arch. Starting in the lower part of the Tate formation of the upper Ordovician, the well penetrated 418 feet of argillaceous limestones and shales of upper Ordovician, Maysville, Eden, and Cynthiana groups; 191 feet of middle Ordovician, Lexington limestone; 651 feet of lower Ordovician, Wells Creek dolomite; 2,936 feet Cambro-Ordovician dolomite probably more or less equivalent to the Knox dolomite group of Tennessee; 137 feet of Cambrian limestone and dolomite with minor amounts of gray shale tentatively correlated with the Maynardville limestone; 739 feet of Cambrian reddish brown and gray shales with some fossil fragments, and gray interbedded siltstones, considered to be in part correlative of the Nolichucky formation; 615 feet of quartzitic sandstone with intercalated green and gray shales and siltstones that may be middle or lower Cambrian in age; 25 feet of Cambrian or pre-Cambrian limestone, the lower part containing pebbles of rhyolite; and 356 of rhyolite porphyry, probably pre-Cambrian in age.

The California Company's E. W. Beeler No. 1, located ½ mile southwest of Campbellsville, Giles County, Tennessee, reached the total depth of 5,750 feet, stopping in granite, probably pre-Cambrian in age. This well is on a prominent local closure on the southwestern extension of the axis of the Nashville dome. Starting in limestone of the Carters formation of the middle Ordovician, this well penetrated 660 feet of middle Ordovician, Black River-Stones River limestone; 69 feet of lower Ordovician, Wells Creek dolomite; 4,571 feet of Cambro-Ordovician dolomite probably correlative of the Knox and Bibb-Ketona-Brierfield groups; 338 feet of Cambrian calcareous and shaly dolomite; 77 feet of quartzite and quartzitic sandstone, Cambrian or pre-Cambrian in age; and 45 feet of granite.

20. REX P. GRANT, Department of Conservation, Lansing, Michigan, "Recent Developments in Western Michigan."

The Western Michigan district comprises seven counties in the west-central part of the state. The district includes the area from Muskegon, north to Manistee, west to Cadillac, and south to the vicinity of Big Rapids. The area is fortunately situated as regards transportation facilities, being served by four Lake Michigan ports and a network of railroads and highways.

Although one of the major pools of the state, the Muskegon pool, was discovered in this district in 1927, the area apparently was not very attractive to the operating companies and development until recently has been slow. Other fields in the district are Hart, discovered in 1932 but now abandoned, Ravenna gas field in 1936, Dalton in 1940, Sauble in 1942, Woodville and Goodwell in 1943, Stony Lake in 1946, and Kimball Lake in 1947. All oil fields produce from the Traverse (Devonian) limestone; Muskegon also produced from the Dundee (Devonian) limestone. The Ravenna gas field produces from the "Berea," a sandy limestone member of the Ellsworth (Mississippian) formation.

Stony Lake field, Oceana County, was discovered in December, 1946, by the Carter Oil Company. During 1947 the field was expanded to 26 wells which, by November 1, had produced approximately 275,000 barrels of oil. The field has been developed on a spacing pattern of one well to each 40-acre unit, with wells drilled in the northeast corner of each unit. The Kimball Lake field, Newaygo County, discovered by the Sun Oil Company in February, 1947, had produced by November 1, approximately 619,000 barrels of oil from 82 wells. The field is being developed on a diagonal 20-acre pattern; the wells are drilled in the northeast and southwest corners of 40-acre units. Both fields were located by core drilling. Their discovery has resulted in a renewal of interest and vigorous exploration in western Michigan.

21. GEORGE V. COHEE, United States Geological Survey, Ann Arbor, Michigan, "Lower and Middle Silurian Rocks in Michigan Basin."*

The discovery of the Howell gas field, Livingstone County, Michigan, with gas production from the base of the Salina formation and the top of the Niagara group, has added to the interest in the possibility of commercial production from these rocks in other areas in the Michigan basin. Gas and oil have been produced from the Cataract formation and Niagara group in fields in southwestern Ontario for many years, and showings of oil and gas were reported in Niagara rocks penetrated by wells in various areas in Michigan.

Cataract rocks of lower Silurian age and Niagara rocks of middle Silurian age occur in the subsurface in the Michigan basin, and they crop out, or underlie glacial drift, around the margin of the basin. The rocks are exposed in places in the Northern Peninsula of Michigan, eastern Wisconsin, northeastern Illinois, northern Indiana, northwestern Ohio, and southwestern Ontario, Canada.

The Cataract formation which includes the "White Medina" and "Red Medina" gas-producing sandstones in Ontario west of Niagara River, is 45–190 feet thick in the Michigan basin. The Cataract is represented by dolomite and shale in the Michigan basin, and sandstones of the eastern facies are absent.

The Niagara group of the Michigan basin is composed almost entirely of dolomite, with some chert and shale in places. Shale, which grades laterally into dolomite, occurs in the group in northern Indiana. The lower part of the Niagara in eastern Michigan and the Northern Peninsula of Michigan

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is dolomite, argillaceous dolomite, and shale. The thickness of the Niagara varies from 66 feet in Kent County in southwestern Michigan to more than 700 feet in Mackinac County in the Northern Peninsula of Michigan. The Niagara increases in thickness southward from Kent County, Michigan, to 425 feet in northwestern Indiana near the area of outcrop. The sequence of Niagara rocks in southern Michigan is thin due to non-deposition of pre-Salina erosion. Outcrop and subsurface data indicate that pre-Salina erosion occurred in some areas. Local variations in thickness are due in part to reefs which in places are numerous. Niagara rocks dip at the average rate of 45 feet per mile from the outcrop area in northern Indiana to the center of the Michigan basin in Clare and Gladwin counties, Michigan, where the top of the group is more than 9,000 feet below sea level. The average dip per mile from the outcrop area in the Northern Peninsula to the center of the basin is approximately 70 feet per mile.

22. R. H. WOLCOTT,* Sohio Petroleum Company, Mt. Pleasant, Michigan, "Coldwater Field, Isabella County, Michigan."

The Coldwater field, discovered in August, 1944, is in the central part of the Lower Peninsula of Michigan, a few miles west of the center of the Michigan structural basin. The principal producing zone is the Rogers City (Devonian) dolomite. A typical Rogers City dolomite field, it has a producing closure of 55 feet covering an area of 3,160 acres. A greenish amber oil of 48° A.P.I. gravity is produced from an average depth of 3,750 feet. The reservoir is a structural trap, anticlinal in nature, the major axis striking northwest-southeast parallel with the major axis of the basin and modified by a strong cross-fold at right angles to the major axis. An important reserve in the Michigan area, the original oil in place was estimated as 43,000,000 barrels, and the expected ultimate recovery more than 5,000 barrels per acre.

On the same anticlinal structure, at an average depth of 1,400 feet, the Michigan series 'Stray' sandstone (Mississippian) forms a reservoir for dry gas with a productive area of 2,400 acres.

The limits of the producing area are well defined and little drilling is foreseen for the future.

* The writer thanks T. S. Knapp, geologist, and the production department, Sohio Petroleum Company, for their contribution to this paper.

23. JOHN G. GROHSKOPF, assistant State geologist, Rolla, Missouri, "Zones of Plattin-Joachim of Eastern Missouri."*

Examination of cable-tool cuttings from water wells has resulted in the establishment of four zones in the Plattin and two zones in the Joachim. The zoning is based on lithologic character and insoluble residues. A cross section through fourteen selected wells extending approximately 300 miles, from Kirksville in northeast Missouri to Cape Girardeau in southeast Missouri, indicates the position and thickness of the zones where present.

At Cape Girardeau the Plattin is 600 feet thick and the Joachim is 250 feet thick. In the type areas, approximately 75 miles northwest, the Plattin and the Joachim are each only 200 feet thick. In northeast Missouri, in the vicinity of Kirksville, both formations are overlapped by the "Decorah," where the latter rests on the St. Peter. The cross section indicates that older beds are overlapped from southeast to northwest and suggests an unconformity at the base of the "Decorah."

Some of the subsurface zones have been located at the outcrop of widely separated localities and can be used in surface mapping. Redefinition of the Plattin-Joachim boundary is desirable. The name Rock Levee, derived from a place of that name approximately 3 miles southwest of Cape Girardeau and near the intersection of Federal Highways 25 and 61, is proposed for the rocks lying between the redefined Plattin and Joachim. The term "Decorah" as used in Missouri requires more specific definition.

* Published by permission of Edward L. Clark, State geologist, Department of Business and Administration, Division of Geological Survey and Water Resources, Rolla, Missouri.

24. JOHN T. ROUSE, Magnolia Petroleum Company, Dallas, Texas, "A Challenge to A.A.P.G. Research."

Last summer the A.A.P.G. research program in sedimentology was presented for the consideration of the A.P.I. advisory committee on fundamental research. After due deliberation that committee recommended that the A.P.I. should sponsor specific projects within that portion of the program dealing with the origin and early diagenesis of sediments and their contained fluids.

The A.A.P.G. research committee has been holding all projects in abeyance until the A.P.I. decided which portions of the sedimentology program they wished to consider. Now the A.A.P.G. is free to go to work on any or all of the programs dealing with pre-Pleistocene sedimentary rocks.

The most important question before us is—What is the A.A.P.G. going to do? The committee feels that the Association now needs the cooperation of all local geological societies in formulating and completing a constructive and concrete attack on that part of the sedimentology program which