value as a direct-application fertilizer.

The deposits have considerable potential value for the agriculturally based economy of New Zealand, where per capita superphosphate consumption is the highest in the world. Current annual consumption of phosphate rock, wholly imported, is about 1,300,000 tons, increasing annually by about 10% during the past 20 years.

KATAHIRA, T., and M. UKAI, Japan Petroleum Exploration Co., Ltd.

PETROLEUM FIELDS WITH RESERVOIRS OF VOLCANIC ROCKS, JAPAN

As 5 of 11 major oil and gas fields found during the last 15 years in Japan have volcanic-rock reservoirs, they have become an important objective in exploration for petroleum in Japan.

Japanese oil and gas fields have been found mainly in Neogene sedimentary basins developed on the Japan Sea coast along the northern half of Honshu. The basin, associated with volcanic activities, began its depression in the early Miocene, but it continued to subside through the Neogene and Quaternary.

Volcanic-rock reservoirs are present in the formations deposited during middle Miocene and early Pliocene times. They are composed of liparitic, dacitic and/or andesitic lava, agglomerate, and tuff breccia. Intergranular pores are the main cause for the porosity, but many fractures and vugs which may provide additional porosity are known.

Volcanic-rock reservoirs have a rough resemblance to carbonate-rock reservoirs in that fractures and vugs are predominant, formation resistivity is higher than surrounding formations, and the shapes of volcanic-rock masses commonly show reeflike forms. However, the decisive difference between them is that whereas carbonate rocks may be source rocks as well as reservoir rocks, the volcanic rocks are not source rocks. Therefore it is important that, in searching for petroleum in volcanic-rock reservoirs, source rocks must be confirmed close by.

Each volcanic-rock reservoir has been found to have its own pore continuity. Some reservoirs have good pore continuity but others do not. For development of these fields, the difficulty is in determining the location and magnitude of the lava bodies which have good porosity.

KATZ, H. R., New Zealand Geol. Survey, Lower Hutt, New Zealand

SEDIMENTARY BASINS AND PETROLEUM PROSPECTS OF ONSHORE AND OFFSHORE NEW ZEALAND

Petroleum prospects are virtually restricted to basins formed after the Early Cretaceous Rangitata orogeny. Basin sedimentary rocks are mainly Cenozoic, but some thick marine Cretaceous sequences fill the Northland and East Coast basins of the North Island; thinner, mainly terrestrial Cretaceous deposits are present in some areas in the northwest and southeast of the South Island. Subsiding epicontinental basins are offshore relatively close to land on the west coast, near 40°S, and the southeast coast, from 44° southward. Along the east coast of the North Island the late Cenozoic fold belt, which extends offshore about 100 km, comprises an extremely thick and continuous marine sequence of Aptian to Pleistocene age. Major areas of submarine rises and plateaus around New Zealand are foundered continental blocks with only thin or no sediment cover. Between these, several younger underdeformed sedimentary basins are below water more than 2,000 m deep and are filled with sedimentary deposits several kilometers thick.

Throughout New Zealand sedimentary rocks are commonly of a sand-shale facies with only minor carbonate rocks, mainly in the Oligocene, locally also in the Paleocene-Eocene, Miocene, and Plio-Pleistocene. Along the west side of both islands and east and south of the South Island, the characteristic assemblage is of the shale-sandstone-coal type. Potential reservoirs generally are in sandstones near the base of the sedimentary sequence (Late Cretaceous to early Tertiary), in an environment that was transitional between shallow-marine and nearshore deltaic to estuarine-brackish and nonmarine (sandstones in coal measures). Locally, reservoirs may be in limestones. Many unconformities, pinchouts, onlaps, and lateral facies changes throughout the Cenozoic sequence may have created favorable conditions for extensive stratigraphic traps, but exploration has been concentrated on structural traps.

Production has been obtained only in the Taranaki basin, both on- and offshore, with proved recoverable reserves of about 6 trillion cu ft of gas and 200 million bbl of condensate. Except for a minute percentage produced from Pliocene sandstones, all of the production is contained in the Eocene Kapuni Formation. Good shows in wells, and also surface seepages, are known from the east coast of the North Island and the west coast of the South Island. In Northland one recent well had strong gas shows, but over 9,000-ft thick allochthonous olistostrome deposits make this a particularly difficult area to explore. In general, the prospects are good for further discoveries, mainly offshore, and also on some land areas. The total area of prospective basins on land covers nearly 50,000 sq mi, whereas offshore the area, to an arbitrary depth limit of about 1,000 m, is roughly 100,000 sq mi. Only 10 wells have been drilled offshore, of which three established the large Maui gas field and one noncommercial well which tested oil at a rate of 600 bbl/d was abandoned.

KELLER, G. V.

DRILLING AT SUMMIT OF KILAUEA VOLCANO

No abstract available.

KILKENNY, J. E., Union Oil Co. of California, Los Angeles, Calif.

GEOTHERMAL POTENTIAL OF SOUTHWESTERN UNITED STATES

The area comprises the states of California, Nevada, Utah, Colorado, New Mexico, and Arizona, and includes the following geologic provinces: the Colorado Plateau, Basin and Range, Sierra Nevada and Southern California batholiths, Great Valley and Coast Ranges of California.

This area is considered favorable for geothermal prospecting because of the presence of many hot springs, Tertiary and especially Quaternary volcanism, and faulting of both block and rift type.

The Geysers field, the largest geothermal field in the world as well as the only commercially producing