STATE OF OHIO
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DEPARTMENT OF NATURAL RESOURCES
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REGIONAL BEDROCK GEOLOGY OF THE OHIO PORTION OF THE LIMA, OHIO-INDIANA 30 X 60 MINUTE QUADRANGLE

by Glenn E. Larsen

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OHIO DIVISION OF GEOLOGICAL SURVEY
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LIMA, OHIO—INDIANA

INTRODUCTION

This regional bedrock-geology map of the Ohio portion of the Lima 30 x 60 minute (scale: 1:100,000) quadrangle is a product of the cooperative U.S. Geological Survey–Ohio Department of Natural Resources, Division of Geological Survey COGEOMAP (now known as STATEMAP) geologic mapping program. The goals of this program in Ohio are: (1) development of a statewide digital bedrock-geologic database, (2) production of open-file regional 1:250,000-scale structure-contour maps of all mapped geologic units, (3) production of open-file regional 1:250,000-scale bedrock-geology maps, consisting of one to two 30 x 60 minute (1:24,000-scale) topographic quadrangles within the state, and (4) publication of regional bedrock-geology maps for the thirty-four 30 x 60 minute quadrangles covering Ohio. The geology of the Ohio portion of the Lima 30 x 60 minute quadrangle was constructed from the digital compilation of twenty-eight 7.5-minute open-file bedrock-geology quadrangles. The remaining quadrangles fall within the state of Indiana.

REGIONAL GEOLOGIC SETTING

The Lima quadrangle, located in central-western Ohio and eastern Indiana (fig. 1), lies within the Till Plains and Eastern Lake Sections of the Central Lowland Physiographic Province (Fenneman, 1938). The topographic surface is generally smooth and of low relief. The bedrock surface, for the most part, is covered by unconsolidated Quaternary-age sediments ranging in thickness from 20 to more than 200 feet (Schneider, 1974). Some topographic features, such as the Greenville Moraine, are considered to be pre-Pleistocene in age; others formed as the result of Pleistocene glaciation (Stout, Var Steeg, and Lamb, 1943; Goldthwait, 1991). The thickest deposits of unconsolidated sediments locally exceed 400 feet and fill a west-northwest-trending buried valley in the southern portion of the quadrangle. This buried valley is considered by many workers to be part of the Teays Valley system of early Pleistocene age(?) or older (Stout, Var Steeg, and Lamb, 1943; Bieser, 1989; Goldthwait, 1991).

The Lima 30 x 60 minute quadrangle lies along the southern periphery of the Michigan Basin and on the northern edge of a structurally positive area formed by the intersection of the Cincinnati and Findlay Arches (fig. 1). Regionally, the rocks dip gently to the north into the Michigan Basin. As a result, younger rocks underlie Quaternary sediments in the northern portion of the map area, whereas older rocks are found in the southern portion. The bedrock surface is composed primarily of Silurian-age dolostones'. Ordovician-age limestones, dolostones, and shales subcrop within the Teays Valley in the southern portion of the map area.

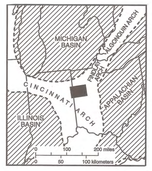

FIGURE 1.—Regional structural setting and location of the Lima 30 x 60 minute quadrangle (modified from Rudman, Summerson, and Hinze, 1965, fig. 2).

METHODS

This map is based on surface and subsurface data from 44 geophysical logs of oil/gas wells, 23 geophysically logged water wells with sample descriptions, 8 continuous core holes, and 20 measured stratigraphic sections from quarries; these data are on open file at the Ohio Division of Geological Survey (ODGS).

Three core holes (OGS 3061, 3062, 3063) were drilled in the map area as part of a regional network of nine reference cores for central-western Ohio. Each core hole was geophysically logged and served as a control point for stratigraphic interpretation and correlation of surrounding oil/gas and water-well geophysical logs. Regional studies by the Ohio Division of Water (1970); Burger, Forsyth, Nicoll, and Wayne (1971); Norris (1975); Janssens (1977); Shaver and others (1978); Recroad (1980); Droste and Shaver (1982); and Larsen (1991) provided much of the geologic and stratigraphic framework upon which the correlations were based.

All data were incorporated into the COGEOMAP database and used to digitally produce regional 1:250,000-scale structure maps of each mapped unit within the Lima, Bellefontaine, Marion, and Piqua 30 x 60 minute quadrangles (Larsen, Schumacher, Shrake, Slucher, and Swinford, 1992a-f). The mapped geologic contacts follow the buried topography at the top of the bedrock surface. The contacts between units were drawn on 7.5-minute (1:24,000-scale) quadrangle maps, using open-file 1:62,500-scale county bedrock-topography maps photographically enlarged to 1:24,000 scale and the 1:250,000-scale regional structure-contour maps digitally enlarged to 1:24,000 scale. The 7.5-minute bedrock-geology quadrangles were digitized and electronically compiled in order to construct the Lima 30 x 60 minute geologic map.

BEDROCK GEOLOGY

The bedrock stratigraphic units mapped in the Lima quadrangle are Ordovician and Silurian in age. Ordovician rocks were mapped as undifferentiated because of the difficulty in differentiating any of the stratigraphic units recognized and mapped in southwestern Ohio, where Ordovician rocks are exposed (Schumacher, Swinford, and Shrake, 1991; Schumacher, 1993; Swinford,1994). The Silurian-age rocks, in ascending order, are the sub-Lockport undifferentiated, the Lockport Dolomite, and the Salina Group, which is divided into the Greenfield Dolomite, the Tymochtee Dolomite, and the Salina undifferentiated. The same stratigraphic nomenclature used for this map is based on the subsurface nomenclature of Janssens (1977) for northwestern Ohio.

ORDOVICIAN UNDIFFERENTIATED

The undifferentiated Ordovician rocks, which subcrop in the buried Teays Valley, belong to the Upper Ordovician Cincinnatian Series (Shaver and others, 1984; Hull, 1990). They are unconformably overlain by the Silurian-age sub-Lockport undifferentiated (Janssens, 1977). Upper Ordovician rocks consist of interbedded dolostones and dolomitic silty shales, which grade downward into interbedded limestones and calcareous shales. Core data indicate the upper dolomitic portion of the Ordovician sequence grades laterally from interbedded dolostones and shales into argillaceous dolostones to locally massive, finely to coarsely crystalline dolostone toward the northwest.

SUB-LOCKPORT UNDIFFERENTIATED

Rocks of the Silurian-age sub-Lockport undifferentiated unconformably overlie the Ordovician undifferentiated and are unconformably overlain by the Lockport Dolomite (Janssens, 1977; Recroad, 1980). Dolostones of this unit are finely to coarsely crystalline and medium to thick bedded. Argillaceous and fossil-fragmental dolostone lithologies also are common.

Janssens (1977) considers the sub-Lockport undifferentiated a lithologically indistinguishable carbonate sequence laterally equivalent to the Cataract Group and Dayton and Rochester Formations of north-central Ohio. Core data indicate sub-Lockport rocks thicken northward, and lithologic divisions used in the Michigan Basin for the Cataract Group (the Manitoulin Dolomite and Cabot Head Formation) are recognizable. Recroad (1980) noted a similar relationship in northeastern Indiana and reclassified the rocks equivalent to the sub-Lockport undifferentiated in northwestern Ohio as the Cataract Formation.

LOCKPORT DOLOMITE

The Lockport Dolomite unconformably overlies the sub-Lockport undifferentiated and is overlain by the Salina Group. The nature of the contact with the Salina Group has been controversial. Janssens (1977) and Shaver (1991) describe this contact as conformable, but recognize local unconformities do exist around reefoid dolostone facies, which generally extend upward from the top of the Lockport Dolomite. However, Kahle (1988) considers the contact to mark a regional unconformity. Conodont studies by Kleffner (1992) indicate the contact in western Ohio ranges from a conformable, gradational contact to a major unconformity.

In the map area, the Lockport Dolomite is typically pure, medium- to massive-bedded, medium-crystalline to coarsely crystalline dolostone. The upper portion contains massive reefoid dolostones. Conversely, the lower portion of the Lockport Dolomite becomes argillaceous and cherty in the southwest. Because of the difficulty in correlating the Lockport Dolomite from outcrop to the subsurface (such as the Goat Island Dolomite (of Howell and Swinford, 1967) is present. Where the Goat Island Dolomite is present, Janssens subdivided the Lockport Group into three formations, in ascending order: the Gasport Dolomite (Kindle and Taylor, 1913), the Goat Island Dolomite, and the Guelph Dolomite (Logan, 1863). Wherever the Goat Island is absent or not recognizable, the Gasport and Guelph Dolomites cannot be differentiated and the Lockport is considered an undivided formation (Lockport Dolomite). Cores drilled in western Ohio through the Lockport interval indicate the Lockport cannot be subdivided in the mapped area. Thus, the Lockport interval in the Lima quadrangle is considered a formation (Lockport Dolomite).

SALINA GROUP

The overlying Salina Group consists of argillaceous and shaly dolostone interbedded with algal-laminated dolostone and finely crystalline to medium-crystalline dolostone. The upper portion of the Salina locally contains zones of intraformational breccia. In the western portion of the map area, coarsely crystalline reefoid dolostones are locally present.

The Salina Group over most of the quadrangle is divided, in ascending order, into the Greenfield Dolomite (Orton, 1871), Tymochtee Dolomite (Winchell, 1870), and Salina undifferentiated (Janssens, 1977). These three units of the Salina Group in central-western and northwestern Ohio are laterally equivalent to the A-1 carbonate, evaporite, and A-2 carbonate units (Landes, 1945; Landes (1945) in the Michigan Basin and northeastern Ohio (Alling and Briggs, 1961; Janssens, 1977). In the map area, the Greenfield and Tymochtee Dolomites are considered to be lateral equivalents of the A unit, and the Salina undifferentiated is equivalent to the B, C, and F units (Janssens, 1977).

In the southern and western portions of the map area the Greenfield and Tymochtee Dolomites cannot be distinguished. The inability to recognize these two formations may be due to lateral facies changes to the west influenced by *reef* development that was contemporaneous with deposition of rocks of the Salina Group in western Ohio (see Pinsak and Shaver, 1964; Janssens, 1977; Shaver and others, 1978; Droste and Shaver, 1982, 1983). In areas where the Greenfield and Tymochtee Dolomites are not identifiable, the entire interval is included in the Salina undifferentiated.

ECONOMIC GEOLOGY

Economic resources of the Lima 30 x 60 minute quadrangle consist of dolostone, oil and gas, sand and gravel, and clay. Dolostone, and to a lesser extent sand and gravel, are the principal commodities produced. Oil, gas, and clay are produced in small amounts. Ground water from bedrock and glacial deposits is adequate for domestic and industrial consumption.

DOLOSTONE

Dolostone has been the chief mineral resource of the quadrangle. Silurian dolostones of the Lockport Dolomite and Salina Group are quarried primarily for concrete aggregate, road ballast, and building stone (Weisgerber, 1992). Dolostone from the Lockport Dolomite is extensively quarried in the map area.

SAND AND GRAVEL

Sand and gravel deposits within the glacial sediments occur in many places throughout the area. Sand and gravel are mined in Union and Paulding Townships, Auglaize County, and Monroe Township, Allen County, for building and concrete aggregate (Weisgerber, 1992). Sand mined at the operation in Allen County is an important resource for septic-system filtration sand in the central-western Ohio region (Mard Materials, Inc., oral communication, 1992).

OIL AND GAS

Commercial quantities of oil and gas have been produced from the Ordovician Trenton Limestone. The first commercial well in the area was drilled in 1885 in Lima, Allen County (Newsocker, 1903). This well produced from the Lima-Indiana field, the first giant oil and gas field discovered in North America. Production from the Lima-Indiana field, which includes the Lima and extends southward to Indianapolis (Carman and Stout, 1936; Keith and Wickstrom, 1992). Mass production of the field began in 1887 and by 1896 when over 20 million barrels of oil were produced (Cottingham, 1951; Wickstrom, Gray, and Stieglitz, 1992). Activity in the field has been sporadic since the turn of the century (Keith and Wickstrom, 1992; Wickstrom, Gray, and Stieglitz, 1992).

CLAY

Clay from glacial till has been mined for use in ceramics at many localities in the area. Currently, clay for the production of drain tile, flue liners, and cooling-tower block is mined in Salem Township, Auglaize County (Sandusky Tile Co., Inc., oral communication, 1992).

GROUND WATER

Water-bearing characteristics of the geologic units and the availability of ground water in the region including the Lima quadrangle are discussed by Walker and Brunsteter (1959a-f); Walker (1961); Ohio Division of Water (1970); Norris and Fidler (1971); Kontodiakis (1981, 1982, 1983); Schmidt (1982); Raab (1986), and Casey (1992, in press). Ground water is available from two types of aquifers, the Silurian dolostone and the glacially-derived sand and gravel deposits which overlie the bedrock.

The dolostone bedrock is the principal aquifer providing water supplies for industrial, municipal, agricultural, and domestic needs. Sufficient water supplies are obtained where the bedrock has been subjected to solution and fracturing (Ohio Division of Water, 1970; Kontodiakis, 1985; Casey, in press). Water supplies of 200 to 500 gallons per minute have been reported from these areas at depths of 300 feet or less. The Ordovician rocks are shale rich and relatively impermeable, restricting the interchange of ground water with the overlying Silurian dolostone aquifers (Casey, 1992).

Water supplies from sand and gravel aquifers in the glacial deposits overlying the bedrock may provide yields of 100 gallons per minute or more. The thickest deposits of unconsolidated sediments, in the southern portion of the map area, which overlies the buried Teays Valley system, contains considerable amounts of water-bearing sand and gravel deposits. These deposits provide water yields of 100+ gallons per minute and also are a major source of recharge to the bedrock aquifer (Walker, 1961; Ohio Division of Water, 1970; Kontodiakis, 1981).

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[1]The term dolostone was proposed by Shrock (1948) to replace dolomite as a rock term in order to avoid confusion with the mineral dolomite. The term dolostone is used in this report according to Shrock's definition. However, the use of the term dolomite is the names of stratigraphic units (for example, Greenfield Dolomite) was retained to preserve the integrity of well-established names.

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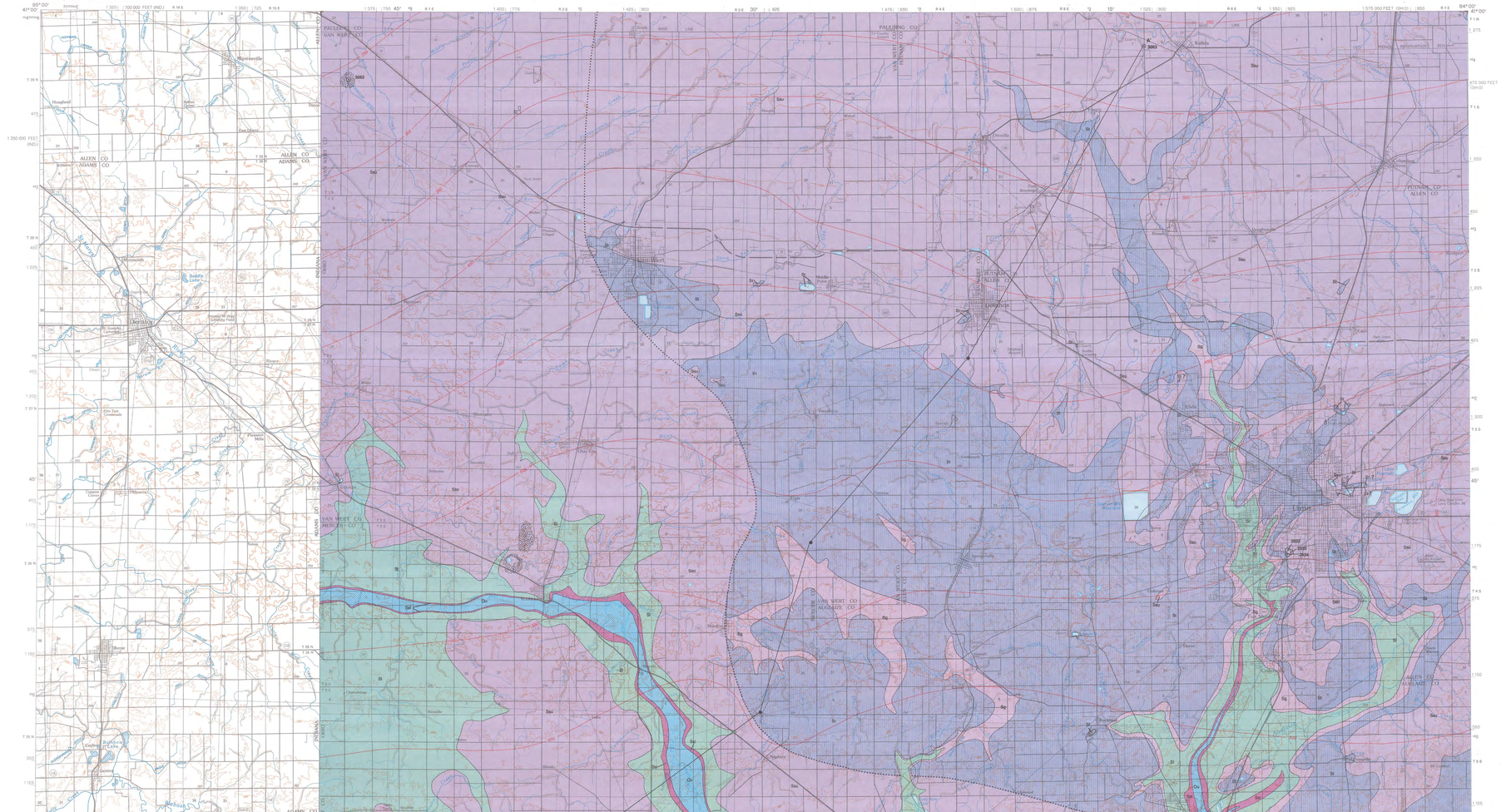
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