

Large Scale Mineral Exploration and New Mining Development Prospects in Indonesia*

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Abstract: Since the outbreak of the Pacific War until 1967, no large scale and systematic mineral exploration activities were carried out in Indonesia. With the changes of the political situation and the Government's economic policy since then, international companies became interested in the development possibilities of the country's natural resources. Anticipating that major international companies would welcome the opportunity of undertaking large-scale mineral exploration in the mostly still unprospected parts of the country, the Indonesian Government adopted an unconventional exploration concept, to make up for lost time.

In addition to tenders that had been issued earlier for the exploration and development of the tin resources in the western part of the archipelago and the extensive lateritic nickel deposits in several regions in the eastern part of the country, the Government at the end of 1967 issued a worldwide announcement that competitive bidding was open for private companies for the exploration of 53 separate units of potential mineral-bearing land, each averaging 9,000 to 10,000 square kilometers.

Positive responses were received from quite a number of major foreign companies. Selected companies are granted exclusive exploration rights and exploitation rights as well, in case exploration leads to the discovery of one or more commercially exploitable mineral deposit or deposits. Companies who are granted exclusive exploration rights are obliged to submit to the Government quarterly progress reports on the results of their exploration activities and geological maps of the investigated areas on the scale of 1:250,000 together with attendant reports.

Under such mutually attractive arrangements, there were until the end of 1971, 14 foreign companies carrying out large-scale mineral exploration programmes in various parts of Indonesia. Their activities, employing modern mapping and exploration techniques, covered a total area of 400,000 square kilometers not including exploration for oil and gas.

While the ultimate purpose of these exploration programmes is the eventual development of economic mineral deposits, the intermediate but not the least important gain for the Government is the invaluable collection of geological and mineral exploration data assembled by private companies.

INTRODUCTION

Many developing countries today face numerous common problems in developing their mineral resources. Perhaps the most serious and universal problem, however, is that of obtaining adequate resources to finance the costly and risky systematic exploration and development of their mineral potential.

For Indonesia, a country consisting of more than 3,000 tropical islands spread over an area larger than western Europe, geographical conditions pose added problems involving communications and general logistics. But given the right political and investment climate, those seemingly endless problems are not unsolvable. Benefitting from the experience of others, including the application of modern technology to mineral exploration, Indonesia has since 1967 adopted an unconventional policy to speed up the assessment of its mineral resources and is presently making up for the arrears caused by many years of neglect.

* This paper does not include developments in the Indonesian petroleum industry.

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HISTORICAL REVIEW

Despite being considered primarily an agricultural country, Indonesia's geologic setting and mineral potential has for sometime attracted considerable international interest. Centuries ago the Hindus from mainland Asia mined gold in Indonesia, their old Sanscrit documents mentioning Sumatra as an island rich in gold. As early as the end of the 16th century European seafarers, which included the Portuguese, Spaniards and Dutch, recognized the economic importance of the Indonesian archipelago as a producer of both invaluable spices and precious metals, including gold.

Beginning in the early 17th century the entire Indonesian archipelago was brought progressively under Dutch control. During the 300 years of their rule, the Dutch succeeded in developing the greater part of the "Netherlands East Indies" into one of the world's richest colonial possessions. The real wealth of the country consisted of agricultural products, but efforts were also made to develop its petroleum and mineral resources. The success of these efforts, which became evident in the first quarter of this century, was for the greater part a result of the "open-door policy" toward investment adopted by the Dutch Government at the end of the 19th century. As a result, petroleum and mineral production became increasingly more important so that by 1939, i.e. two years before the outbreak of the Second World War in the Pacific, petroleum and minerals products accounted for about 30 percent of Indonesia's total exports.

Table 1 illustrates in brief the history of mineral development in Indonesia and Indonesia's pre-war mineral production.

Table 1. Historical Review of Mineral Development in Indonesia

Mineral	Year of first Discovery/Earliest Records	Start of first regular production in Indonesia	Production in 1940	Indonesia Locality/Mines
Tin	Before 1700, Bangka Island	1710 (Bangka) 1851 (Belitung) 1887 (Singkep)	44,400 kg ton	Bangka, Belitung, Singkep.
Bauxite	1925, Bintan Island	1935 (Bintan Island)	275,000 kg ton	Bintan.
Nickel	1916, in S.E. Sulawesi	1938 (S.E. Sulawesi)	55,000 kg ton	S.E. Sulawesi.
Manganese	1854, Java	1932 (West Java)	11,900 kg ton	West Java, Central Java.
Rock asphalt	1909, Buton Island	1926 (Buton)	5,383 kg ton	Buton.
Gold	Before 700 Java	Before 700 (Java)	2,798 kg ton	Sumatra, Kalimantan, N. Sulawesi, Java.
Silver	?	?	46,847 kg	-do-
Coal	ca 1825 (?) Java	1846 (1849?) (S.E. Kalimantan)	2,001,000 kg ton	Sumatra, Kalimantan.

Table 2. Mineral Production of Indonesia*

Mineral	1940	1966	1970	1971	Unit
Tin	44,400	12,769	19,090	19,765	kg ton
Bauxite	275,000	701,223	1,229,175	1,237,610	kg ton
Nickel ore	55,500	117,402	600,000	900,000	kg ton
Gold	2,798	128	237	329	kg
Silver	46,847	6,867	8,800	8,876	kg
Manganese	11,900	990	10,837	n.a.	kg ton
Rock asphalt	5,383	13,905	61,483	n.a.	kg ton
Iron sand	—	—	—	270,900	kg ton

* Petroleum and Coal not included.

Then came the Second World War, which destroyed the greatest part of what had been built during so many years, followed by political instability and an unfavorable investment climate which persisted for almost a quarter of a century. Thus, while in other parts of the world new mining projects were developed based on spectacular mineral discoveries, conditions in Indonesia were such as to cause a general decline in mining activities. Rehabilitation and modernization of existing mines were hampered because of lack of national capital and domestic savings, but worse, there was no encouragement for private investment, domestic or foreign. Geological mapping and mineral exploration were almost non-existent, except for a few Governmental projects.

Status of Mineral Exploration Until 1967

When the Second World War broke out in the Pacific and in fact for the 25 years that followed, our knowledge on the mineral potential of Indonesia was limited. Of a total land area of more than 1,900,000 square kilometers, only about five percent had been mapped geologically in some detail, about 75 percent had been only cursorily reconnoitred, while the remaining 20 percent was still completely *terra incognita*. Practically nothing was known of the offshore regions, except for those shallow coastal areas surrounding the Indonesian tin producing islands (Bangka, Belitung, Singkep) which were explored for their tin potential.

Apart from the mineral fuels, Indonesia's known economically exploitable mineral resources of significance consisted of a bare two minerals: tin and bauxite. Only deposits of these two minerals have been proven to be substantial enough in size and grade to support large scale mining operations. Indeed, many of the small concentrations of mineral throughout the country were exploited, some in a rather primitive way using the handselection method and limited to high-grade material. But these small prospects and the numerous, but largely unexamined indications of mineral occurrences known to exist throughout Indonesia, by no means constitute what can be regarded at present as known mineral wealth.

On the other hand, however, there are reasons for optimism regarding the possibilities of extensive explorations revealing the presence of economic mineral deposits.

Firstly, many mineral occurrences which have never been adequately investigated or occurrences which may indeed have been investigated 25 to 50 years ago with negative results may still warrant reevaluation. Modern mining techniques, mineral extraction and metallurgical processes, and market conditions may have changed completely the economics of developing certain mineral deposits within these last 10 to 20 years. Secondly, there are large areas in West Irian, Kalimantan, Sulawesi and parts of Sumatra, in which geological reconnaissance work in the past has indicated that the general geological conditions therein are favorable for the occurrence of mineral deposits. Remoteness, ruggedness of terrain and heavy forest cover were the main obstacles in carrying out surveys in the past. Now, however, by employing modern prospecting and exploration methods, supported by adequate budgets, those previously inaccessible areas may open up new perspectives.

MINERALIZATIONS PATTERNS

It has since long been recognized that the distribution of mineral occurrences in Indonesia follows well established orogenic patterns. The post Triassic, presumably Jurassic, granite batholiths in the western part of the archipelago produce tin in the Riau Islands, Bangka and Belitung. In varying proportions wolframite and monazite occur together with cassiterite in the granites of this potentially very rich tin belt. Changing in character from acid to a more intermediate composition, the eastward extension of these granite batholiths in southwestern and western Kalimantan yield primary deposits of gold, copper, iron, molybdenite, antimonite, zinc and lead. In addition to this widespread mineralization, bauxite and aluminous laterites occur in this region as a product of weathering and lixiviation of the underlying rocks.

Associated with the late Cretaceous orogen which comprises the greatest part of the pre-Tertiary mountain system in Sumatra are iron, lead, zinc, gold and silver deposits in the Barisan Mountain range of Sumatra and diamond, gold and platinum occurrences derived from the Meratus Bobaris Mountains in southeastern Kalimantan. Of importance are also the extensive deposits of nickeliferous iron ore formed by lateritic weathering of the ultrabasic rock in southeastern Kalimantan and the island of Sebuk.

In the zone of Miocene volcanism and plutonic activity in the western coast ranges of South Sumatra, the Southern Mountains of Java and the western arc of Sulawesi gold-silver veins are numerous, sometimes accompanied with a little copper, lead and zinc. Manganese deposits are widely distributed in limestone beds lying in or upon the younger Tertiary volcanic rocks. In Flores and southwestern Sulawesi, sizeable but scattered bodies of pyrometasomatic iron ore are related to this Miocene magmatism.

Of great importance are the lateritic iron and residual nickel ore deposits resulting from the weathering of the gabbro-peridotitic rocks in eastern and southeastern Sulawesi which are related to the upper Cretaceous-lower Tertiary orogen of the Timor-Seram-East Sulawesi arc. Similar deposits are found on the island of Halmahera and surroundings, on the island of Waigeo and surroundings, and in some parts of northern West Irian.

Younger Tertiary acid and intermediate igneous rocks, exposed in the central mountain range of West Irian, are known to contain copper, gold and silver; the high-grade copper deposit of Ertsberg is an example.

Given these geological patterns, it was not unreasonable to assume that large international companies would welcome the opportunity of undertaking large scale systematic prospecting and exploration programs in various parts of Indonesia.

RECENT DEVELOPMENTS AND NEW EXPLORATION CONCEPTS

Following the issuance of the Foreign Capital Investment Law in 1967 the Government decided that new and unconventional approaches had to be adopted to assess, as soon as possible, the potential of Indonesia's mineral resources. It was fully realized that the development of mineral resources could not only help generate the badly needed foreign exchange to improve the national economy, but that it could also assist in stimulating desirable social and industrial development, especially in the less developed areas of the archipelago outside the over populated island of Java.

It was soon decided that the quickest way to get large scale mineral prospecting and exploration going was to let international mining companies participate in the program. This approach called for a policy of close co-operation between the Government and private investors.

At the end of 1967, the Government launched a worldwide announcement soliciting competitive bids from private companies for the exploration of 53 separate units of potential mineral bearing land in various parts of the country, each averaging 9,000 to 10,000 square kilometers. This most unusual governmental action was part of its mineral exploration policy that included the issuance earlier in the year of two other international tenders for the exploration and development of tin resources in the western part of the archipelago and the extensive lateritic nickel deposits in several regions in the eastern part of the country.

A number of major international mining companies responded positively to these tenders. Under the system of what has come to be called a "contract of work" with the Government, selected companies are granted exclusive mineral exploration and exploitation rights. The total time allowed for a company to carry out its survey and exploration program is 12 months for general prospecting, 36 months for exploration, and 12 months for feasibility studies, with possible extensions upon request of up to 12 months for the prospecting period and up to 24 months for exploration. In case of economic mineral discoveries, the company is allowed an additional period of 36 months to construct the necessary mining and mineral processing facilities and a trial operation period of up to six months.

During the general prospecting, exploration and feasibility study periods, the company must reduce gradually the size of its contract area by periodically relinquishing some of the non-prospective parts of the area.

The company is required to spend a minimum of US\$10.00 per square kilometer per year during the prospecting period and US\$100.00 per square kilometer per year during the exploration period. The company is further obliged to submit to the Government quarterly progress reports on its prospecting and exploration activities and a geological map of the investigated area or areas on the scale of 1:250,000 with related reports. Depending on the methods used and the nature of the investigations, such data to be submitted to the Government may include copies of logs of drill holes and testpits, representative rock and ore samples, assay results with respect to any analyzed samples, aerial photographs, and copies of topographical and geological maps.

Table 3. Large Scale Mineral Survey and Exploration Projects in Indonesia,
1967-1971
(Excluding Petroleum and Coal; see attached Map)

Project	Total Area (square km.)	Investigated Regions	Company (Consortium)
Nickel	107,500	1. Central and S.E. Sulawesi.	—International Nickel Indonesia (INCO).
		2. Northern Maluku.	—Indonesian Nickel Development Co. (Consortium of: Fuji Iron and Steel Co. Ltd., Mitsubishi Shoji Kaisha Ltd., Mitsui & Co. Ltd., Nippon Mining Co. Ltd., Nippon Yakin Kogyo Co. Ltd., Pacific Nickel Co. Ltd., Sumitomo Metal Mining Co. Ltd., Sumitomo Shoji Kaisha Ltd., and Yawata Iron and Steel Co. Ltd.)
		3. Waigeo and surrounding islets, Mt. Cyclops (West Irian).	—Pacific Nikkel Indonesia (Consortium of: United States Steel Corporation, Koninklijke Nederlandsche Hoogovens en Staalfabrieken N.V., Wm. H. Muller & Co. N.V., Newmont Mining Corporation and Sherritt Gordon Mines Limited.)
Tin	30,000	1. Offshore area between Bangka and Singkep Islands and Karimata Island surrounding off-shore area.	—Billiton Maatschappij.
		2. Primary tin occurrences, Belitung Island.	—Broken Hill Pty. Indonesia.
		3. South Bangka, including offshore.	—Koba Tin (Consortium of: Colonial Sugar Refining Co. Ltd., Blue Metal Industries Ltd. and Ready Mixed Concrete Ltd.).
Bauxite	125,000	N. Sumatra, Bangka, Riau Archipelago, West Kalimantan, S.E. Kalimantan, Central Java, Sumba, Muna.	—Alcoa Minerals of Indonesia (ALCOA).
General Mineral Exploration.	137,500	1. Tapanuli Area and Northern West Sumatra.	—Overseas Mineral Resources Development Co. (Japan).
		2. West Sumatra, Western Djambi and Northern Bengkulu.	—Riotinto Bethlehem Indonesia (Consortium of: Rio Tinto Zinc Corp., England, and Bethlehem Steel Corp., USA).
		3. Southern West Sumatra and Bengkulu.	—Kennecott Indonesia (Kennecott Copper Corp.).
		4. South Central Java.	—Kennecott Indonesia (Kennecott Copper Corp.).
		5. Central North Sulawesi.	—Tropic Endeavour Indonesia (Consortium of: Tropic Mineral Holding N.L. and Endeavour Minerals N.L.).
		6. Eastern Central Mountain Range of West Irian.	—Kennecott Indonesia (Kennecott Copper Corp.).

A little more than four years have passed since the Government announced the tenders for large scale mineral explorations in Indonesia. So far a total area of some 400,000 square kilometers is covered by prospecting and exploration activities em-

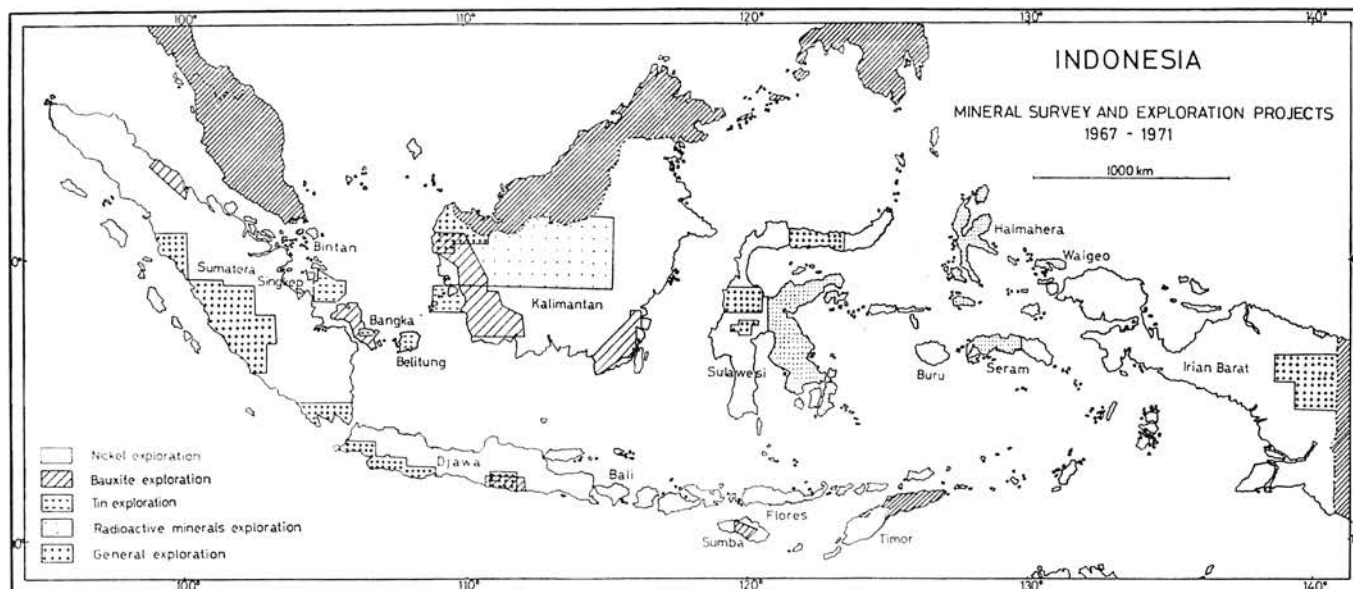


Fig. 1. Map of Indonesia showing the areas covered by prospecting and exploration activities (1967-1971).

ploying all sorts of modern techniques. Investigations for nickel ore cover a total area of 107,500 square kilometers; for tin 30,000 square kilometers; for bauxite 125,000 square kilometers; and, for general mineral explorations 137,500 square kilometers (see Table 3). Fourteen foreign enterprises, involving more than two dozen major international companies, are engaged in these activities. In addition, the Government of Indonesia, working through the Indonesian Geological Survey and the National Atomic Energy Agency (BATAN) partly in cooperation with agencies of other governments—have engaged 116,500 square kilometers for general mineral prospecting and 175,000 square kilometers for radiometric mineral survey (see Fig. 1).

OUTLOOK

Given the proper development climate and the general high level of interest in Indonesia's mineral resources, it is reasonable to assume that mineral exploration in Indonesia will intensify in the near future and that mineral production, which has increased gradually since 1966 (see Table 2), will continue its upward trend, provided market conditions are favourable.*

At least one project initiated since 1967 will start up soon; in the first quarter of 1973 Freeport Indonesia, Inc. will begin production from its Ertzberg Project in West Irian at an annual rate of 250,000 tons of copper concentrate (25% Cu). Other projects in Southeastern Sulawesi and the Waigeo area, West Irian, are in the feasibility study stage for the development of low-grade lateritic nickel deposits, including the establishment of multi-million dollar nickel processing plants. Three years of country-wide bauxite prospecting have resulted in the discovery of extensive deposits of aluminous laterite and bauxite in West Kalimantan. For many of the other projects now under way, it will take another two or three years before definite results are available.

Reviewing all these activities and developments in the field of mineral resources, one has to conclude that Indonesia is rapidly moving from its former position of one of the least explored to one of the most extensively investigated countries in the world today.

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* In addition to the minerals shown in Table 2, Indonesia's petroleum production almost doubled within the last five years, from 170,706,067 barrels in 1966 to 325,157,450 barrels in 1971, and petroleum exploration is now taking place in virtually all offshore areas of the entire archipelago.