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GEOLOGIC RESEARCH IN INDONESIA

by

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U. S. Geological Survey

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INTRODUCTION

Indonesia offers unparalled opportunities for geological research in the fields of volcanology, seismology, plate tectonics, geomorphology, and many other fields. A nearly complete lapse in geological research for three decades multiplies the opportunity for making original earth science contributions. Fruitful research problems in an area uncrowded by research geologists may be found in Indonesia. The following information was compiled while the author was on temporary duty from February 1970 to March 1972, assigned to the geologic program being undertaken cooperatively by the Geological Survey of Indonesia (GSI) and the U.S. Geological Survey (USGS), under the auspices of the Government of Indonesia and the Agency for International Development, U. S. Department of State.

SOURCES OF DATA

The following Indonesian institutions can provide information useful to the geologist. All have staff members who speak English.

1. Departemen Pertambangan (Ministry of Mines)
   Djl. Merdeka Selatan 18
   Jakarta

2. Direktorat Geologi (Geological Survey of Indonesia)
   Djl. Diponegoro 57
   Bandung

3. Perusahaan Tambang Minjak Nasional (PERTAMINA, the National Oil Enterprise)
   Djl. Perwira 4-6
   Jakarta

4. Lembaga Minjak dan Gas Bumi (LEMIGAS, the Indonesian Oil and Gas Institute)
   Tjipulir, Kebajoran-Lama, Jakarta
   Post Office Box 22 KBB

5. Perusahaan Negara Aerial Survey (PENAS, National Aerial Surveys)
   Djl. Patrice Lumumba, Kebajoran
   Jakarta

6. Institut Teknologi Bandung (ITB, Bandung Institute of Technology)
   Djl. Ganeca 10, Bandung
   Bagian Geologi = Department of Geology)

7. Universitas Padjadjaran (UNPAD, Padjadjaran University)
   Djl. Dipati Ukur 37
   Bandung

8. Universitas Gadjah Mada (Gadjah Mada University)
   Djl. Sitihinggil
   Jogjakarta

Geologic information can also be obtained from foreign companies currently operating in Indonesia. The names of petroleum companies can be obtained from PERTAMINA and the names of mining companies can be obtained from the Ministry of Mines.

Most of the literature on the geology of Indonesia is in Dutch, but a majority of the significant reports published since 1940 are in English. Anyone seriously interested in researching the literature on Indonesia should begin by consulting the guides listed below and the partial bibliography of papers in English at the end of the present report. Unpublished reports filed in the library of the Geological Survey of Indonesia in Bandung are a largely untapped resource. Many of them have been translated into English. Although these reports are listed in the library by author, area, and topic, the catalogs are difficult to use, and, unless a very thorough search is made, important reports can escape notice.

Bemmelen, R. W. van, 1949, The geology of Indonesia: Government Printing Office, The Hague. This contains an extensive bibliography. A 1970 printing contains a bibliographic supplement dated 1969. Neither of these bibliographies is complete.

Decker, R. W., 1961, Geophysics in Indonesia 1921-1961: Madjelis Ilmu Pengetahuan Indonesia, Penerbitan 2, p. 67-97. This report contains extensive bibliographies on both the geology and geophysics of Indonesia.

Purbo-Hadiwidjojo, M. M., 1970, Dokumentasi Bidang Geologi Indonesia (Documentation on the geology of Indonesia): Direktorat Geologi special publication no. 4. This report contains a summary in English of the history of publications on the geology of Indonesia and is followed by a list of bibliographies. Copies can be obtained from the Geological Survey of Indonesia in Bandung for US $ .50 each.

BASE MAPS AND AERIAL PHOTOGRAPHS

Ozalid prints of topographic contour maps of parts of Indonesia are available from the Geological Survey of Indonesia. Although these maps were made before 1940 by ground-survey methods, many of them are of very good quality. Index maps showing topographic map coverage at various scales can be examined at the Geological Survey headquarters in Bandung.

Aerial photographs of much of Indonesia are available and the coverage is being rapidly extended. Information on the coverage can be obtained from the Geological Survey in Bandung and from PENAS in Jakarta; however, data from these sources may not always be completely up to date. Information on the most recent photographic coverage should be sought from aerial survey contractors whose names and addresses can be obtained from PENAS and from private petroleum and mining companies.

EQUIPMENT AND SUPPLIES

Field cars should have four-wheel drive. Canvas cabs are more comfortable and convenient than all-metal cabs because they can be kept open for ventilation and easy entry and exit. So long as the driver stays with the car there is little need for an all-metal, lockable cab. Extra spare tires should be kept on hand because they are hard to obtain outside principal cities.

Recommended field equipment for general geologic work consists of the usual back pack, cloth sample bags, hammer, Brunton compass, dropper bottle for acid, hand lens, and notebook case. In some areas a machete is useful. For overnight trips a pack large enough to hold an inflatable or foam mattress and small tent is needed. For one-day trips a small pack will usually do. Sleeping bags are needed only in the highest mountains. Soft packs are preferred because rigid, projecting frames tend to catch on dense vegetation. Cloth sample bags are preferable to plastic because they permit the samples to dry out and they are easy to label. However, if cotton bags are not stored where they can dry there is danger they will mold and fall apart. Late model Brunton compasses are made with rubber gaskets which make them nearly water-proof, a very desirable improvement. Compass needles must be compensated for the difference in magnetic inclination between the place of manufacture and equatorial area. This is best done by winding the high end of the needle with enough fine copper wire to make it balance horizontally.

For most areas shorts, short-sleeve shirts and canvas shoes are comfortable and are recommended. Long pants, long-sleeve shirts, and hats, though uncomfortably hot, are recommended for those unused to working in the sun. Long pants should be without cuffs which collect sediment. Low-cut canvas shoes tend to collect sand a little more readily than do high shoes, but they are more easily taken off to empty; canvas shoes with coarse treads are much preferable to those with fine or smooth treads. Leather boots offer more protection than canvas shoes, and they commonly have better treads, but they tend to be heavy when wet and stiff when dry. Both leather and cotton shoes wear out rapidly as a result of being constantly wet. Nylon tropical combat boots are good.

Canned food should be taken on overnight trips unless it is certain that cooked food can be obtained without difficulty. In any case westerners usually find it more satisfactory to take a can along for lunch than to rely on leftovers from breakfast. It is advisable to have on hand a supply of medicine such as lomotil and tetracycline for diarrhea, and anti-malaria pills, aspirin, and mercurochrome.

FIELD CONDITIONS

The commonly held belief that rock exposures in tropical regions are inadequate for general geologic investigations is unfounded in the case of Indonesia. For map scales of 1:50,000 and smaller, the exposures in Indonesia are entirely adequate. For very large scale mapping, however, the density of good exposures may leave something to be desired. Although the exposures along some trails are useful, 90 percent of the good exposures are found in the beds and banks of streams.

The principal cities of Indonesia are linked by airways and can be reached readily by daily flights from Jakarta. In some provincial towns it is possible to rent four-wheel-drive vehicles for field excursions. However, most of those available are in poor condition and expensive. Motor bikes may be useful in some areas where most of the work is to be done near roads, and they can be used in a few areas on trails in the dry season. Many trails, however, are too steep or slippery for efficient use of bikes, and most trails are crossed at frequent intervals by streams which must be forded. Beyond the end of the road there are three modes of transportation: by boat, on horseback, and on foot. Dugout canoes can be rented or purchased for trips on some of the medium-size streams. Larger boats, usually motor driven, can be rented for use on some of the principal rivers, along coasts, and between islands but are expensive. Riding horses and pack horses are available in many villages; however most of the horses are too small to carry oversize westerners. Ultimately, it is necessary to walk, and this is usually when one begins to see the geology. Trails connect every village with its neighbors, but in some areas

there are so many trails that a local guide must lead the way. Nearly all small to medium-size streams can be waded. Although wading is a slow process, it can't be overemphasized that nearly all the good clean outcrops are in the beds and banks of streams. Moreover, wading in many jungle streams is a cool, pleasant experience not to be missed by anyone.

The towns and many villages are served by the Indonesian Post, and principal cities are served also by "Elteha," a reliable private travel and courier service. Telephone and telegraph communications are maintained between principal towns but service is often poor.

Acceptable hotels can be found in all the principal cities. In addition, small family-operated hotels (losmen) can be found in principal cities and many of the larger villages. The Indonesian Government maintains inns (wisma or passanggrahan) for use of government officials, and these are usually open to non-governmental travellers. With the exception of some hotels in Jakarta, all accommodations are inexpensive by western standards. The Geological Survey of Indonesia maintains several volcano observatories where food and lodging are available to geologists engaged in volcano research. In villages, overnight accommodations in private homes can usually be arranged through the village head men.

When possible a base camp should be established in a rented house in a village or a tent camp just outside a village. This will serve as headquarters where the drivers will stay when not needed, where field parties will rendezvous between excursions, and where supplies and equipment can be stored. Village women can be hired to cook and wash clothing

and a guard can be hired to watch the base camp when all members of the parties are out. From this base, one-, two-, or three-day trips can be made into the surrounding countryside. When it becomes necessary to spend more than that amount of time away from base camp, the camp should be moved. Each base camp should be served by two vehicles, if possible, so the regular work can be carried on while one vehicle is being repaired or is in use elsewhere.

The requirements for traverses away from base camp of one or more overnight stops depend on whether it is going to be possible to sleep and eat in villages along the way. If this is uncertain, it is best to carry a small tent, light mattress, and a little food, as well as the usual canteen of boiled water and technical equipment. Porters can be used for carrying, especially if rocks are to be collected. It is best not to have a rigid program that requires being in a certain village by nightfall because progress is often held up by interesting geology or unexpectedly tough going. Making haste in late afternoon is a good way to miss the geology and invite accidents.

In spite of proximity to the equator, the climate in Indonesia is eminently suitable for field work during the dry season and tolerable in the wet season. Humidity is high most of the time but temperatures are generally moderate and in upland areas are ideal for field work. The extremely high temperatures of the mainland of southern Asia (or southern United States) are unknown in Indonesia, owing to the moderating influence of the sea. Commonly during the wet season, the rain begins

after noon and is often light or of short duration, permitting a full day's work. On some days, however, it is possible to work for only four or five hours in the morning. Near freezing temperatures are common only on the tops of the highest mountains.

Most parts of Indonesia are remarkably free from insect pests. Mosquitoes are not abundant and generally constitute no problem in the daytime and only a slight annoyance at night. In most upland areas, it is possible to sleep without mosquito netting. However, it is advisable to have repellents available such as "612" and "Off." The sprays and mosquito repelling incense used in some hotels cause objectionable local air pollution.

The danger from leeches, snakes, and wild animals is commonly exaggerated. Although the dangers cannot be entirely dismissed, they need not inhibit normal field work if one is reasonably wary. Leeches are very common in some wet, shady areas and can cause problems. In these areas it is necessary to inspect arms and legs every few minutes and put a drop of irritant, such as dilute hydrochloric acid, on each leech or touch each one with the lighted end of a cigarette. Leeches can also be scraped off with little danger of infection, especially if an antiseptic is applied to the lesions immediately. Inspection is easy if shorts rather than long pants are worn because the leeches can be seen and eliminated easily. Long pants are no protection unless they are tied tightly below shoe tops.

Snakes are less abundant than they are in the United States. Usually only two or three are encountered in a week's work. They can be in tree

branches over the trail, in streams, or on the ground. Danger can be avoided by proceeding cautiously and by beating thick ground cover with a stick before stepping into it.

The danger from animals is negligible and carrying firearms for protection is unnecessary.

There is little danger of contracting serious diseases provided inoculations are kept up to date. Anti-malaria pills should be taken regularly and all drinking water should be boiled. Usually the food and drink available in village homes and small restaurants (warung) can be taken without fear of serious consequences. The serious disease schistosomiasis, which is contracted by wading in sluggish streams in some tropical regions, is unknown in Indonesia except for a small area of central Sulawesi.

Neil

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