gas reserves for this section are calculated at 252 billion cu ft/sq mi.

Extensive logging, coring, and testing have been carried out in the program, including special logs for rock mechanics study. Cores were compared with those from Gasbuggy as to compressive strength, shear behavior, and potential for fracturing. Petrographic analyses indicate better fracture potential at Wagon Wheel due to a higher degree of grain to grain contacts and lower clay content.

Environmental protection studies include examination of surface waters, springs and wells, man-made structures, mines, flora, fauna, and general land use. The most important aspect from a geologic standpoint is protection of the extensive groundwater aquifers above the gas reservoir. Two wells, in addition to the Wagon Wheel No. 1, were drilled for the purpose of evaluating those aquifers. Potable water extends to a depth of approximately 3,600 ft. Salt water occurs from 3,600 to approximately 5,200 ft. Low quality subpotable water extends from 5,200 to about 7,200 ft. The saltwater zone is interpreted to be in a tongue of Wasatch Formation extending from the west into Eocene arkoses derived from the Wind River Range on the east.

Plans call for sequential detonation of 5 explosives spaced at intervals from 9,220 to 11,560 ft to produce a more or less continuous chimney from about 8,700 to about 11,600 ft. There will be a safety margin of 1,500 ft between the top of fractures and the bottom of known aquifers.

SHELDON, R. P., U.S. Geol. Survey, Washington, D.C.

PHOSPHATE DEPOSITION SEAWARD OF BARRIER ISLANDS AT EDGE OF PHOSPHORIA SEA IN NORTHWESTERN WYOMING

Four elongate tongues of the Shedhorn Sandstone of Permian age extend southeastward from the Yellowstone Park area into the Gros Ventre, Hoback, and Wyoming Range area. These tongues represent barrier-island complexes that built southwestward in the Phosphoria sea, creating a lagoon on their northeast side. The lagoonal facies includes algal laminated and ostracodal limestone and dolomite and a greenish-gray shale. The barrier island facies consists of crossbedded quartz sandstone which contains abraded thick-shelled fossils. The marine facies southwest of the barrier island facies includes chert, quartz sandstone, calcarenite containing a siliceous sponge, brachiopod, and bryozoan fauna, and phosphorite containing a brachiopod and fish fauna. Major phosphate deposition was restricted to the marine environment seaward of the barrier islands, and was absent in the lagoonal environment.

SHEPPARD, R. A., U.S. Geol. Survey, Denver, Colo.

BEDDED ZEOLITES IN UNITED STATES—POTENTIAL INDUSTRIAL MINERALS

Zeolites are among the most common authigenic silicate minerals in sedimentary deposits. Zeolites occur in rocks that are diverse in age, lithology, and depositional environment, but they are most common in sedimentary rocks that originally contained abundant vitric material. Of the more than 30 naturally occurring zeolites, 6 commonly occur in bedded deposits that have not been subjected to deep burial or hydrothermal activity. These are analcime, chabazite, clinoptilolite, erionite, mordenite, and phillipsite. They are generally more siliceous and more alkalic than their counterparts that occur in mafic volcanic rocks. Most zeolites in sedimentary rocks formed during diagenesis mainly by reaction of vitric material with interstitial water, which may have originated as either meteoric water or connate water of a saline, alkaline lake. Formation of zeolites is favored by a relatively high pH and high activities of alkali ions in the interstitial water. Most zeolitic sedimentary rocks consist of 2 or more zeolites with authigenic clay minerals, silica minerals, or feldspars, and relict glass and crystal and rock fragments. Extensive and relatively pure beds of zeolite, however, occur in upper Cenozoic lacustrine deposits of the western United States.

The ion exchange, adsorption, and molecular sieve properties of zeolites, coupled with a seemingly low cost of mining, suggest a variety of industrial applications. Potential uses include purification and drying of gases and liquids, chemical separations, catalysis, decontamination of radioactive wastes, removal of ammonia from wastewater, and numerous other uses in agriculture and animal husbandry. Potential uses of these zeolites could be considerably increased by chemical and structural modifications of the natural materials.

SIBLEY, D. F., Dept. Geol. and Geophys., Univ. Oklahoma, Norman, Okla., and R. C. MURRAY, Dept. Geol., Rutgers Univ., New Brunswick, N. J.

MARINE DIAGENESIS OF CARBONATE SEDIMENT, BONAIRE, NETHERLANDS ANTILLES

A discontinuous layer of lithified carbonate sandstone underlies a small part of the Lac, a large lagoon on the southeastern coast of Bonaire. The layer lies 35 cm below the sediment surface, varies from 5 to 20 cm in thickness, and is restricted to an area beneath a broad intertidal and subtidal flat. Beachrock crops out in the high intertidal zone.

The lithified layer consists of grainstone cemented by acicular aragonite. Numerous lines of evidence indicate the cementation occurred in the marine environment. The lithified layer is at present continuously saturated with normal seawater. The submarine-cemented rocks lack the gray algal coating which is characteristic of beachrock and subaerially exposed coral rubble. Carbon-14-dating of the rock indicates cementation occurred less than 900 years ago. Study of the constituent particles of the lithified layer and the sediment above and below indicates continuous marine sedimentation.

Several distinct types of micrite are present in the beachrock and submarine-cemented layer. The most common is a high- and low-Mg calcite which coats single and multiple skeletal fragments with a sharp contact between the grain and micrite. The coating results from micritization of the high-Mg calcite of the encrusting coralline algae. Electron microprobe and X-ray diffraction analysis of these coatings demonstrated that as micritization proceeds and the microstructure of the algal coating is destroyed, the mineralogy changes from high- to low-Mg calcite.

SLOCUM, R. C., Independent Indonesian American Petroleum Co., San Francisco, Calif.

OIL BOOM IN INDONESIA—TOO OPTIMISTIC?

Since the awarding of Indonesia's first offshore-production sharing contract to IIAPCO in August 1966 the boom has been on. Never before have so many