The Labo iron deposits comprised by vein Venida, Malay, Mabilo, and Mayaman deposits, are localized in intercalated volcanic and sedimentary rocks of Eocene age. The emplacement of the diorite caused thermal metamorphism and believed to be the source of the mineralizing solution which were responsible for the formation of replacement deposits. The deposits are lenses, tabular, and pod-shaped bodies that conform with bedding and fractures, the possible loci of

deposition. Of the four mentioned deposits, only Vein Venida indicated an anomaly east and west of the existing outcrop. The three other deposits show only weak and less defined anomalies that may not be of economic interest.

C. C. FERRARIS;1987;*Seminar workshop on disseminating information on environmental hazards*;Phil-3058;31
Professional Development;Environmental Geology
Educating people about flood risk, flood hazard and methods of coping are essential first steps in programmes aimed at reducing flood losses. The effective measures are enhanced by efficient early warning devices and forecasting. Public education of the interpretation of the forecasts and warnings is considered a vital component in the total warning system. Discussed are the factors that causes flooding, like climatological(rain, snowmelt,combined rain & snowmelt), part climatological (estuarine and coastal surges) and others (earthquakes, landslides, failure of dams and other control works). Discussed also are the flood intensifying conditions and the assessment of flood characteristics. On sea level changes, the effects of water density, ocean currents, atmospheric pressure,wind, evaporation and precipitation, seasonal cycles in sea levels,seasonal variation of slope and water surface, seasonal water balance of the ocean, vertical movements of the earth's crust,gravitation and tide-generating forces, the chandler effect, eustatic factor, seiches,tsunamis and effects of earthquake in sea level are incorporated in the seminar.

T. C. FOIN, E. O. GARTON, C. W. BOWEN, J. M. EVERINGHAM, R. O. SCHULTZ and B. J. HOLTON;1977;*Quantitative studies of visitor impacts on environments of Yosemite National Park, California, and their implications for park management policy*;Journal of Environmental Management;5;1;
Environmental Geology;
Investigations of the impacts of visitor use in two areas of Yosemite National Park, California, were conducted during summers of 1973 and 1974. Comparative analysis of several sites using a number of parameters measuring visitor use, vegetational structure, and animal populations was carried out in order to assess the relative impact of visitor use on meadow and forest environments. Particular emphasis was placed on trail impact and campground use effects. The principal results were (1) that meadow use was largely restricted to a few trails with limited use elsewhere in the meadows, (2) that the primary forest impact was wood-gathering and suppression of the understory in campgrounds, (3) that in complex and heterogeneous environments visitor use impacts other than the obvious effects on vegetation structure are extremely difficult to detect, especially secondary (indirect) effects, and (4) that most ecological impacts are predictable only from knowledge of the biology of particular species affected. Some current controversies about the role of ecological research in park management policy are re-examined in the light of the results, and arguments are made for research priorities to be placed on an ecosystem approach in the study of visitor impacts in parks and reserves.

C. FONTANOS and M. MENDOZA;1961;*Report on the valuation of the iron deposit at Mataque, Capalonga Camarines, Norte operated by Century Iron Mines Company, Inc.*;CN-344;25

Metallic Mineral Deposits;

Exploration within the claims inspected consisted mostly of trenches and few test pits. The Century Iron Mines Company, Inc. which is on its early development stage produced approximately 2,900 tons of iron ore assaying 57.23% Fe, 0.73%S, 10.89% SiO_2, 0.041% P and 0.41% Cu from its development work as of September 22, 1961. The iron ore is now stockpiled at the Company's Shipping point in Dahican Bay. Iron ore exposures and float are extensively distributed in the 19 claims inspected.

P. C. FORTUNO;1961;*Memorandum report on the ground magnetometer survey conducted on the Sibuguby iron deposit Bu-ug, Zamboanga del Sur*;ZM-374;15

Applied Geophysics;

A detailed ground magnetometer survey was conducted by Philippine Bureau of Mines Geophysical Survey Team on the Sibuguey iron deposits,Bu-ug,Zamboanga del Sur. The work was to test the workability of the magnetometer instrument on the island's iron deposits and on areas with suspected blind iron formations and /or mineral deposits with substantial magnetic properties. The Sibuguey iron deposit was chosen as the testing ground for two reasons: (1) it has known iron bodies as established by exploration and mining operations, and (2) the general detailed geology of the area is already mapped.

P. C. FORTUNO and N. J. B. BAUTISTA;1964;*Geology and magnetometer survey of the Bacungan Iron deposit, Puerto Princesa, Palawan*;PW-1432;15

Applied Geophysics;Metallic Mineral Deposits

The Bacungan iron deposit occurs as magnetic and/or hematite irregular bodies in a metavolcanic rock. Its iron mineralogy and intimate association with a hydrothermally altered zone suggest an epigenetic origin. The iron bodies are discriminated as magnetic (magnetite-rich) and non-magnetic (hematite-rich). These contain 26% and 1% magnetic fraction, respectively. The non-magnetic iron comprises roughly 90% of the entire deposit. Due to the lack of magnetic contrast between the non-magnetic iron and underlying materials, the magnetometer survey did not prove effective. Previous exploration activity in the area included 34 test pits and 12 diamond drill holes. Using the data from these workings and the detailed geologic map, the deposit is estimated to contain a reserve of 20,000 tons with at least 54% iron.

P. C. FORTUNO and M. V. GARCIA;1966;*Geologic investigation of the nickel-iron prospect of C. Maglana in Luzon-Magdug, Gov. Generoso, Davao*;DA-607;10

Metallic Mineral Deposits;

The salient feature of the Luzon-Magang laterite prospect is that the nickeliferous laterite is developed over their parent serpentinised peridotite on the crestal part of the ridges at elevation 150 to 730 meters above sea level. The bulk of deposit is above 500 meters.

F. U. FRANCISCO and P. M. VELEZ;1955;*The Matabang iron prospect, Matabang, Abra de Ilog, Occidental Mindoro*;MD-172;15

Metallic Mineral Deposits;

Two magnetite outcrops, both in gabbro and approximately one and a half kilometers apart, disposed in plan along the line of a northwest-southeast fault (?) were located within the Matabang River valley. Outcrop no. 1 occurs at elevation 800 feet along the bed of northwesterly flowing tributary to Matabang river. This creek seems to be controlled by an apparently post-mineralization northerly-steeply-dipping fracture which could be an extension of the fault inferred above. Outcrop No. 2 occurs the east bank of Ilog Lawin creek at 500 feet elevation. Both outcrops have irregular outlines and are not over two meters in longest dimension.

D. F. FRASCHE;1938;*Geological report on the Surigao iron ores for the Commonwealth of the Philippines*;SR-2;97

Metallic Mineral Deposits;

The surveys have proven, or blocked out approximately 17,000,000 tons of iron ore which can be easily mined by open pit methods near the foot of the Dahican Bay. This survey and other preliminary surveys and sampling carried on in the interior of the reservation shows that many hundreds of millions of tons of iron ore exist in the government reservation. This enormous iron deposit is one of the largest in the Far East.

E. A. GAMUS and J. P. TABOADA;1965;*Memorandum report on the geologic investigation of CLA-V-747 of Mrs. Amparo M. Nuenay at Balirong and Lutak, Naga, Cebu*;CE-688;11

Fossil Fuels (Coal,Oil and Gas);

The CLA-V-747 of Mrs. Amparo M. Nuenay lies mostly in a coal-bearing sedimentary terrain between Lutak and Alpaco coal areas but includes non-commercial coal-bearing areas underlain by the Pandan Series, Cansi Volcanics and Toledo Formation. Two coal seams vary in thickness from 1 ft. to 1.5 ft. The heating values ranges from 11,727 to 6,021 BTU per pound. The probability of finding coal in the area can be gauged from the fact that most of it is in a coal-bearing terrain coupled with the existence north and west of the coal producing properties. No estimate of the coal reserves can be given in this report because unluckily at the time of the investigation most of the exploratory workings have already caved-in.

M. V. GARCIA and N. L. CAAGUSAN;1963;*Preliminary report on the geology and dip needle survey of the iron deposits in Abra de Ilog, Occ. Mindoro.*;MD-450;1-16

Metallic Mineral Deposits;

The Mayorga Mine is characterized by rugged topography embracing the headwaters of Mamburao River and part of the Occidental Mindoro-oriental Mindoro divide. The bedrock in the area consists mainly of paraschist, Marble, and diorite. The iron deposits are of pyrometasomatic type with magnitite and hematite as the main mineral constituents.

A. R. GATDULA, V. L. BALISI and M. R. APELO;1982;*Induced polarization survey of Lammin iron deposit Lammin, Piddig, Ilocos Norte*;ILN-5009;12
Metallic Mineral Deposits;
Induced Polarization (IP) survey was conducted in the Lammin iron deposit, Lammin, Piddig, Ilocos Norte to determine the response of magnetite bodies to the McPhar Model P660 frequency domain induced polarization instrument. This geophysical method was applied to observe if a physical contrast between the deposit and the surrounding host rock can be defined. For the period of one month, the geophysical team has covered 120 hectares from the 500-hectare mineralized area delineated by previous worker.

M. GAUTHIER and A. C. BROWN;1986;*Zinc and iron metallogeny in the Maniwaki-Gracefield district, southwest Quebec*;Economic Geology and the Bulletin of the Society of Economic Geologists;81;1;
Metallic Mineral Deposits;
Zinc and iron deposits in the Grenville supergroup metasedimentary rocks of the Maniwaki-Gracefield district, Quebec, exhibit close similarities to the economically important Balmat-Edward district of New York state. The mineralization is stratiform, it is consistently associated with dolomitic marble units, and it has ages similar to the New York deposits (1,200-1,300 m.y.). At least two phases of intense Grenvillian deformation affected the host rocks regional metamorphism reached the granulite facies. Lateral and vertical zoning of major and trace element observed within the zinc deposits indicate that they probably had a submarine exhalative origin. Small magnetite-iron-rich-formations related to Mg-rich carbonates, and minor amounts of base metal sulfides including sphalerite, occur within th metasediments closely resembling those which host the zinc deposits. The iron deposits are interpreted to occur at stratigraphic positions which are laterally equivalent to the zinc mineralization, and consequently the iron formations form an important stratigraphic guides to zinc mineralization within the complexly deformed and strongly metamorphosed strata of the Grenville supergroup.

F. C. GERVACIO;1958;*Report on the Santa Cecillia Consolidated Mines iron prospect,Goto,Dupax,Nueva Viscaya*;NV-271;15
Metallic Mineral Deposits;
The iron deposits lie unconformably above the metamorphic rocks.It is of the type known as sedimentary bog iron, the ore consisting principally of limonite and minor amount of hematite.

F. C. GERVASIO;1959;*Notes on the geomorphic history of southern Nueva Vizcaya and the genesis of the Taan Iron Deposit of Sta. Cecilia Consolidated Mines*;The Philippine Geologist;13;3;
Metallic Mineral Deposits;
The Taan iron deposit is a sedimentary bog iron deposit consisting of an upper layer of crispy limonite with floral imprints which grade down to limonite and poorly sorted limonitic conglomerate. The deposit lies unconformably above the truncated surface of a metamorphosed sequence of volcanic flows and clastic rocks and forms a mantle fringing the slopes within the watershed of the Taan River. Geomorphic indications together with features of the deposit seemingly indicate that iron deposition took place in a ponded drainage basin developed as a consequence of the down-faulting of the headwater portion of the former San Juan River.

A. J. GORRICETA;1971;*Memorandum report on the geological verification of the laterite deposits in Barrio Birong, Quezon, Palawan*;PW-1128;5
Metallic Mineral Deposits;
Based on the findings in the field and the results of chemical analysis, the area is mineralized with laterite. The application for lease shall be given due course.

J. M. HALL and J. S. YANG;1994;*A preferred environment of preservation for volcanic massive sulfide deposits in the Trooddos Ophiolite (Cyprus)*;Economic Geology;89;4;
Metallic Mineral Deposits;
It is difficult to link the formation of volcanic massive sulfide orebodies, whcih are at or very close to sea floor on spreading ridges, to their preservation at depth in oceanic crust. The relationship of volcanic massive sulfide orebodies to other features of crustal construction in the Troodos ophiolite (Cyprus) suggests that a mechanism for preservation required burial to an optimum depth interval during the completion of crustal construction. Incomplete burial may result in dissolution on the sea floor or from downward-permeating seawater. Excessive burial leads to mechanical fragmentation by diking together with the dispersal of metals and sulfur through the action of high-temperature hydrothermal fluids. In a study involving the location of orebodies with respect to contours of increase of dike density below the volcanic surface, it is found that the optimum depth interval for preservation is on average 0.5 plus/minus 0.2 km beneath the volcanic surface, about 0.1 km in thickness, and everywhere located about 0.1 km above the 25 percent dike density surface.

J. F. HARRINGTON and L. E. ANDREW, Jr.;1969;*Iron ore resources of the Philippines*;Phil 3038;34
Metallic Mineral Deposits;
It seems evident, therefore, that a favorable geological environment exists for the discovery of additional ore bodies and for increased iron ore resources through systematic mapping and exploration.

R. W. HUTCHINSON and J. E. LARSON;1993;*The Selbaie Zn-Cu-Ag deposits, Quebec, Canada: an example of evolution from subaqueous to subaerial volcanism and mineralization in an archean caldera environment*;Economic Geology;88;6;

Metallic Mineral Deposits;

The Selbaie deposits of western Quebec are hosted in calc-alkalic pyroclastic rocks of Abitibi subprovince. Rocks range upward from subaqueous debris flows through pumiceous tuff to welded ignimbrite, they form an intracaldera sequence over 1,200 m thick which records evolution from subaqueous to subaerial deposition.

C. B. IBAÑEZ and O. A. CRISPIN;1958;*Report on the geological investigation of the iron deposits in Dumalinao and Liargao, Zamboanga del Sur*;ZM-266;16

Metallic Mineral Deposits;

High grade magnetite-hematite deposits of pyrometasomatic origin occur in metavolcanic rocks and/or metasedimentary rocks and are related to diorite intrusions. The deposits consist of several discontinuous lenticular orebodies which appear to have been localized along definite zones. No iron ore outcrops are observed in the Dumalinao area, but the distribution of iron ore float makes it worthwhile considering for exploration. In the Liargao area, previous exploration work has indicated a recoverable ore reserve of roughly 2 MT for the Lumangoy and Midsalip groups of claims.

E. M. IRVING;1950;*Iron in Southern Samar*;The Philippine Geologist;4;4;

Metallic Mineral Deposits;

The high iron, low sulphur Camcuevas iron orebody of Pambuhan Sur was discovered by B.D. Cadwallader in the early 1930's. It was not until the iron ore deposits of Larap, Camarines Norte, had demonstrated the profitability of iron mining in the Philippines that the Samar deposit was considered commercial. To undertake its development, the Elizalde interests, in 1937, organized a company capitalized at 1,000,000 PhP. Production commenced in 1938 and approximately 1,000,000 tons of ore were produced up to the outbreak of war.

E. M. IRVING;1950;*Notes on the geology of the Gold Star Iron Mines, Mogpog, Marinduque*;The Philippine Geologist;5;1;

Metallic Mineral Deposits;

The Gold Star iron ore deposits belong to the pyrometasomatic class as distinguished by Lindgren. The deposits are not strictly of the contact metamorphic type for they occur some distance away from the intrusive contactand appear to be controlled primarily by fissuring within the metavolcanics. Metasomatic replacement has also occurred along certain preferred horizons in the metavolcanics but adjacent to fissures, and not to the intrusive contact. It is believed therefore that the mineralizing fluids from the diorite intrusive rose along intra-metavolcanic fissure systems, and formed ore deposits within fissures (e. g. lower part of North Taluntunan deposit) and along favorable horizons in the metavolcanics, (e. g. upper part of North Taluntunan deposit, and the South Taluntunan deposit). The abundance of magnetite and garnet, and the presence of diopside and epidote indicate that the deposits formed at high temperatures incalcium -rich host rocks.

E. M. IRVING;1952;*Notes on the geology of the Gold Star Iron Mines, Mogpog, Marinduque*;MR-53;18
<u>Metallic Mineral Deposits;</u>
The Gold Star iron deposits belong to the pyrometasomatic as distinguished by Lindgren. The deposits are not strictly of contact metamorphic type for these occur at distances away from intrusive contact and appear to be controlled primarily by fissuring within metavolcanics.

R. S. JAVELOSA and A. D. TORRES;1988;*Geological studies: aspect of environmental impact assessment for lifting the ban on beach mining along Roxas and San Vicente, Northern Palawan*;PW-5031;16
<u>Mineral Economics;Environmental Geology</u>
The coastal areas in San Vicente and Roxas municipalities in Northern Palawan are primary sources of economically extractable silica sand deposits. At present, the socio-economic development of both municipalities are intimately interwoven with the existence and operations of major silica mining companies (e.g. Nimbay Mining Corp., Vulcan Mining, and Republic Glass Corp.) This study was made primarily to assess the effects of silica sand mining on the environmental and geo-ecological characteristics of the surveyed areas.

R. S. JAVELOSA, E. G. DOMINGO, V. J. CALAMANAN, A. FERNANDO and F. BOSTON;1994;*Surficial perturbation of alluvial fan-plain environment, Marabang river basin, Eastern Leyte Island, Visayas*;LE-5078;21
<u>Quaternary Geology;Environmental Geology</u>
Eco-stratigraphic facies analysis indicates the relative dominance of an irregular segmentation of associated distal and alluvial island sediments in the north and central sections of the Marabang alluvila plain, where the effects of subsidence seem to be greatest. Obviously, the segmentation of subfacies-D_1resulted from distributary aggradation in response to subsidence.

C. P. JONGCO, C. A. FONTANOS and M. N. BAGUE;1965;*Report on the ore reserve estimate of Sta. Ines Iron Mines, Sta. Ines Antipolo, Rizal*;RZ-759;1-11
<u>Metallic Mineral Deposits;</u>
The iron deposit at Sta. Ines, Antipolo, Rizal was previously examined by the Bureau of Mines from June 8 to 13, 1959 and again on October 8 to 12, 1963. In the first investigation, the ore reserve estimate was based on diamond drilling results while the second one was based on information gathered from both diamond drilling and tunneling. After October 12, 1963 the Filipinas Consultants and Management Corporation continued the tunneling and drilling exploration. Based on their latest exploration work, the said corporation requested for a re-

estimate of the ore reserve. The field investigation was made on January 19-23, 1965 inclusive.

F. H. KIHLSTEDT;1940;*The Larap iron ore deposit*;CN-82;10
Metallic Mineral Deposits;
A number of years ago the Larap deposit was opened up but the first attempt failed after some ore had been shipped. The claim owners, notably Judge Frank B. Ingersoll and his associates, nevertheless held on to these claims for many years until with the growing iron industry in Japan and the stabilization of the yen the conditions seemed right to the late Wm. J. Shaw and his associates in Atlantic, Gulf and Pacific Company to do some successful pioneering in iron mining and the property was re-opened six years ago under the supervision of Mr. Cort.

M. C. LIGGAYU;1970;*Report of verification of nickeliferous laterite deposit in Barrio Birong, Quezon, palawan*;PW-1072;6
Metallic Mineral Deposits;
The 150 lode claims under lease application No. Lla-V-10234 and Lla-V-10531 for A. Soriano y Cia, Inc. covered a potentially mineralized area primarily for nickel and/or ferronickel ore deposits derived from the laterization of serpentinized ultramafic rocks. Favorable consideration is recommended for the application of lease.

D. G. MALICDEM;1960;*Memorandum report on the Alilem iron prospect at Alilem, Ilocos Sur*;ILS-326;9
Metallic Mineral Deposits;
From the foregoing discussion, the following could be stated: (a) The iron prospect is in sedimentary rocks and is directly associated with the non-calcareous sandstone (b) The associated non-calcareous sandstone contain 11.78% Fe and magnetic separation test run on this sample revealed 9.14% be weight of magnetic component. (c) Results of chemical analysis of two cut samples and one pick-up massive magnetite sample show that the iron content of the prospect range from 45.49% Fe to 56.18% Fe. While sulfur and phosphorous contents are well within market limitations, titanium and silica contents may not be within market specifications. (d) Recent and old trenches and test pits failed to provide adequate openings for taking the reliable and needed geologic information, thus no estimate of ore reserve can be given to the iron prospect. It should be noted, however, that the iron outcrops were found only within a few square meters. In connection with the government policy of canvassing iron ore reserve and to gain more data as to the extent of the ore horizon laterally and at depth, systematic trenching and test pitting or diamond drilling along the slope above and below the outcrops should be initiated. Test pits may be done in the area where there is concentration of iron ore float below the outcrops. From this operation, the ore bodies may be discovered below the present outcrops.

D. G. MALICDEM and F. A. RAMOS;1961;*Memorandum report on the Cabittauran iron prospect in Cabittauran, Nueva Era, Ilocos Norte*;ILN-200;9
<u>Metallic Mineral Deposits;</u>
The iron deposit in Cabattauran, Nueva Era, and the reported iron deposit in Piddig, are good indications of iron mineralization in Ilocos Norte. The understanding of the geology of these deposits may be used as a guide in prospecting other possible iron deposits in the region.

D. MALICDEM and L. H. L. RAVAL;1962;*Memorandum report on the geological investigation of an iron deposit at Binalbagan, Negros Occidental province*;NG-389;19
<u>Metallic Mineral Deposits;</u>
The region is underlain by Quaternary alluvium and Tertiary sequence of undifferentiated lava flows, pyroclastics and sedimentary rocks. The Tertiary rocks are in part silicified and formed jasperoid masses of undetermined thickness in the area. The iron ore and the jasperoid masses appear to be closely associated with talus materials derived from brecciated jasperoid masses which appear to be the base upon which the iron ore was deposited. There are four iron ore float areas mapped within the claim area of 85 lode claims The iron ore is light in weight and porous. It varies in color and almost black to brownish red. It consists essentially of cryptocrystalline minerals and amorphous iron hydroxides, hence it can be aptly called limonite or limonitic iron ore. There are two general type or iron ores. The iron ore with abundant jasperoid inclusions generally appear on the upper portions of the iron ore float areas while the iron ore with abundant imprint of leaves of trees appear on the lower portions of the iron float areas. The iron contents of 9 iron ore samples range from 47.71 to 55.83% and the average iron content determined appear to be insignificant to affect the commercial value of the iron ore, except for silica contents of samples with jasperoid inclusions. Judging from the close similarities of this deposit with the reported thermal spring iron deposit in Tupi, Cotabato with respect geologic setting and physical chemical characteristics of the iron ore, it seems fair to infer that this iron deposit under discussion may be related to recent thermal spring activity in the region. If the iron deposit is a thermal spring deposit, then it follows that it is surficial.

D. G. MALICDEM, Raval, Leon Hugo L.;1962;*Memorandum report on the Tutak iron prospect Nueva Era, Ilocos Norte*;ILN-370A;11
<u>Metallic Mineral Deposits;</u>
The Tutak iron prospect consists of iron mineralized zones ranging in width from a fraction of a meter to about 5 meters or more in trondhjemite and in aphanitic basaltic rock adjacent to a dioritic mass. Zone number 1, which is the smallest of the exposures mapped, is about 0.25 meter wide and zone 4, the largest, is about 5 meters wide.

D. G. MALICDEM;1964;*A report on the geology and iron-copper prospects of a portion of Kiamba, Cotabato*;CO-540;54

Metallic Mineral Deposits;

The presence of iron and copper prospects in Kiamba, Cotabato, in southwestern Mindanao might have been known for a long time but nothing much was known about their geologic setting and economic possibilities. It was only in 1963 that a group of enterprising Filipinos organized themselves to explore these prospects.

D. G. MALICDEM and R. PEÑA;1965;*A report on the geological investigation of an iron prospect in Sitio Supon, Alegria, San Francisco, Agusan*;AG-557;9

Metallic Mineral Deposits;

The rocks in the visited claim area include undifferentiated clastic rocks and volcanics, Eocene limestone, porphyries, and a younger pinkish limestone. Only magnetite-bearing boulders, with maximum diameter of 0.70 meter were found during the fieldwork.

D. G. MALICDEM and R. PEÑA;1965;*A report on the geology and iron-copper prospects of a portion of Kiamba, Cotabato*;CO-811;54

Metallic Mineral Deposits;

The presence of iron and copper prospects in Kiamba, Cotabato, in southwestern Mindanao might have been known for a long time but nothing much was known about their geologic setting and economic possibilities. It was only in 1963 that a group of enterprising Filipinos organized themselves to explore these prospects.

D. G. MALICDEM, L. H. RAVAL and R. PEÑA;1965;*A report on the geological investigation of some iron prospects in Agusan and Surigao del Sur*;AG-545;14

Metallic Mineral Deposits;

Of the two types of iron prospects, only the magnetite-bearing boulders merit attention. The gossan prospect along Badbad-5 Creek is insignificant as a source of iron. The magnetite-bearing boulders, distributed in spotty manner, occur along an east-west belt that covers a portion of the lease surveyed claim DEMIJOKA 1, 4, 11 & 12 (Plate 1). The results of the dip needle survey covering portions of the mapped claim area indicate local anomalies of 1 to 1.5 degrees. These anomalies might have been due to mechanical error of the instrument man or to local and insignificant accumulations of magnetite-bearing material beneath the thick soil cover.

F. B. MAMARIL;1963;*Preliminary report on the geology of the Giporlos iron and coal deposits, Giporlos, Samar*;SA-325;17

Fossil Fuels(Coal,Oil and Gas);

The iron and coal deposits are located 15 kilometers north of the municipality of Giporlos, province of Samar. Pre-Miocene(?) rocks exposed in the prospect area and its vicinity. A coal-bearing sedimentary sequence, tentatively dated as Miocene, unconformably overlies these Pre-Miocene(?) rocks. Underlying the iron deposit is serpentinized ultramafic rock. The deposit consists of limonite, hematite, and magnetite. The chemical composition and geologic distribution of the deposit indicate its probable derivation from the laterization of serpentinized ultramafic rocks. The original laterite deposit presumably underwent compaction and chemical reconstitution so as to produce the present type of iron deposit. Resting upon the iron deposit are coal-bearing Miocene sedimentary rocks. A coal seam, 3.5 meters thick, was observed near the base of the formation.

E. M. MANALANG;1975;*Mineral verification of the gold-iron-titanium placer deposit along Sta. Maria River in Sta. Maria and San Jose Del Monte Municipalities, Province of Bulacan*;BL-1521;1-6
<u>Metallic Mineral Deposits;</u>
The mineral verification was conducted in response to a paid request of Construction Aggregates Producers Company. The area essentially contains gold, magnetite, and ilmenite associated with the gravel and sand. Upon extraction of these heavy minerals, the sand and gravel waste constituents can also be utilized as construction materials after their separation and washing. However, before starting on the commercial operation of the extractions of these minerals, further exploratory work must be undertaken to prove the actual available reserve and which should be followed by feasibility study to ascertain the economic profitability of the project.

E. M. MANALANG, C. L. BAGUILAT and P. J. ROVILLOS, B.;1976;*Radiometric survey and preliminary geologic estimate of uranium tonnage at tunnel 3 in Bessemer rescue area of Philippine Iron Mines, Larap, Jose Panganiban, Camarines Norte.*;CN-1639;14
<u>Metallic Mineral Deposits;Applied Geophysics</u>
The radioactivity in Larap area is caused essentially by the presence of uraninite mineral, probably of mesothermal origin. The uraninite mineral occurs as diffused grains along the cleavages of the molybdenite mineral deposited in thermally metamorphosed calcareous sediments, and in granular form in late siliceous gangue.

P. M. MANLANSING and J. MANTARING;1970;*Report on the geological investigation of the nickeliferous-iron laterite resources in Balangiga-Giporlos area, Provinces of Eastern Samar, Philippines*;SA-1032;14
<u>Metallic Mineral Deposits;</u>
Several factors were considered in the computation of the geologic reserve. Area of influence is the approximate lateral extent of laterite deposit in a placer mining claim having a maximum area of 640,000 square meters.

P. M. MANLANSING;n/i;*Preliminary report on the iron resources of Eastern Davao Province*;DA-250;24
<u>Metallic Mineral Deposits;</u>
The iron deposits have four modes of occurrences, namely: (1) mechanical concentration of magnetite sand, (2) residual concentration of lateritic soils, (3) pyrometasomatic deposits, and (4) thermal spring deposits. Magnetite sand occurs as numerous but erratic concentrations along beaches. Lateritic soils were developed from the weathering of pre-Tertiary ultrabasic rocks consisting mainly of the peridotite-dunite variety. Pyrometasomatic deposits in the

metamorphosed volcanic and sedimentary rock sequence, exemplified by Mati Iron Mines, were found disposed along the margins of intermediate intrusives. Deposit believe to be of thermal spring origin were found in Plio-Pleistocene limestone areas.

M. MATSUKAWA, H. NAGATA, Y. TAKETANI, Y. KHANDA, P. KHOSBAJAR, D. BADAMGARAV and I. OBATA;1997;*Dinasaur bearing lower Cretaceous deposits in the Choir basin, S.E. Mongolia- stratigraphy and sedimentary environments*;Journal of the Geological Society of the Philippines;52;3 & 4;
Stratigraphy;Paleontology
This paper describes the Lower Cretaceous stratigraphy of dinasaur-bearing beds in the Choir basin, southeast Mongolia, and interprets depositional environments according to vertical and lateral changes in litho and biofacies. The Lower Cretaceous is divided into the Sharilin, Tsangaantsav and Shinekhudag Formations in ascending order. Ostracods from the middle member of the Shinekhudag formation indicate a Hauterivian to Barremian age. Therefore, the Sharilin to Tsagaantsav formations are regarded as approximately Valanginian to Hauterivian. A dinasaur assemblage consists of Psittacosaurus mongoliensis, Iguanodon orientalis, turtles, crocodiles, fish and terrestrial plant megafossils, which have close affinity with faunas from China, Korea and Japan. The Sharilin formation rests unconformably on basement rocks and is characterized by fining-upward, minor cyclic units comprising conglomerate, sandstone and mudstone. The Tsagaantsav formation consists of sandstone characterized by cross laminae that reflect alluvial fan debris flows from the eastern hinterland into the basin, based on paleocurrent directions. The Shinekhudag formation is made up of laterally varying lithofacies in the lower member, monotonous mudstone in the middle member, and dominant sandstone in the upper member. These sediments were transported by a fluvial system from the western hinterland to the centre of the basin.

G. B. MOREY and D. L. SOUTHWICK;1993;*Stratigraphic and sedimentological factors controlling the distribution of epigenetic manganese deposits in Iron-Formation of the Emily District, Cuyuna Iron Range, East-Central Minnesota*;Economic Geology and the Bulletin of the Society of Economic Geologists;88;1;
Metallic Mineral Deposits;
Early Proterozoic strata of the Emily district at the far northern end of the Cuyuna iron range define the southwestern closure of the Animikie basin in east-central Minnesota. As such, the rocks of the Emily district are correlative with strata of the well-known Animikie Group of the Mesabi Range. However, unlike the monoclinal nature of the Mesabi Range, strata in the Emily district are deformed into a series of broad, open, eastward-plunging folds with near-vertical axial planes. Geometric relationships imply that the basal contact of the Animikie overlies an unconformitiy cut onto older folded rocks of the Cuyuna North Range. That unconformity marks a boundary between twice-deformed rocks of the

Penokean fold and thrust belt and the once-deformed rocks of the Animikie basin.

J. O. NYSTROM and F. HENRIQUEZ;1994;*Magmatic features of iron ores of the Kiruna Type in Chile and Sweden: ore textures and magnetite geochemistry*;Economic Geology;89;4;
<u>Metallic Mineral Deposits;</u>
Magnetite lavas and feeder dikes on the flanks of the volcanic El Laco in the Chilean Andes are characterized by textures demonstrating rapid crstal growth from supersaturated melts. Columnar magnetite, a conspicuous form of magnetite at El Laco with occassional dentritic branching, has been found in two other apatite iron provinces: the Creteceous iron belt in Chile, a 600-km-long zone along the Pacific with about 40 deposits, and the Early Proterozoic Kiruna ore field in Sweden. Presence of columnar magnetite in an iron ore is suggested to be diagnostic of a magmatic origin. Platy magnetite, another dendritic form widespread at Kiruna, also occurs at El Laco. Moreover, many ores of the three provinces contain pyroxene or pseudomorphs after it with dendritic morphology. The occurence of similar rapid-growth textures in the investigated apatite iron ores demonstrates a similar origin with emplacement of ore magmas at or near the surface. In fact, existence of vesicular ore lava and pyroclastic ore at Kiirunavaara shows that this deposit is volcanic.

A. OKAMURA and M. MAKAHARA;1963;*Report on exploration of Pagadian Iron Mines*;PHIL-3001;18
<u>Metallic Mineral Deposits;</u>
Areas where possibilities for the existence of ore deposits are seen as the result of the geological survey and magnetic exploration are the nine places indicated in the geological map (Fig. 1)

E. OSTREA;1946;*The Surigao iron ore and its metallurgical treatment*;The Philippine Geologist;1;1;
<u>Metallic Mineral Deposits;</u>
The Surigao Iron Ore was first recognized by H.P. Cameron, Chief Engineer of the Department of Mindanao and Sulu in 1912. This deposit was reserved in 1915 under Executive Order No. 63 for the use of the Philippine Government. In 1937, the Bureau of Mines processed for a leace, undertook a detailed geological study and exploration program. The iron ore are residual in origin, having been formed in situ by the subaerial decomposition of the serpentinite rock. The ore estimated confirms that of Pratt and Lednicky, 500,000,000 metric tons.

T. PARAK;1985;*Phosphorus in different types of ore, sulfides in the iron deposits, and the type and origin of ores at Kiruna*;Economic Geology and the Bulletin of the Society of Economic Geologists;80;3;
<u>Metallic Mineral Deposits;</u>

In the Kiruna-type iron ores, apatite has been regarded as the most conspicuous mineral. Advoactes of the magmatic-intrusive mode of ore emplacement at Kiruna have argued that the apatite crystallized from a parent ore magma. However, a close examination of deposits classified as Kiruna-type ore shows that they include both apatite-bearing and virtually apatite-free orebodies or parts of orebodies. In general terms this means that apatite is uneven in this type of ore. Along individual layers or bands, however, apatite, distribution is persistent. In this respect, there are similarities between the Kiruna-type ore is a documented component even in the other ore types in environment geologically similar to those of Kiruna-type ores. There are several examples of skarn-type ores, banded iron-formation-type ores, and massive stratiform sulfide ores where the phosphorus content is as high as in the phophorus-rich occurrences of Kiruna-type ores.

O. M. PINEDA and N. D. QUIWA;1983;*Semi-annual report on the geological and geoschemical survey conducted in the Lammin Iron project in Piddig, Ilocos Norte.*;ILN-5006;4
Metallic Mineral Deposits;
Iron deposit: Lammin area, Abaga and Balbalisi area, Manganese: Palong area, Silica: Pasuquin area.

O. M. PINEDA and N. D. QUIWA;1987;*Geological survey and evaluation of raw materials needed for the proposed pig iron plant in Ilocos Norte*;ILN-5030;52
Metallic Mineral Deposits;
Iron mineralization in Ilocos Norte is of two types, one is a replacement and vein deposit in igneous rocks and the other is a replacement type in the pyroclastic sedimentary rocks.

J. S. PORTACIO;1979;*Preliminary studies on hydrothermal alteration in the Philippine porphyry copper deposits in relation to tectonic environment*;Journal of the Geological Society of the Philippines;33;4;
Metallic Mineral Deposits;
On the basis of extensive petrographic studies of wallrock samples gathered and collected from major porphyry copper-producing mines and prospects, some definitive pattern regarding hydrothermal alteration and mineralization of porphyry copper deposits in intra-oceanic island-arc environment such as the Philippines has been observed.

C. B. PRESBITERO;1963;*Geology and dip needle survey of iron prospects in Guimaras Island, Iloilo.*;IL-410;11
Metallic Mineral Deposits;
Guimaras Island is located southeast of mainland of Panay and west of Negros Island. Geological mapping and dip needle survey of iron prospects was conducted as an integral part of Bureau of Mines' project to evaluate in detail all iron deposits in the whole Archipelago and secondly, it is in connection with the regional mapping and mineral evaluation of Panay island.

R. B. QUICHO, A. F. J. SAN MIGUEL and A. S. MALICSI;1962;*Preliminary report on the beneficiation of high sulfur iron ores*;RI-42;1-17
<u>Metallic Mineral Deposits;</u>
This report presents preliminary results of beneficiation studies on high sulfur iron ores from Sta. Ines, Rizal and Sibuguey, Zamboanga del Sur. Utilization of high sulfur iron ores constitutes a giant step towards conservation and development of the country's iron ore reserves. It will insure stability of the proposed integrated steel project.

N. D. QUIWA and O. M. PINEDA;1982;*Progress report on the geological survey of Ilocos Norte Iron Project*;PROG-5000;6
<u>Metallic Mineral Deposits;</u>
Numerous attractive geologic occurrences which need more detailed studies pertaining the emplacement, lithologic and stratigraphic position of the iron deposit in Lammin area should be made. As observed, the deposit is a contact metasomatic type. Normally, skarn is developed at the contact of the intrusive and the intruded rock. As noted, some of these skarns are replaced by magnetite or hematite but a considerable portion was observed in the intruded rock particularly within a garnet rich skarn zone.

F. A. RAMOS and R. DE LUNA;1964;*The geology and dip needle survey of Bulacan iron deposits*;BL-430;21
<u>Metallic Mineral Deposits;</u>
The Bulacan iron deposit, probably the oldest known commercial deposit of iron in the Philippines, lie along northeast trending belt on the western flank of the Sierra Madre Mountain Range. The deposit consists of several discontinuous exposures of magnetite-hematite over a distance of about 15 kilometers. The region as a whole is characterized by north-south trending ridges. Rock types are found with their long dimensions along the same direction. With some variations, the rocks are generally younger on the western part and gradually becomes older towards the eastern side. metamorphosed volcanics and sedimentary rocks of pre-Miocene age which comprise the basement, makes up most of the eastern part of the area, Miocene to Pleistocene rocks, composed of clastic sediments, coralline limestone, low-dipping bedded tuff, terrace gravels and alluvial deposits occupy the western portion, while centrally-located is the biggest mass among the four diorite outcrops. These exposed bodies probably intrude the older rocks during the Miocene time, and may be responsible for iron mineralization. Among the iron deposits, only the biggest at Camaching, situated on the northernmost part, near the headwater of Balaong River was studied in detail, geologic and topographic mapping was supplemented by dip needle survey. Geologic findings showed that the iron deposits is mainly of the replacement type. Magnetite with subordinate amount of hematite replaced clastic sediments, marbolized limestone and probably volcanic rocks. The ore in places conform in strike and dip with the sediments. Results from dip needle survey within the mineralized

area show that magnetic anomalies indicate a wide range of positive and negative values. These values almost reflect the general trend of the orebody.

C. V. RAMOS;1972;*Geological investigation and mineral verification of the Midsalip Iron prospect at Midsalip, Zamboanga del Sur*;ZM-1219;10
Metallic Mineral Deposits;
The Midsalip iron prospect consisting of 6 lode claims in underlain principally by metamorphosed volcanic rock with inter-bedded limestone which is intruded by quartz diorite. iron ore deposit are generally made up in part as boulders and float concentrate along hill slope and also as massive replacement iron body in the metavolcanic rock adjoining a skarn and tactite zone. Principal ore mineral consist of magnetite with minor lominite and geothite. Associated minerals with the ore garnet, clay epidote, chlorite, pyrite, and sometimes chalcopyrite.

L. L. RAVAL and M. GARCIA;1969;*Report on the geological investigation and mineral verification of the copper-iron prospects at Tuburan and Pigsagan, Cagayan de Oro City*;MI-928;5
Metallic Mineral Deposits;
The area mapped shows copper-iron mineralization both in the metavolcanic rocks and diorite. They occur as irregular lenses and vein systems that are traceable for considerable distances. The report of analyses of the samples showed a copper content of 16.11% and iron content of 69.30%. Based on the geological data obtained in the field, the area is mineralized. It is therefore recommended that the Lease Application be favorable acted upon.

R. M. RELOVA;1959;*Report on the Iron Prospect in Lagonoy, Camarines Sur*;CS-5000;15
Metallic Mineral Deposits;
Evidently, there are two areas located for iron in Lagonoy, Camarines Sur. One area, located in barrio Sta. Cruz, consists of 19 claims, namely Lamit 1 and Lamit 2 have already been surveyed. Lamit 1 to Lamit 10 in Sitio Bulasulapid, covers a promentory where concentration of the iron ore occurs mostly at the northern tip, near the level of the sea. About 129 metric tons of iron were already in stockpile near the shore line. Floats of iron near the base of the slope of the headland facing the Nantigbao River may aggregate to about 300 tons. A composite sample was taken each from 125 metric tons of stockpile and also from the low grade stockpile of about 5 metric tons.

C. S. SAMONTE;1975;*Geological verification of iron and copper mineralization of the vein Venida Claim in Labo, Camarines Norte.*;CN-1547;5
Metallic Mineral Deposits;
The area is overlain by Eocene rocks(Universal Formation) intruded by diorite. Replacement iron deposit were formed in the Eocene rocks along calcareous rocks. A total geologic reserve of 21,000 MT of iron in situ. Malachite stains occurs in iron outcrops, however, the behaviour of copper is still undetermined.

A. F. J. SAN MIGUEL;1962;*Preliminary report of direct reduction of iron concentrate from Philippine Iron Mines*;RI-40;1-16
Metallic Mineral Deposits;
The continued growth of the iron and steel industry in the Philippines depends upon the availability of its basic raw materials, scrap and pig iron. Presently, iron and steel producers in the country are confronted with the critical short supply of scrap iron and increased cost of imported pig iron. On the other hand, local iron ore producers are having market difficulty with more strict specifications from foreign iron ore consumers. To help relieve these problems and promote both iron ore and iron and steel industries of the country, the Bureau of Mines initiated a research on the production of sponge and direct iron which will replace part of the scrap iron requirement of steel producers.

A. F. J. SAN MIGUEL, L. O. PEDRON and G. C. MAGKAWAS;1963;*Direct reduction of pyrite cinder to produce sponge iron*;RI-50;1-16
Metallic Mineral Deposits;
The iron and steel industry in the Philippines consists of reshaping or refining imported semi-finished material and limited melting and/or refining of local scrap. The industry is handicapped by the absence of significant smelting operation to provide local producers with its basic raw material pig iron. Currently, the industry is faced with the graved problems of short supply of scrap and increased cost of imported pig iron. To contribute towards relieving these problems, the Bureau of Mines in August 1961 started small scale tests on a research project on direct reduction processes to produce sponge iron suitable to replace part of scrap iron requirement of the iron and steel industry.

J. U. SANTIAGO;1964;*The investigation on the occurrence of stibnite in Lucbuan and iron deposit in Bacungan, Puerto Princesa, Palawan*;PW-438;3
Metallic Mineral Deposits;
The Bacungan Iron Deposit is underlain by metavolcanic rocks which exhibits pillow structures and amygdules. Most of the iron mineralization are hematite, either granular or platy (specular) and limonite. the heavier specimens are partly magnetic or weakly magnetic. The lateral extent of the deposit was not seen.

T. M. SANTOS;1977;*Trends shaping future patterns of trade in iron ore*;Journal of the Geological Society of the Philippines;31;2;
Metallic Mineral Deposits;
No abstract

A. T. SANTOS, S. T. PARAGAS and R. J. L. VELASCO;1982;*Environmental impact of a small scale mining operation - A case study conducted at Hinatuan Mining Corp. at Hinatuan island ,Surigao del Norte.*;SR-5002;23
Metallic Mineral Deposits;Environmental Geology
Conclusion: It is a fact that the mining activities of the company to a certain degree will have a significant effect on the environment. The major positive impacts include the creation of job opportunities, the growth of industries other

than the mining, payment of taxes to the local and national government and the generation of the much needed foreign exchange earnings thru experts of nickel ore. On the other hand, the major negative impacts are changes in topography of the area where actual mining takes place, the destruction of surface cover and the erosion of silted materials into the Sanug Strait. Except for the siltation and erosion that occurs as a result of the operation, the major negative impacts of the project are local in scope. Furthermore, siltation and erosion as well as the other negative impacts can be remedied/minimized with proper safeguard by the company. While we cannot give a monetary value on the major negative effects, it is our belief that with proper environmental safeguards, the positive impacts far outweigh the negative ones. Furthermore, we feel that a small scale mining operation such as the resource extractive project of the company in effect does not pose a major threat to cause geological imbalance to be classified under environmentally critical projects. And also, classification of small scale mining operation whether it falls under environmentally critical projects should depend on but not limited to the kind of minerals to be mined, beneficiation processes involved, mining methods used and the relative location of the proposed action which may run in conflict with established national environmental plans, goals and policies.

L. M. SANTOS-YÑIGO;1953;*The geology of iron ore deposits of the Philippines*;The Philippine Geologist;7;4;
Metallic Mineral Deposits;
The principal Philippine iron ore deposits are distributed mainly along the eastern rim of the archipelago, although a few small deposits are found in the central and western part. The deposits studied thus far may be classified under three main genetic types, namely: 1) Pyrometasomatic-hydrothermal deposits, 2) Residual deposits of lateritic type, and 3) Sedimentary deposits. The majority of the deposits fall under the first group, but the largest reserves by far are found in deposits of the second group. Sedimentary ores are relatively unimportant.

L. M. SANTOS-YÑIGO;1961;*Geology of the Landayao iron deposit at Tupi, Cotabato Province*;The Philippine Geologist;15;4;
Metallic Mineral Deposits;
No abstract

L. M. SANTOS-YÑIGO;1965;*Distribution of iron,alumina, and silica in the Pujada laterite of Mati,Davao Province, Mindanao Island,Philippines*;The Philippine Geologist;19;4;
Metallic Mineral Deposits;
The alumina-bearing nickeliferous iron laterites on the Pujada Peninsula have resulted from the weathering of a saxonitic peridotite.Preliminary exploration hand auger drilling and test pitting of the northern one-third of the laterized terrain have yield samples which indicate that the average nickel content is comparable to that of the Surigao ore,but its iron content is lower by a few percent. However, this is conpensated by higher alumina concentrated in the

upper portion of laterite mantle. Initial geologic mapping and laboratory study of the physical and chemical characteristics of meter samples from selected auger holes and tested pits showed that the high-level laterites (above 500 meters altitude) possesses characteristics distinct from those found at lower levels.The former are thicker and of lighter color compared to the low-level deposits.They also carry relatively more iron,nickel,chrome, and less silica and alumina compared to the latter deposits. Systematic auger drilling and sampling of the alumina enriched crust subsequently conducted on a 200-meter grid system,permitted closer study of the distribution of iron,alumina, and silica within two explored areas in relation to ore thickness and topography.These variations are adequately expressed in countour diagrams.

L. M. SANTOS-YÑIGO;n/i;*The geology of iron ore deposits of the Philippines*;PHIL-42;74
<u>Metallic Mineral Deposits;</u>
The principal Philippine iron ore deposits are distributed mainly along the eastern rim of the archipelago, although a few small deposits are found in the central and western part. the deposits studied thus far may be classified under three main genetic types, namely: (1) pyromatasomatic-hydrothermal deposits, (2) residual deposits of lateritic type, and (30 sedimentary deposits. The majority of the deposits fall under the first group, but the largest reserves by far are found in deposits of the second group. Sedimentary ores are relatively unimportant. This paper discusses the geology of the ore deposits briefly and is accompanied by regional and detailed maps which show their geographical distribution and essential geologic features. Production statistics, analytical data, and ore reserve figures are also presented.

J. Z. J. TABIOS and S. B. I. BERNARDO;1980;*Evaluation of iron-manganese ore stockpile in Bo. Submakin-Batobalani, Paracale, Camarines Norte*;CN-2072;10
<u>Metallic Mineral Deposits;</u>
From its configuration, computation of volume and tonnage were based on the assumption that the stockpile approaches that of a tabular many-sided polygon.

TASK FORCE EASTERN SAMAR;1977;*Description of chromite, coal, and iron prospects in McArthur, Giporlos and Salcedo Eastern Samar*;SA-1740;14
<u>Fossil Fuels(Coal,Oil and Gas);</u>
The region is generally underlain by Pre-Tertiary volcanic flow mostly spilitic basalt which is believed to be the basement rock in the area. At the south and northwestern parts, thrusted ultramafic rock, which is mostly serpentinized due to the intrusion of gabbro is widespread. Pleistocene argillaceous sandstone heavily loaded with marine megafossil was mapped in the southeastern portion of McArthur Quadrangle and at the northeastern side of Guiuan Quadrangle in unconformably underlain with ultramafic body. Within the serpentinized ultramafic rock, chromite floats and in-place deposits were observed to be associated with serpentinized peridotite rock. Iron, in the form of limonite, was likewise encountered to be underlain by the thrusted ultramafic rock. Coal bed

interstratified with siltstone was observed in the central portion of McArthur Quadrangle. The area is also suited for residual nickel deposits.

M. H. TUPAZ;1951;*Ore reserves and ore possibilities of Marinduque Iron Mines, Mogpog, Marinduque*;MR-14;28

Metallic Mineral Deposits;

The deposits consist mainly of magnetite in a tactita or amphibolite-host rock, belongs to high-temperature type. The mine has a positive ore reserve of 67,250 MT.

M. H. TUPAZ;1952;*The iron deposits in the claims of Busran Mining Corporation, barrio Midsalep, Aurora, Zamboanga del Sur*;ZM-111RA;6

Metallic Mineral Deposits;

The area west-northwest of the presently known westernmost deposits must be prospected to discover more areas overlain by abundant float or more ore-in-place. If more deposits are found, the deposits can again be examined for proved and possible ore. If the new tonnage estimates suggest that at least fifty thousand tons of ore may eventually be proved, development work can be undertaken. Before, or concurrently with, development work, the general area of the deposits must be geologically mapped.

M. H. TUPAZ;n/i;*Report on the iron deposit in Donsolihon Lumbia, Misamis Oriental*;MI-803;4

Metallic Mineral Deposits;

The writer believes that the present deposit is not mineable- the tonnage , which is measurable in a few hundred tons at the most, is insufficient , and the concentration of float is so sparse that the cost of mining would be prohibitive. Furthermore, it is extremely unlikely that a sizable body of iron ore in place exists in the vicinity of the present deposit.

E. VALLESTEROS, Y. and C. V. RAMOS;1967;*Memorandum report on the geological investigation of the Balbalisi iron and copper prospects Piddig, Ilocos Norte*;ILN-692;14

Metallic Mineral Deposits;

The geological investigation of the Balbalisi iron and copper prospect is preliminary in nature. The studies made without benefit from any initial exploratory work are admittedly incomplete, however the information gathered provide good grounds to arrive at the following generalized observations. Most of the iron and copper mineralizations are classified as pyrometasomatic replacement type deposit. The iron bodies contain massive to porous fine-grained magnetite and hematite, the latter occurring largely as specularite. The mode of occurrence of the iron minerals is similar to those iron prospects investigated by Malicdem, in Cabittauran, Nueva Era, Ilocos Norte and perhaps those iron deposits studied by Fernandez, in Lammin, Piddig, Ilocos Norte. Primary copper minerals unevenly replaced the skarn and some of the iron minerals. Secondary copper minerals are noted locally as veinlets in the magnetite-hematite lenses. The iron and copper mineralizations are apparently disposed along the northeast fault which probably exercised structural control to the orebodies localization. Secondary copper enrichment are apparently enhanced by almost north-south tracing and steeply dipping fractures. The iron and copper mineralization are probably related to diorite intrusion.

X. WAN, M. A. LAMOLDA and C. Wang;1997;*Upper Cenamonian-Lower Turonian foraminiferal assemblages from southern Tibet: the responses of the biota to oceanic environmental change*;Journal of the Geological Society of the Philippines;52;3 & 4;

Paleontology;Stratigraphy

Foraminiferal assemblage changes indicate that an oceanic event occured in southern Tibet during the Cenomanian-Turonian transition. By studying foraminiferal abundance and diversity, planktonic and benthic foraminiferal ratios, and the ratio of keeled and non-keeled planktonic foraminifera, it is proposed that the onset of oxygen-depleted conditions began in the upper part of the R. cushmani zone, followed by the acme of the OAE in the lower part of the W.archaeocretacea Zone. Oxygenated waters gradually returned in the Turonian

W. S. WRIGHT, R. B. QUICHO, L. M. SANTOS-YÑIGO, A. SALAZAR and M. D. MANIGQUE;1958;*Iron-nickel-cobalt resources of Nonoc, Awasan, and Southern Dinagat Islands in Parcel II of the Surigao mineral reservation, Surigao, Mindanao*;Special Projects Series-17;1-276

Metallic Mineral Deposits;

Roughly 4500 hectares of land within the bounds of Parcell II of the Surigao Mineral Reservation is balnketed to depths of 1 to 18 meters by nickel-bearing ferruginous laterite, a porous residual material underlain by serpentinite from which it is derived. Normally the subjacent partially decomposed serpentinite is enriched by secondary nickel silicate to depths ranging from 0.5 to 15 meters below the laterite-serpentinite contact. Test pitting and auger drilling at 100-meter intervals, over 2500-hectare portion of this area, embracing the laterites of Nonoc, Awasan and Southern Dinagat islands, proved that 97 percent of the penetrated material contains enough iron, nickel and cobalt to warrant exploitation. Estimated ore reserves are classified according to grade as follows: (1) iron ore - 104 million metric tons containing 47.55 percent iron and 0.79 percent nickel, plus (2) iron-nickel ore - 26 million metric tons containing 43.36 percent iron and 1.48 percent nickel, plus (3) nickel ore - 13 million metric tons containing 14.91 percent iron and 1.70 percent nickel. Pyrometallurgical tests by the U.S. Bureau of Mines on 300 tons of typical Nonoc ore show by controlled carbothermic reduction in electric furnaces that a 90 percent recovery of nickel and an 80 percent recovery of cobalt can be expected from all ores, and that 80 percent of the iron in "iron ore" and "iron-nickel ore" can be recovered and processed into low-alloy mild steel of commercial grade. Recoverable iron amounts to 48.5 million metric tons; recoverable nickel, 1.412 million short tons; and recoverable cobalt, 99,000 short tons. The recoverable metals have a gross value, based on U.S. market prices as of September 1958, of more than $6 billion, or P12 billion. Each dry short ton of ore, when processed, would yield P85.83 ($42. 91) worth of metal in nickel, cobalt and steel.

The investment capital including an initial operating fund required for a 2000-tpd mining and processing plant is estimated to amount to P105, 321, 000 ($52, 660, 500), about 50 percent of which would be in foreign currency. The amount and unit cost of major expense items required in mining and processing one ton of ore are: (1) electric power - 1629 kw-hr at P0.0108 per kw-hr, (2) reductant (coal) - 0.347 ton at P25.00 per ton, (3) electrode (soderberg paste) - 28.145 lb at P0.115 per lb, (4) electrode (graphite) - 1.66 lb at P0.40 per lb, (5) fuel (bunker, diesel, gasoline) - 13.8 gal at P0.28 per gal, (6) labor - 0.63 man0days at P9.45 per man-day. All operating costs from land clearing to marketing including amortization and overhead amount to P68.41 ($34.21) per short ton of ore. The steel production from a 2000-tpd plant would be about 228,000 short tons yeraly which is very close to the current (1958) annual rate of steel consumption in the Philippines.

R. R. ZERDA and M. E. MARCELO;1970;*Geologic investigation of Mataque, iron copper prospect, Capalonga, Camarines Norte*;CN-970;12

Metallic Mineral Deposits;

Mineralization in the area is confined within fault and shear zones. Their preference along these structures aided greatly in visualizing the probable extension of mineralized areas. Iron and copper are mutually associated in a number of outcrops although the majority of outcrops exhibit mainly iron mineralization. Recognized mineral suite are hematite-magnetite-pyrite, chalcopyrite with minor bornite and probably chalcocite.