

- 1:30 D. R. HORN, B. M. HORN, M. N. DELACH: Nickel- and copper-rich nodules of equatorial north Pacific
- 2:00 G. P. GLASBY: Exploitation of manganese nodules in South Pacific
- 2:30 W. M. LONIE, J. L. MCINTOSH: Occurrence and development of sedimentary manganese ore, Groote Eylandt, northern Australia
- 3:00 A. W. KARNS: Submarine phosphorite deposits of Chatham Rise near New Zealand

### COAL, Room I

*Presiding:* B. K. KIM

- 1:00 E. N. MILLIGAN: Status of coal exploration and mine development in Australia
- 1:30 T. SHIMOYAMA, A. IJIMA: Influence of temperature on coalification of Tertiary coal in Japan
- 2:00 B. K. KIM: Paleozoic and Mesozoic coal in Korea
- 2:30 A. A. WANEK: Coal in Alaska
- 3:00 B. A. LATOUR: Coal resources of Canadian cordillera
- 3:30 M. SIMANJUNTAK, (no initials) WURJANDI, S. U. WIJAYA: Coal resources of Indonesia
- 4:00 P. WU: Coal resources of Taiwan
- 4:30 CCOP Meeting

### Abstracts of Papers

ACHALABHUTI, C., Dept. of Mineral Resources, Ministry of Industry, Thailand

### PETROLEUM GEOLOGY OF GULF OF THAILAND

Significant oil and gas shows and discoveries in the Gulf of Thailand in mid-1973 have encouraged the six petroleum concessionaires to drill 15 additional wildcat wells in 1973-1974. Detailed geophysical surveys and results of seven wildcat wells have revealed that the Gulf of Thailand is underlain by Quaternary and Tertiary formations about 2,000-12,000 ft thick. Palynology dating indicates that the basal Tertiary formation is as old as Oligocene, but from place to place the acoustic basements vary from granitic basement to metasedimentary rocks of Mesozoic and/or late Paleozoic age.

ALCARAZ, A., Philippine Commission on Volcanology, Philippines

### GEOHERMAL EXPLORATION AND DEVELOPMENT IN PHILIPPINES

The Philippines, like many developing countries, is energy-deficient and needs to import much of her raw energy in the form of oil. The government, therefore, as early as 10 years ago gave encouragement and support to studies of the islands' indigenous energy resources, not only with the view of reducing dependence upon external sources, but to meet her steeply increasing power requirements. One such indigenous energy resource is geothermal energy in which the Philippines apparently abounds.

Geothermal exploration and development undertaken in the Philippines during the past decade are reviewed and discussed. Results obtained, especially

in the Tiwi geothermal field of southeastern Luzon which was the first to be studied, are evaluated and potentials are estimated. The sequential investigations undertaken in the study of a particular geothermal field and the interplay of geologic, geophysical, and geochemical approaches are outlined.

An overview of the future role of geothermal energy in the power development of the country is presented. Research being undertaken on other uses of geothermal energy in industry and agriculture is discussed.

ALMOGELA, D. H., Bureau of Mines, Manila, Philippines

### GEOLOGIC ENVIRONMENT AND ECONOMIC POSSIBILITIES OF PORPHYRY COPPER DEPOSITS IN PHILIPPINES

In the Philippines, the bulk of copper production comes from the porphyry copper type. The original concept of porphyry copper is a uniform low-grade sulfide deposit wherein the sulfide minerals are disseminated discrete grains and veinlets throughout a large volume of rock, commonly a porphyry. In contrast, and reflective of what is termed as such in the Philippines, porphyry copper means a hypogene copper sulfide deposit in which the ore minerals are disseminated grains or networks of veinlets within siliceous to intermediate intrusive bodies and their intruded rocks. This definition emphasizes the occurrence and genetic significance without consideration of the economic aspect and avoids the use of descriptive relative terms, such as low-grade, large, and big.

At least seven of these deposits in the Philippines are being mined and 16 are in the development or prospect stage. All are close to the axes of Tertiary geanticlines made up of Cretaceous to Tertiary meta-volcanic and metasedimentary rocks. Most of the deposits are near prominent fault zones, especially where they branch or are intersected by other faults. The deposits are irregular in form, steeply dipping to flat, and localized near contacts of plutons and their intruded rocks. Ore minerals are chiefly chalcopyrite and to a less degree bornite. Magnetite, pyrite, molybdenite, gold, and silver, in some prospects, are recoverable as by-products.

Considering the present expansion programs of producing mines and the development of new mines which are in various stages of intensive exploration for this type of deposit, in the not too distant future mining of porphyry copper will constitute the biggest foreign-exchange earner among our major industries.

ALONSO E., H., Comm. National Territorial Studies, Mexico

### GEOHERMIC POTENTIAL OF REPUBLIC OF MEXICO

After almost 15 years of study in different parts of the country and after 10 years in the geothermal zone of Cerro Prieto, Baja California, the first plant in this zone, with a capacity of 75,000 kw, was inaugurated in April 1973. Electricity is generated on a commercial scale using the natural steam from underground.

The possibilities for Mexico in this field are rather large, as there are 130 known zones where it is feasible

to obtain geothermal energy. Only one of them has been developed, five more are being studied, and general inventory and sampling are being done throughout the country.

The probable potential in the geothermal zone of Cerro Prieto, Baja California, has been determined and a general estimate of the known geothermal zones and the total potential have been completed.

AOKI, S., Faculty of Science, Niigata Univ., Niigata, Japan

#### LAND SUBSIDENCE IN JAPAN RESULTING FROM FLUID EXTRACTION

The land-subsidence areas in Japan are in and around big cities, industrial zones, and paddy-field zones on the coastal lowlands where groundwater has been utilized extensively and excessively. In view of the enormous sums of money spent for various counter-measures in the land-subsidence areas, groundwater hardly can be said to be a cheap resource.

From the viewpoint of an unsuccessful example of groundwater-resource development, the characteristics and the future problems of land-subsidence in Japan are summarized briefly.

AVILA, J. L., Council of Nonrenewable Natural Resources, Mexico City, Mexico

#### PRINCIPAL CHARACTERISTICS OF PORPHYRY COPPER DEPOSITS IN STATE OF SONORA, MEXICO

The State of Sonora, where several porphyry copper deposits are located, is south of Arizona and New Mexico, USA. Sonora and the copper province of the southwestern USA have similar physiography in part, mineralized areas, and geologic conditions, which have been traced southward parallel with the Mexican Pacific Coast.

This paper is a summary of the regional geology of the area as well as of geologic characteristics of the mineralization and alteration of the main deposits such as Cananea, Pilares de Nacozeni, and La Caridad.

BACA, M. F., Petroperu, Lima, Peru

#### LATIN AMERICA'S OUTLOOK TOWARD ENERGY RESOURCES

Latin America countries are alike in many ways, but they differ widely in respect to present and future problems in energy and mineral resources. Rapidly rising demands for energy already have created serious trade-balance problems for some countries. As development rate accelerates, Latin America will be consuming an ever increasing share of its own mineral resources most of which are now exported. As a region, Latin America is rich in energy and mineral resources. For a group bound by history, culture, and language, a logical approach for the future is to make a joint study of the situation, and to propose a unified formulation of a regional development plan which will make most effective use of each country's potential for the mutual benefit of all the Latin American countries.

BASKOV, E. A.

#### REGULARITIES OBSERVED IN REGIME OF WATER OF CIRCUM-PACIFIC AREA

No abstract available.

BERG, H. C., A. L. CLARK

#### METALLIFEROUS PROVINCES OF ALASKA

No abstract available.

BERGER, V. I.

#### EVOLUTIONARY SERIES OF ANTIMONY DEPOSITS OF EASTERN USSR

No abstract available.

BEZRUKOV, P. L., A. S. MONIN

#### MANGANESE NODULES OF PACIFIC

No abstract available.

BOUCAUT, W. R. P., Geol. Survey of Australia, Adelaide, Australia

#### SALINE GROUNDWATER INFLOWS TO RIVER MURRAY IN SOUTH AUSTRALIA

The River Murray flows for 650 km of its total length of 2,600 km through South Australia, where it meanders in an incised channel across a floodplain 1 to 10 km wide, and is underlain by 500 m of predominantly Tertiary bryozoal limestone and sand of the Murray basin. Natural groundwater in the basin commonly has a salinity of 30,000 mg/l.

Groundwater gradients are relatively flat (0.25 m/km) and flow is generally toward the river and reflects the recharge from the higher country of the basin margins, about 250,000 sq km in area. The Tertiary sediments form aquifers of moderate transmissivity (200 to 500 cu m/day/m). Some inflows of saline groundwater are present naturally through the river bed but most inflows are the result of man-made structures and practices.

The waters of the River Murray are vitally important to South Australia for domestic supplies and for irrigation of citrus orchards along the river banks. This irrigation has resulted in the buildup of groundwater mounds which are relieved by a tile drainage system. Drainage water, now of increased salinity, is pumped to evaporation basins on the floodplain close to the river. The raised water levels in these basins and also in the river weir system have increased inflows of saline groundwater to the river. In drought years these salt accessions can make the water unsuitable for irrigation.

Piezometers have been established to monitor the regional groundwater regime, the irrigation groundwater mounds, and the effect of raised water levels in storage basins. The mechanisms of leakage from these basins have been studied to determine remedial measures necessary to intercept and remove saline-groundwater underflow. Alternative evaporation basins sited