

est). Each formation is a lithologic unit which consists of a basal sand member, a middle lignitic shale member, and an upper calcareous member. The surface lithologic units can be traced locally into the subsurface by use of driller's logs and electrical logs. The practicability of employing these units for mapping is shown by the fact that detailed mapping of formations delimits the various oil fields of this area and shows the highest structural portion of the Sabine uplift to be in the DeSoto-Red River field.

## CENTRAL AND EASTERN STATES

48. ALFRED H. BELL, Illinois Geological Survey, Urbana, Illinois  
*Oil and Gas Development in Eastern Interior Basin in 1940*

Oil production in the Eastern Interior basin reached a new high in 1940, about 54 per cent above 1939. Most of this increase was due to the drilling of wells in the Devonian limestone in the Salem and Centralia pools, Illinois. Thirty new oil pools were discovered in Illinois, and several in southwestern Indiana and western Kentucky. The Indiana discoveries were within about 10 miles of the Wabash River which is the Illinois-Indiana state boundary in this area. Twelve of the 30 new pools discovered in Illinois are in counties bordering the Wabash River. Geological conditions revealed by the new drilling are discussed.

49. PAUL H. PRICE, State geologist, West Virginia Geological Survey, Morgantown, West Virginia

A. J. W. HEADLEE, chemist, West Virginia Geological Survey, Morgantown, West Virginia

*Geochemistry of Natural Gas in Appalachian Province*

This paper contains the results of further studies on the variations in the composition and properties of natural gas by geologic and geographic distribution.

New data corroborate the composite regional variations previously published. The regional map has been extended to include the gas and oil fields in Canada which lie in the Appalachian Province north of Lake Erie.

Well to well variations in the composition of the gas in several individual reservoirs are given. Definite relationships exist between the composition of natural gas and associated oil both areal and quantitative.

Numerous samples of near-surface gases and gases from coal seams have been analyzed.

A résumé of the geologic occurrence of methane, ethane and higher boiling saturated compounds, nitrogen, carbon dioxide, and hydrogen sulphide is given. Also the relationship of these gases to their associated constituents, i.e., sand, shale, limestone, coal, water, brine, calcium sulphate, are discussed.

The origin, migration, and natural storage of gas and oil are discussed in the light of these data.

50. E. T. HECK, West Virginia Geological Survey, Morgantown, West Virginia  
*Gay-Spencer-Richardson Oil and Gas Trend in West Virginia*

An outstanding example of the control of oil and gas production by sand distribution is provided by the Berea sand trend extending from Gay in Jackson County, north-eastward through Spencer, Roane County, and Richardson, Calhoun County. With the exception of a few undeveloped edge areas, the producing area closely follows the extent of the sand. The producing area varies in width from less than one mile to about three miles. Cross sections show that the sand pinches out in both directions at right angles to the trend and the linear shape strongly suggests a buried beach. Although only the southwestern part of the trend is considered in the paper, the trend is known to continue northeastward to Fink Creek, Lewis County. A total length of over 55 miles.

Within the sand body the adjustment of oil and gas to structure is very good, with oil in the synclines and gas on the intervening anticlines. No areas containing only water in the Berea sand are known along the trend.

Secondary recovery of oil by means of gas drive is being tried near Spencer, on an experimental basis, with encouraging results.

51. MAX W. BALL, consulting geologist, Edmonton, Alberta, Canada  
T. J. WEAVER, American Production Company, Grand Rapids, Michigan  
DOUGLAS S. BALL, student, Colorado School of Mines, Golden, Colorado  
*Shoestring Sand Gas Fields of Michigan*

The "Michigan Stray" sand, from which most of Michigan's gas is produced, consists of a series of sand bars formed on off-shore shoals in a shallow Mississippian sea. The shoals that caught the bars are on long, anticlinal trends, the sea-floor topography being determined partly by structure and partly by erosion during a previous period of emergence. In some fields enough data are available to show the size and shape, and configuration of the bars, and in at least one the sea-floor topography has been worked out, and the cause and manner of deposition of the bar are plain. The main bar formed against a small sub-sea hill, the top of which may have protruded as an island, and a smaller bar formed on a lower shoal on the opposite side of a cross channel through which enough current passed to keep the channel almost, but not quite, free of sand.

The sand bodies are of some magnitude. The largest so far explored is about 8 miles long and 3 wide and held about 50 billion cubic feet of gas. Here three parallel bars were formed and eventually coalesced into a single great bar, featured by three main undulating ridges with intervening hollows. The upper surface of the sand body is strikingly similar to the topography of a present-day sand-bar area.

None of the Kansas and Oklahoma shoestring sands described by Bass and others shows sand-bar characteristics and origin more clearly than these Mississippian sand bars of Michigan.

52. L. E. WORKMAN, State Geological Survey, Urbana, Illinois  
 I. T. SEHWADE, State Geological Survey, Urbana, Illinois  
*Subsurface Strata between Base of Osage Group and Top of Devonian Limestone in Illinois*

The lithology of the formations between the base of the Osage group and the top of the Devonian limestone in Illinois, as revealed by subsurface studies, is described. A series of isopach maps and cross sections shows the lateral variations in thicknesses of the entire group of sediments and also of the upper Kinderhook, Rockford, and New Albany divisions.

53. JOSEPH PURZER, Phillips Petroleum Company, Shreveport, Louisiana  
 WARREN B. WEEKS, Phillips Petroleum Company, Shreveport, Louisiana  
*Development in Southern Arkansas and Northern Louisiana during 1940*

Annual oil production for this area during 1940 increased by 3,563,675 barrels, or 7.6 per cent over the figure of the previous year. South Arkansas produced 25,790,380 barrels and North Louisiana 24,381,760 barrels, for a total of 50,172,140 barrels.

Of the 169 wells drilled in Southern Arkansas, 38 were dry; while 131 of the 651 North Louisiana wells were dry. The majority of the wells drilled in South Arkansas were drilled to the Smackover formation, with the Hosston ("Travis Peak") formation a close second. In northern Louisiana a great majority of the wells ended in the Gulf series, while the majority of the remaining wells ended in the Eocene series. The preponderance of Gulf wells in north Louisiana is due largely to drilling in the old Caddo field. Prospecting and development in southern Arkansas continued to point to the Smackover formation, while in northern Louisiana the search for Wilcox production predominated.

South Arkansas had one new gas-distillate field from the Smackover limestone, a new oil field from the Paluxy formation, and one producing from the Hosston formation. North Louisiana had two new oil fields and two new gas fields in the Wilcox formation, and one gas field in the Paluxy. A new field from the Hosston was in prospect at the end of the year.

54. LEO HENDRICKS, Bureau of Economic Geology, Austin, Texas  
*Correlation of Subsurface Sections with Outcrops of Ellenburger Formation of Texas*

Wells that have penetrated to the Cambrian in North-Central Texas reveal a series of limestones and dolomites of varying thickness, which has been identified by lithologic evidence as belonging to the Ellenburger formation. Based on the variation in types of contained cherts as shown by a study of insoluble residues from cuttings, the thickest development of the formation in the subsurface can be subdivided into four units. By similar study of insoluble residues of samples from carefully measured sections on the outcrop of the Ellenburger in the Central Mineral region of Texas, it is possible to recognize the subsurface units at the surface. The age of the measured sections can be determined by faunal correlation. The age correlation carried into the subsurface of North-Central Texas by means of the insoluble-residue units indicates that the ap-