Krakatau caldera. Krakatau has a history of at least 2 major episodes of caldera collapse, the second, in 1883, caused tidal waves killing over 36,000 persons. The first collapse occurred in prehistoric times, but may have been even more destructive in its physical violence on fortunately uninhabited coasts. The present volume of material forming Anak Krakatau is a very small fraction of the pre-1883 bulk of Krakatau, but its occasional violent eruptions suggest the energy source which has constructed and destroyed Krakatau twice already is not exhausted. Little or no catastrophic danger exists at Krakatau at this time or even in the near foreseeable future, but the scientific value of closely documenting and analysing the symptoms of such an important patient as Krakatau should more than justify the small costs of an observation post.

If continuous observation is not possible, then scientific expeditions to the island should be conducted at regular intervals. Such an expedition is now long overdue*, especially in view of the renewed activity of Anak Krakatau.

NATURAL GASES OF NORTH AMERICA

B. W. Beebe

In 1935, the American Association of Petroleum Geologists published a symposium, "Geology of Natural Gas." Since that time, huge gas transmission systems have been constructed to all heavily populated areas in the country. Consumers have recognized natural gas as a premium source of energy, not only because of its cleanliness and ease of handling, but because natural gas is grossly underpriced. More than six times as much natural gas will be furnished consumers in 1960 than was furnished in 1935. Natural gas marketed currently is equivalent in energy to approximately 5,750,000 barrels of oil daily. Current oil production in the United States is approximately 6,500,000 barrels daily. The impact of this growth on the market for crude oil needs no comment.

Recognizing the rapidly increasing importance of natural gas as a source of energy, the Executive Committee of AAPG has authorized a new two-volume symposium, "Natural Gases of North America," now in preparation. It will be by far the most comprehensive study of this type to be available to those interested in natural gas.

In the immediate future, as in the past, Tertiary rocks of the Gulf Coast Embayment of Texas, Louisiana and Mississippi will continue to be major sources of gas. With depletion of reserves in the Permian Basin of West Texas and the Hugoton-Panhandle field of Kansas, Oklahoma and Texas, importance of the Paleozoic rocks in the Mid-Continent and Permian Basin will probably diminish, to be replaced by gas discoveries from Tertiary and Cretaceous rocks in the huge intermountain basins of the Rocky Mountain region. These two provinces, then, probably will be the major sources of new gas reserves within the United States excluding Alaska, importance of which as a gas productive area cannot be predicted at this time. Vast untapped reserves of natural gases no doubt exist in Canada and Mexico, but demands for energy in both are expanding rapidly, and only a small fraction of these will be available to consumers in this country.

We must therefore depend on discoveries of gas in our own country for the near future to satiate the ever increasing demand. The geologist exploring for natural gas faces a unique and unprecedented challenge. Not only must he deal with problems and risks inherent in all exploration, but he is beset by unique economic con-

*) Last volcanological expedition to Krakatau was in October 1953.

siderations which are often confusing and contradictory, and which often appear to defy solution. With the constantly declining ratio of reserves to yearly production, can the demands be met?

MIDDLE PERMIAN EVAPORITES IN SOUTHWESTERN OKLAHOMA

WILLIAM E. HAM

The two thickest outcrop sections of evaporites in the Midcontinent region of the United States are in the Blaine and Cloud Chief formations of southwestern Oklahoma. Each is composed mainly of gypsum at the outcrop and of anhydrite in subsurface.

The earlier sequence is the Blaine, of Late Leonardian or Early Guadalupean age. It has maximum thickness of 250 feet and consists of four principal cycles. Each cycle is a three-fold division beginning with dolomite less than 5 feet thick, continuing upward with white gypsum normally 15-30 feet thick, and ending with reddish-brown shale 10-30 feet thick.

The upper half of the Blaine formation is 90 feet thick and is made up of massive gypsum containing as many as four thin dolomite beds but practically no shales, thus representing a composite of several incomplete normal cycles. Northward in subsurface this evaporite unit grades into nearly pure halite.

Four hundred feet above the Blaine is the thickest single evaporite body in the Midcontinent region. It is in the lower part of the Cloud Chief formation, of probable Late Guadalupean age, and consists of gypsum and anhydrite 120 feet thick with no interbedded shale or dolomite. Extensive core drilling has shown that the Cloud Chief evaporite body is massive and non-cyclic. By Cloud Chief time the position of the evaporite basin had shifted markedly eastward, as it was then situated over the shoreward or clastic facies of the Blaine. The Cloud Chief gypsum also is noteworthy for containing marginal tongues of strontium minerals, chiefly celestite, and for containing in the massive gypsum a few small nodules of the borate mineral probertite.

1) Presented before International Geological Congress, 1960.

IMPLICATIONS OF PALEOGEOLOGIC MAPS OF NORTH AMERICA

A. I. LEVORSEN

A sequence of subcrop and paleogeologic maps of North America are presented showing the geology at the beginning of the Ordovician, Devonian, Mississippian, Pennsylvanian and Cretaceous systems.

There are many implications to be seen in such a set of maps. Some are as follows:

1. The continent has been in repeated periods of broad structural upswells in which great arches formed. Later the crests were eroded, the surface peneplaned, and the overlying sediments deposited across the truncated edges of the older rocks.

2. The intervening basins are structural and not depositional in nature. Their location is fortuitous, inasmuch as the boundaries are formed by arches that occurred at different times.