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.

Structurally, the northern Cumberland Plateau is a monocline dipping gently to the east toward the highly folded and faulted Appalachian structural province. The Plateau is bordered to the northeast by the Pine Mountain thrust block and to the east and southeast by the Cumberland Mountain-Walden Ridge fault system. Strong secondary faults are present in southern Morgan County. Within the Plateau proper gentle dips prevail.

The upper and middle Mississippian strata have been productive in the Oneida and Glenmary areas in Scott County, respectively, and the Fort Payne of lower Mississippian age is the producing formation in the Boone Camp pool in northern Morgan County.

The subsurface stratigraphy and general structural conditions of the area are discussed and special emphasis is placed upon the pre-Mississippian possibilities.

59. J. R. LOCKETT, president, Appalachian Geological Society and Committee
Developments in Appalachian Area during 1940

60. F. R. DENTON and R. M. TROWBRIDGE, consulting geologists, Tyler, Texas
Developments in East Texas during 1940

Three oil fields were discovered and oil production found in a gas field in East Texas during 1940.

The Hawkins field of Wood County which is producing from the Woodbine is a discovery of major importance and has set in motion a large-scale leasing and geophysical program.

Routine development of proved oil fields kept completions at approximately the 1939 level. Relatively few exploratory tests were drilled.

NORTH MID-CONTINENT

61. EDWARD A. KOESTER, Darby Petroleum Corporation, Wichita, Kansas
Developments in North Mid-Continent in 1940

Kansas experienced a year of increased activity both in development and wildcatting, but results in the latter were relatively less fruitful. The number of total completions increased 33.9 per cent over 1939 and the dry hole percentage dropped from 24.7 per cent to 20.3 per cent. Initial oil production per well fell slightly from 1,577 barrels to 1,561 barrels, but the completion of 1,421 oil wells developed about 2,200,000 barrels of new potential compared to 1,500,000 barrels of new potential in 1939. Despite less activity in the Forest City basin, wildcatting increased from 95 completions in 1939 to 145 in 1940, but no important pools have yet been developed among the 23 discoveries. The most promising, as well as the most important of these pools, is the Ray pool in Phillips County, which previously had had but one small pool. In the Forest City basin, an oil and gas discovery of doubtful value was made in the McLouth pool of Jefferson County. The Bemis-Shutts, Burnett, Bornholdt, Trapp, Hall-Gurney, and Zenith pools account for 42 per cent of the new wells and 61 per cent of the new potential. Numerous extensions to old pools were made and many pools were joined.

In Nebraska the Falls City pool of Richardson County was the scene of the completion of 25 oil wells and seven dry holes. This pool produces low-gravity oil from a dolomite in the upper portion of the Devonian that is generally referred to as "Hunton." The wells respond favorably to acid treatment but water encroachment is rapid and it is doubtful that "Hunton" production in this pool will ever be of much importance. Thirty wildcat dry holes and one small oil well were completed elsewhere in Nebraska in 1940.

The Forest City basin play in Missouri resulted in the completion of seven additional deep failures and northeastern Missouri drew seven dry holes. There was also some moderately successful shallow gas development in the area east of Kansas City. There was a little intermittent drilling in Iowa, and some in the Dakotas, but the latter states were the scene of much checkerboard leasing and exploratory work.

62. LUTHER E. KENNEDY, chairman of committee of Tulsa Geological Society, Tulsa, Oklahoma
Occurrence of Oil and Gas in Pennsylvanian Sands in North Central and Northeastern Oklahoma and Southeastern Kansas

The oil and gas development maps of the northern Mid-Continent show the vast number of producing wells and fields in north-central and northeastern Oklahoma and in southeastern Kansas. These are generally described as being old Pennsylvanian pools about which geologists in general know few of the details. This paper is a joint effort of a number of geologists to divide this production into different stratigraphic horizons.