China Sea spreading center. A pre-Tertiary continental basement complex is separated from the accreted oceanic crust, outcropping on southern Palawan, by the Ulugan Bay fault, which is one of several north-south-trending strike-slip fault zones recognized in the area.

A geologic section consisting, in the lower part, of limestones, volcanics and fine-grained clastics, ranging in age from pre-Tertiary to lower Oligocene, is encountered off northwest Palawan. This is unconformably overlain by the Nido Limestone and deep-marine shales of the Pagasa Formation (upper Oligocene to middle Miocene). The contact with the coarse clastic Matinloc Formation is an unconformity recognized on a regional scale and related to collision of the drifting margin with the remainder of the Philippine archipelago. The sequence is topped by the Carcar Limestone, described from many areas in the Philippines.

A total of 30 wells have been drilled so far: 12 were dry, 10 were discoveries, 7 of which have been declared commercial, and 7 were delineation wells. Occurrence of hydrocarbons had been restricted to reef-related reservoirs of the Nido Limestone, until the recent discovry of oil in sandstone reservoirs in Galoc 1 heralded a new chapter in the Philippines search for hydrocarbons.

Evaluation of the production performance from these reefs and analysis of the behavior of fractured limestones as reservoirs serves as a guide for future operations in the area. The future prospects of the northwest Palaway shelf and rise can be assessed from the current discovery success ratio in the exploration for reefs and from initial discoveries in turbidites.

SCHEIBNER, ERWIN, Dept. Mineral Resources, Australia

Tectonic Map of Circum-Pacific Southwest Quadrant—A Draft Presentation

(No abstract)

SCHOLL, D. W., U.S. Geol. Survey, Menlo Park, California, T. U MAUNG, CCOP/SOPAC, U.N. Offshore Mineral Prospecting, Suva, Fiji, T. V. VALLIER, U.S. Geol. Survey, Menlo Park, California, and Scientific Party Cruise, CCOP/SOPAC, R/V *S. P. Lee* (J. CHILDS and A. J. STEVENSON, U.S. Geol. Survey, Menlo Park, California; N. F. EXON, Bur. Mineral Resources, Canberra, A.C.T., Australia; R. H. HERZER, New Zealand Geol. Survey, Lower Hutt; M. W. SANDSTROM, Australian Natl. Univ., Canberra, A.C.T.; S. SOAKI, Ministry of Lands, Nuku'alofa, Tongatapu, Tonga)

Preliminary Results of Geophysical and Geological Studies to Assess Resource Potential and Geologic Evolution of Central Tonga Ridge and Summit Platform (21-24° Latitude)

In April 1982, the R/V *S. P. Lee,* operated by the USGS, supported geological and geophysical studies over the central area of the Tonga Ridge immediately south of Tongatapu. The cruise plan calls for the collection of approximately 1,250 mi (2,000 km) of multichannel (24) seismic reflection data and several dredge stations to sample submarine outcrops. The bulk (70%) of this work will be concentrated over the summit platform of the ridge, in water depths less than about 5,000 ft (1,500 m). One or more seismic lines will be extended eastward to and slightly seaward of the Tonga Trench, and westward of the ridge's present volcanic axis toward the Lau Basin, in order to resolve the regional rock and structural framework of the ridge. Several multichannel lines will cross the fore-arc basin that lies between the summit platform and the trench. Sonobuoy refraction and wide-angle reflection data will be gathered routinely as well as gravity and magnetic data and high-resolution subbottom seismic records (3.5 kHz and multiplate Uniboom sources). Navigation will be controlled by satellite fixes and computer-generated dead-reckoning positions, based on ship's heading and speed, and doppler-sonar inputs.

The results of the shipboard examination of dredged samples, seismic monitor records, and possibly several hundred km of brute-stacked processed multichannel records will be presented at the CPEMRC III. The implications of this sketchy and roughly assembled data base relative to the mineral and petroleum resource potential of the sedimentary sections underlying the ridge's summit platform and the adjacent fore-arc basin will be discussed. Comments on the geologic and tectonic history of the Tonga Ridge implied by the incompletely analyzed field data will be offered for discussion and consideration.

SHUPE, JOHN W., and D. RICHARD NEILL, Hawaii Natural Energy Inst., Univ. Hawaii, Honolulu, Hawaii

Wind Applications in Pacific

Hawaii shares with many other isolated areas and island communities of the Pacific a near-total dependence for energy on imported oil—a supply source which during the past decade has become increasingly expensive and less secure. Hawaii also shares with many of these areas which are deficient in conventional energy supplies, a variety of renewable energy resources which can serve as substitutes, or alternatives to seaborne petroleum. A case study showing what has been accomplished in Hawaii in moving one of these resources—wind energy—closer to commercialization is based on the limited amount of known information on the potential of wind energy in the Pacific region and studies which are underway to expand the knowledge on the extent of the wind resource throughout this region.

The Hawaii Natural Energy Institute (HNEI) and the Department of Meteorology of the University of Hawaii have developed over the past 6 years an inventory of the wind resource in Hawaii. This effort involved an extensive system of 18 long-term wind data stations located on the five major islands, supplemented by a series of mobile, short-term stations and a loan program of wind measurement devices for specific site measurements. The Hawaii Wind Data Bank provides information both to wind researchers and to those who are seeking optimum sites for installing wind energy conversion systems (WECS). HNEI also is engaged in a WECS reliability verification program and is conducting research on various wind energy applications, including storage and nitrogen generation.

SITUMORANG, B., Oil and Gas Technology Development Center-LEMIGAS, Jakarta, Indonesia

Formation, Evolution, and Hydrocarbon Prospects of Makassar Basin, Indonesia

The occurrence of hydrocarbons in back-arc basins of Indonesia has been known since the beginning of this century, but its relation to the formation and evolution of sedimentary basins is rather poorly understood. This can be resolved by explaining the origin of a basin in terms of extensional tectonics. This approach has been applied to the Makassar basin. Data provided by well records and multichannel seismic reflection profiling indicate that the observed subsidence can be explained by the thinning of continental crust by a factor of between 2 and 2.9. Stret-

ching and initial fault-controlled subsidence commenced during early-middle Eocene time (or perhaps earlier), and had ceased by early Miocene time. Since middle Miocene time, there has been thermally-controlled subsidence due to conductive cooling of the lithosphere, and post-lower Miocene sediments have been deposited across the basin with little or no internal deformation.

Assuming the pre-stretched thickness of the crust to be 22 mi (35 km), the thickness of the crust in the Makassar basin is about 12 mi (19 km) at the basin margin, and it decreases to about 9 mi (15 km) in the abyssal plain. Evaluation of the degree of hydrocarbon maturation indicates that the pre-lower Miocene sediments have reached sufficient temperatures for hydrocarbon generation, assuming an initial heat flow of 1.6 HFU with crustal contribution of 0.8 HFU, and thermal conductivity of 5×10^{-3} cal/cm.s.°C.

SMITH, KIRK R., KEN NEWCOMBE, STEVE MEYERS, and SAM PINTZ, East-West Resource Systems, Inst., Honolulu, Hawaii

Energy Requirements of South Pacific and the Role of Renewables

(No abstract)

SOETANTRI, B., and PRIJANTO,* PERTAMINA, Jakarta, Indonesia

Assessment of Reservoir Potential of Bali Geothermal Field, Indonesia

A large volume, two-phase reservoir, with a capacity of about 19 mi^3 (80 km^3), underlies the Donau (lake) Bratan Caldera on the island of Bali. Recent resistivity modeling indicates that the reservoir is at a depth of about 3,300 ft (1,000 m). If the reservoir rock porosity is assumed to be 8%, the saturation to be 32.5% and the temperature to be 245°C, the total energy stored in the reservoir is about 2×10^{12} MJ. This means that a promising geothermal field awaits development on Bali.

STAUFFER, KARL W., Chevron Overseas Petroleum Inc., San Francisco, California

Rio Zulia Field, Colombia

The Rio Zulia field in northeastern Colombia lies within the southernmost part of the oil-rich Maracaibo basin. The field measures 3.4 by 0.9 mi (5.5 by 1.5 km) and is located on a faulted anticline whose southeastern flank is cut by an east-directed thrust fault. Cumulative production during the 20 years since Chevron discovered it in March 1962 is 125 million bbl. The oil is brown, paraffinic, and has a gravity of 41.5° API. Maximum production of 35,000 BOPD was reached in 1966; present production is about 4,000 BOPD.

Almost all the production has come from the Eocene Mirador Formation, a loosely consolidated fine to coarse-grained, noncalcareous sandstone with irregularly distributed clay and siltstone interbeds. The sandstone is part of the Eocene delta built out to the northeast over the Lake Maracaibo region. The Mirador of the Rio Zulia area belongs to the back-delta fluvial system.

STEPHENS, J., and P. SMITH, U.S. BORAX, Spokane, Washington

Quartz Hill, Alaska

The Quartz Hill molybdenum deposit, located 44 mi (70 km) east of Ketchikan, Alaska, contains one of the world's largest concentrations of molybdenite. It is related to a Miocene intrusive complex referred to as the Quartz Hill stock. This deposit was discovered in 1974 by U.S. BORAX geologists as a result of a comprehensive reconnaissance geochemical rock and stream sediment sampling program designed to explore the western margin of the Coast Range batholithic complex on the mainland portion of southeastern Alaska.

The country rocks of the area, orthogneisses and paragneisses, are intruded by the Quartz Hill stock which represents at least five phases of igneous activity. The main rock type within the Quartz Hill stock is a quartz monzonite which has been intruded by steeply dipping bodies of porphyritic quartz latite, and late quartz monzonite. These rocks are chemically and mineralogically similar and consist of quartz, K-feldspar, sodic plagioclase, and minor biotite, with many of the textures suggesting isothermal "quench" textures. These intrusive felsic rocks have been subsequently intruded by regional dikes of felsic and intermediate composition.

The Quartz Hill orebody occurs entirely within the Quartz Hill composite stock. The orebody forms a large, tabular to slightly convex downward shape and is at or near the surface. Molybdenite is the only mineral of economic importance. The ore body is approximately 9,200 ft (2,800 m) long by 4,900 ft (1,500 m) wide and extends from the surface to a depth of 1,215 to 1,640 ft (370 to 500 m). Reserve calculations have projected approximately 2.5 billion tons grading 0.125% MoS_2.

STEVENS, DAVID L., and ROBERT B. HAWKINS, Freeport Exploration Co., Lakewood, Colorado

A Comparison of Gold Mineralization at Jerritt Canyon, Nevada, with Other Disseminated Gold Deposits of Basin and Range Province

The discovery of the gold deposits in the Jerritt Canyon area, containing in excesses of 2.25 million oz (70 million g) of recoverable gold, is one of the most significant precious metal developments in the last decade. The Bell Mine at Jerritt Canyon began production on July 4, 1981, and is currently producing in excess of 193,000 oz (6 million g) of gold per year from ore with an average grade of 0.24 oz per MT (7.4 g per MT).

Disseminated sub-micron gold is hosted within oxidized and unoxidized portions of Upper Ordovician and Lower Silurian limestones, dolomites, and calcarenites that have been locally extensively silicified and subjected to low pH hydrous alteration. Hydrocarbons have been locally remobilized and oxidized and may have played an important role in gold precipitation. Structural control of mineralization is manifested by the location of higher grade gold along northeasterly trending normal faults at the intersection of favorable host lithologies.

Jerritt Canyon is the most recently developed of a group of similar deposits within the Basin and Range province that collectively contain recoverable reserves in excesses of 16 million oz (500 million g) of gold. Similarities and differences between Jerritt Canyon and the other deposits are reviewed in terms of geologic setting, geochemistry, host-rock characteristics, structural controls, and ore reserves.

SUMBONO, JOEDO, PERTAMINA, Jakarta, Indonesia

Indonesia's Role in World Energy Markets in the 80s

Recent trends in consumption showed that world demand for petroleum peaked in 1979-80. However, as industrialized nations emerge from the current economic recession, and as