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-

parent variation in thickness of the lower part of the Ellenburger is due to lateral change in lithology. Limestones underlying the Ellenburger as defined at the surface grade laterally in the subsurface into dolomites identical in character with those of Ellenburger age. Hence a portion of the so-called Ellenburger in the subsurface of North-Central Texas is pre-Ellenburger in age.

55. JAMES L. CARLTON, University of Chicago, Chicago, Illinois
Geology of Bartelso Oil Field, Clinton County, Illinois

The paper gives the location, stratigraphy, structure, production, and oil and water analyses of this field. Subsurface contour maps on the top of the Herrin (No. 6) coal, the base of the Golconda limestone, and on the top of the Devonian producing horizon show two small domes. Analysis was made of an oil and water sample from the field and statistics are given. The Cypress producing graph seems to show the production from that horizon to be declining while that from the Devonian is too recent for any definite estimate.

56. PARK J. JONES, The Texas Company, Fort Worth, Texas
Introduction to Technique for Estimating Oil Reserves

The volume of oil ultimately recoverable from reservoirs is a function of a number of variables, the more pertinent of which may be listed as follows: (1) types of porous media, (2) sources of pressure, (3) reservoir volume factors, (4) connate water contents, (5) porosities and pay thicknesses, (6) permeabilities and permeability distributions, (7) selective location and selective completion of wells, (8) rates of recovery, (9) total or partial pressure maintenances, (10) secondary recovery methods, (11) crude prices and (12) economic limits. The volume of oil ultimately recoverable from individual properties is also a function of the listed variables but in addition it depends on migration of oil away from or into the said properties.

A method of estimating oil reserves from 19 different combinations of porous media and chief sources of pressure is presented in terms of pay thickness, porosity, connate water, reservoir-volume factors, permeability ratios, and operating methods relative to current oil prices and economic limits.

An outline of the method is included as a part of a paper entitled "Introduction to Optimum Spacing of Oil Wells" which was presented before the American Petroleum Institute, Southwestern District, Division of Production, February 27 or 28, at Shreveport, La.

57. R. P. GRANT, geologist, Lansing, Michigan
Oil and Gas Developments in Michigan in 1940

The southwestern part of Michigan was the center of oil and gas activity for the state during the greater part of 1940 with activity increasing in the "Basin" area as the year closed.

The discovery and partial development of two new shallow "Stray" sand (Mississippian) gas areas and important extensions elsewhere have increased materially the gas reserves of the state. Gas production during 1940 was approximately 40 per cent greater than in the previous year.

Dispite numerous oil discoveries and extensions to proved areas, the additions to known oil reserves were of no great consequence. Oil production for 1940 was actually sixteen per cent less than in 1939 but a general strengthening in price partly offset this decline.

Several geophysical parties were reported operating in the Southern Peninsula but core testing seemed to be the favored exploratory method.

The search for new deep producing zones has received some encouragement. In the "Basin" substantial gas showings were encountered in the basal Salina (Silurian). In southwestern Michigan showings of oil were reported at the approximate horizon of the St. Peter sandstone.

58. KENDALL E. BORN, State Division of Geology, Nashville, Tennessee
Oil and Gas Possibilities in Northern Cumberland Plateau
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The northern Cumberland Plateau is surfaced with sandstones, shales, and coals of Pennsylvanian age which aggregate over 3,000 feet in thickness. The Coal Measures are underlain by 900–1,000 feet of Mississippian rocks which, in turn, rest upon as much as 200 feet of Silurian beds that thin out rapidly to the west where the Chattanooga shale is underlain by Ordovician strata.