SOUTHWESTERN REGIONAL MEETING, SOUTHWESTERN FEDERATION OF GEOLOGICAL SOCIETIES, ABILENE, TEXAS, OCTOBER 12-14, 1960. ABSTRACTS

B. W. BEEBE, independent, Boulder, Colorado

Natural Gases of North America

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 6,800,000 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 intermontane 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 can not 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 considerations 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?

EVERETT G. TROSTEL, DeGolyer & MacNaughton, Dallas, Texas

Relative Importance of Natural Gas in the Southwest

TOM G. CALHOUN II, DeGolyer & MacNaughton, Dallas, Texas

Pipeliners' Problems of New Reserves (To Connect Or Not to Connect)

OTTO K. WETZEL, JR., Purvin and Gertz, Inc., Dallas, Texas

Natural Gas—Its Value as a Function of Its Chemical and Physical Properties

Natural gas as it is produced from the ground (after having been separated from the concurrently produced crude oil or condensate) is a mixture of compounds which have widely varying physical characteristics. These compounds are composed of hydrogen and carbon atoms in various molecular arrangements and are generally referred to as hydrocarbons. Impurities sometimes occur in natural gas and are usually removed. Except in special situations, these impurities are not valuable enough to warrant their recovery and purification.

Natural gas obeys the so-called gas laws relating pressure, volume, and temperature as well as certain relationships dictated by the characteristics of the individual compounds. These characteristics are determined by the molecular structure or arrangement of the carbon and hydrogen atoms. Among the characteristics which affect natural gas or its components values are boiling point or vapor pressure, critical pressure and temperatures, specific gravity, and heat of combustion. These same characteristics govern the separation of the mixtures in processing plants. Partly because of the characteristics of the individual hydrocarbons the relative amounts of the separate compounds vary appreciably, with the lighter hydrocarbons being much more prevalent than the heavier hydrocarbons.

The two principal uses for natural gas are for fuel and as a basis for the manufacture of chemicals. By far the largest use of natural gas as produced, as well as some of the constituents extracted therefrom, is for fuel. However, a small but important amount of natural gas is used in manufacturing chemicals. These chemicals are called petrochemicals since their origin is petroleum. The ability of carbon and hydrogen to bond together in a variety of forms makes the constituents of natural gas perfect building blocks for many modern day chemicals.

Many interesting future developments are in store for natural gas. These include extension of existing and the building of new pipeline systems, both for natural gas and for natural gas liquids. In addition, transoceanic movement of natural gas in liquefied form is an accomplished fact and will play an increasing role in the world's energy balance. Future expansion of the petrochemical use is also anticipated.

SAMUEL P. ELLISON, JR., The University of Texas, Austin, Texas

Oil and Gas Geology of North-Central Texas

In this area of more than 42,800 square miles more than 2,615,653,966 barrels of oil have been produced from Paleozoic rocks. Sandstone, conglomerate, and carbonate reservoirs have oil and gas accumulations in both stratigraphic and structural traps. Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, and Permian rocks reaching a total maximum thickness of about 19,000 feet prevail in the area. Pennsylvanian and Permian strata contain remarkable carbonate reefs of various kinds which if completely encased in shale form excellent oil and gas traps.

Major structural features include the Bend arch, Electra arch, Muenster arch, Fort Worth basin, Baylor basin, Fort Chadburne fault zone, Concho arch, and

the buried Ouachita Mountain overthrust belt. Gently dipping surface strata of Permian, Pennsylvanian, and Cretaceous rocks mask most of the deep subsurface structure.

JOHN G. NIKKEL, Pan American Petroleum Corporation, Abilene, Texas

Stratigraphy of Lower Pennsylvanian Gas-Bearing Sediments of Eastern Bend Flexure

The lower Pennsylvanian formations which produce oil and gas along the Bend flexure and in the Fort Worth basin crop out in the Llano uplift area. These outcrops have been studied extensively from both paleontological and lithological viewpoints from which several conflicting classifications have evolved. With the addition of subsurface terminology, stratigraphic classifications vary with individuals and companies.

From a regional subsurface study, it becomes apparent that there are three lithologic units of lower Pennsylvanian age which are of paramount economic importance. These units are the Comyn, Marble Falls, and Big Saline formations. These formation names were used because of their prominence in published literature and their descriptive nature.

The Comyn and overlying Marble Falls are very similar, both in lithologic character and depositional history, but can be separated in the subsurface on the basis of electric-log correlations. It is the contention of the author that these units are equivalent to the undifferentiated "Marble Falls" outcrops in San Saba, Llano, and Burnett counties and that they are Morrowan in age.

Hydrocarbon production from the Comyn has been minor and appears to be limited to porosity traps near its western edge in Eastland and Stephens counties. The Marble Falls deviates from this pattern and produces gas from porosity development along its depositional axis in Comanche and Hamilton counties.

The Big Saline outcrops in McCulloch County are believed to be Atokan in age due to rather wide lithologic variation and depositional history between it and the underlying Morrowan units. This is substantiated by paleontological evidence. The Big Saline is lithologically heterogeneous, with graded sediments in Jack and Wise counties. Both limestone and coarse clastic reservoirs are basically gas-bearing, but oil production is commonly found in either lithologic type of rock.

ORVAL DENMAN, independent, Decatur, Texas

Boonesville Bend Gas Field of Wise County, Texas

The Boonesville Bend gas field is one of the largest in North Texas, more than 470 wells producing from an area of approximately 450 square miles, predominantly in Wise County, at the north end of the Fort Worth basin. A thin Cretaceous cover unconformably is underlain by Mississippian limestone which in turn is underlain by the Ellenburger dolomite. The Boonesville pay produces from stratigraphic traps in highly variable lenses of fine- to coarse-grained, well cemented to porous sandstones and fine, poorly sorted conglomerates. The field is producing 5 billion cubic feet of gas per month. Total ultimate recovery is estimated at one trillion cubic feet of gas. The boundaries of the fields are fairly well defined and drilling of inside locations will be the principal future development in the field.

HAROLD C. BEAIRD, Lone Star Producing Company, Abilene, Texas

Pottsville Gas Area of Hamilton and Comanche Counties, Texas

The Pottsville Gas Area, as it is defined in this paper, is geographically located 90 miles southwest of Fort Worth in Hamilton County and southern Comanche County, Texas. Geologically, it is in the west part of the Fort Worth basin approximately 20 miles east of the Bend flexure. The Marble Falls limestone in the Atoka series of the Middle Pennsylvanian is the gas-producing formation of the area. This limestone occurs in an area 25–35 miles wide trending northeast from its outcrop on the Llano uplift in San Saba County. Under the Pottsville gas area the Marble Falls limestone is deposited on top of the Comyn limestone and is encountered at depths ranging from 2,369 feet to 3,850 feet.

The Energy field of Comanche County and the Pottsville and South Pottsville fields of Hamilton County are Marble Falls gas fields located in the west part of the Pottsville gas area. These fields overlie adjacent anticlinal structures developed on a horst which was formed by post-Marble Falls forces associated with the Llano uplift. Structural relief on the Marble Falls in these fields ranges from 300 feet in the Energy and South Pottsville fields to 500 feet in the Pottsville field with synclinal troughs separating the individual features.

Exploration in the Pottsville gas area for undiscovered fields of the Energy, Pottsville, and South Pottsville type should be confined to the depositional limits of the Marble Falls limestone. Seismograph work guided by subsurface control appears to be the most efficient method to explore for these traps.

RAYMOND C. MOORE, The University of Kansas, Lawrence, Kansas

Permian System in Texas

ROBERT B. TOTTEN and PAUL H. HORN, Sun Oil Company, Amarillo, Texas

Geology of Gas Fields of Western Anadarko Basin, Texas and Oklahoma Panhandles

The general area of this paper consists of the six most northeastern counties of the Texas Panhandle, namely, Hansford, Ochiltree, Lipscomb, Hutchinson, Roberts, and Hemphill counties, and the two eastern counties of the Oklahoma Panhandle, or Texas and Beaver counties. This area is part of the Western Anadarko basin, which is an asymmetrical sedimentary basin with its main axis trending northwest and southeast. This basin actively subsided during Pennsylvanian time. Gas fields have been found scattered over much of this area and these fields produce gas from rocks ranging in age from Permian to the Mississippian with Morrow (lower Pennsylvanian) sands furnishing the greatest number of reservoirs. The depths of production range from 2,600 feet to 13,600 feet. Most of these reservoirs result from stratigraphic traps but structural anomalies control, in part, the gas accumulation in a few fields. Sandstone forms the principal reservoir rock. With rare exceptions these reservoirs have moderate to low pressures, and with few exceptions, the gas is fairly dry. Generally accepted reserves estimates for these various reservoirs range from 350 MCF per acre foot to more than 500 MCF per acre foot. Several gas fields cover large areas and comprise many individual reservoirs which are separated both horizontally and vertically; other fields consist of one, two or few wells. The separate reservoirs of the multipay fields commonly comprise sand lentils each with separate but similar physical characteristics. Dual and triple completions are not