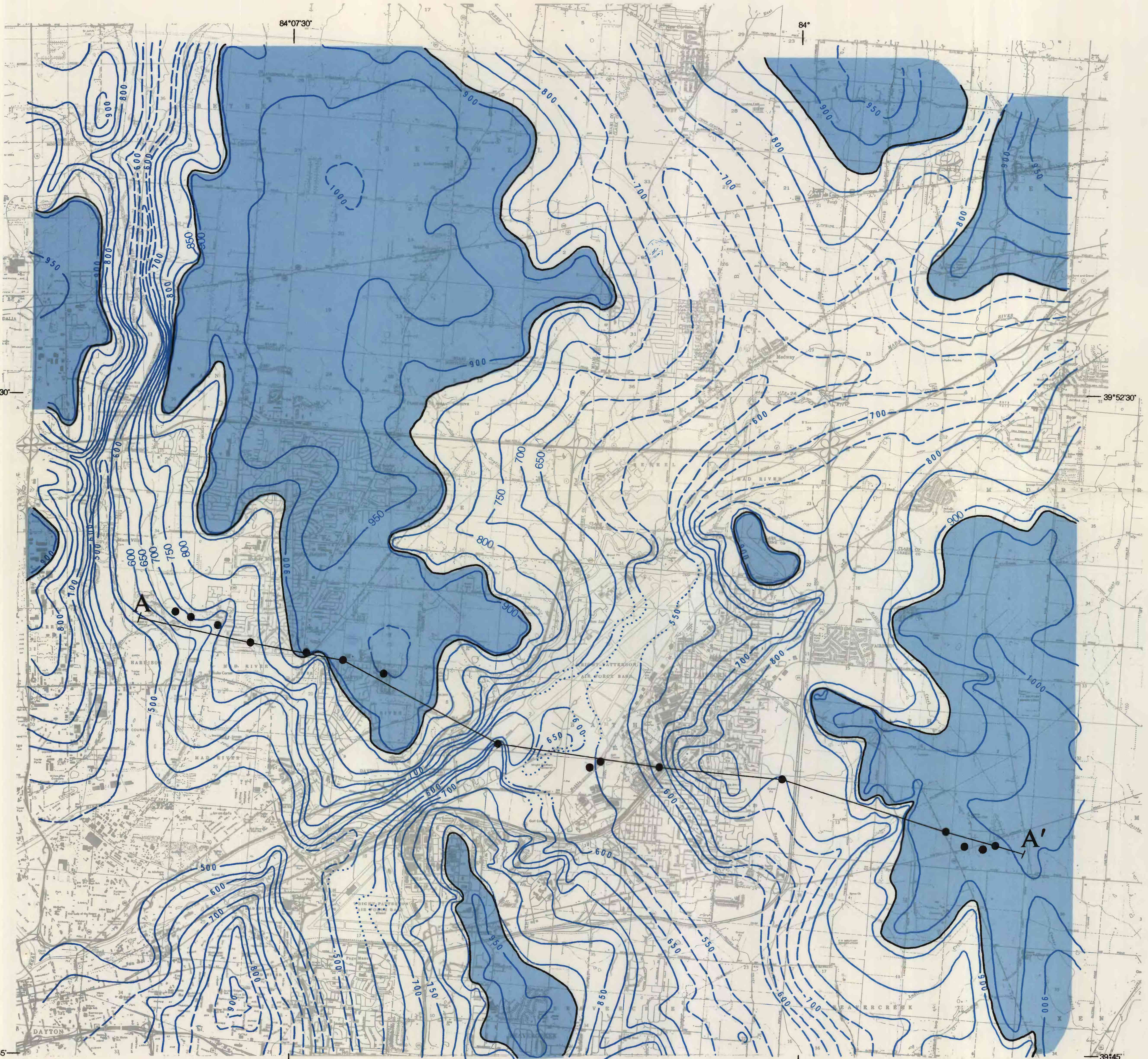
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
U.S. DEPARTMENT OF DEFENSE WRIGHT-PATTERSON AIR FORCE BASE

WATER-RESOURCES INVESTIGATIONS
REPORT 92-4072



EXPLANATION

- Subcrop of Silurian limestone
- Subcrop of Ordovician shale
- ● Well control point for geologic section
- Contact of Silurian and Ordovician rocks on the bedrock surface
- 500 TOP-OF-BEDROCK CONTOUR – Dashed where approximately located, dotted where determined by seismic methods. Contour interval 50 feet. Datum is sea level

Location of study area

SCALE 1:53,300

0 1 2 MILES
0 1 2 KILOMETERS

Sources of Data

Bernhagen, 1945
Dumouchelle and de Roche, 1991
Norris, Cross, and Goldthwait, 1948
Norris, Cross and Goldthwait, 1950
Norris, Cross Goldthwait, and Sanderson , 1952
Norris and Spieker, 1966
Walton and Scudder, 1960
Wright State University, 1980

Data on file with:
Miami Conservancy District.
Ohio Department of Natural Resources, Division of Geological Survey.
Ohio Department of Natural Resources, Division of Water.
Ohio Department of Transportation, Bureau of Testing, Soils and Foundations.
U.S. Geological Survey, Water Resources Division, Ohio District.
Wright-Patterson Air Force Base, Civil Engineering Squadron.
Wright-Patterson Air Force Base, Environmental Management.

Base from U.S. Geological Survey
Dayton North (1965, photoinspected 1984), Donnelsville (1965, photoinspected 1983), Fairborn (1965, photorevised 1988, New Carlisle (1955, photorevised 1968 and 1973), Tipp City (1965, photorevised 1982), and Yellow Springs (1968, Photorevised 1975)
7.5 Minute Series (Topographic) Maps

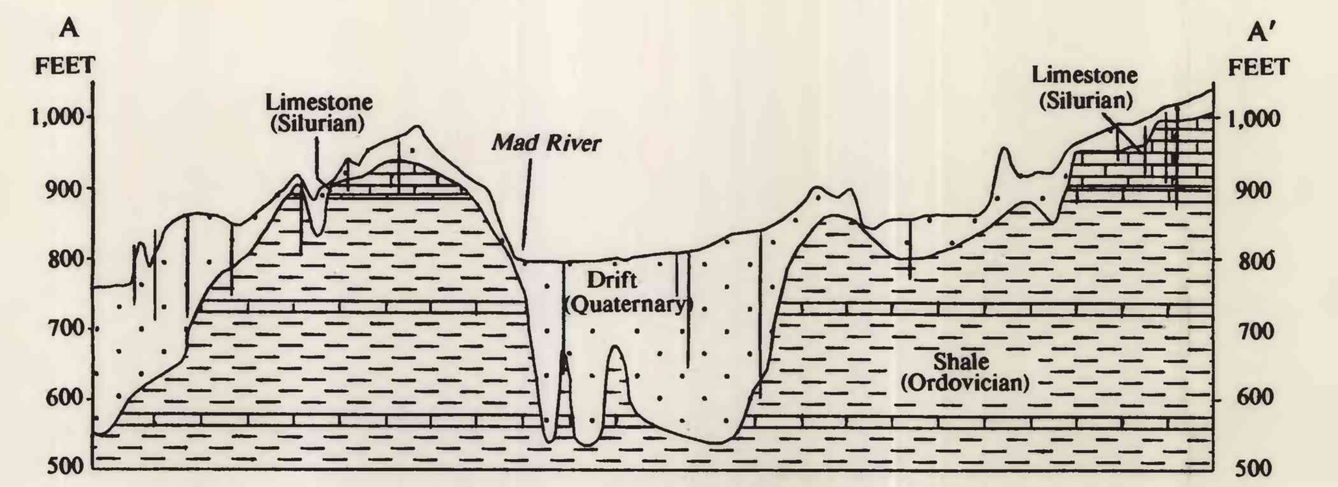


Figure 1.--Geologic section A - A'.

Figure 2.--Location of Teays River Valley, Miami River Valley, Mad River Valley, and study area (shaded).

ALTITUDE OF TOP OF BEDROCK IN THE VICINITY OF WRIGHT-PATTERSON AIR FORCE BASE, OHIO

By Denise H. Dumouchelle

INTRODUCTION

Wright-Patterson Air Force Base (WPAFB) encompasses about 8,500 acres of Montgomery and Greene Counties in southwestern Ohio. The Base is built over a highly productive glacial aquifer within the Mad River valley. A number of cities and industries and WPAFB use this aquifer for a water supply. Although numerous wells have been drilled in the area, data on the regional ground-water-flow system are sparse.

In 1987, the U.S. Geological Survey (USGS), in cooperation with the U.S. Air Force, began work on a regional ground-water study. This map, which was prepared as part of the regional study, is one of a series of reports that describe the geology and hydrology of the WPAFB area. The purpose of this map report is to present the results of an extensive survey of geologic data on the depth to the bedrock around WPAFB. Data were collected from soil and construction borings, well logs, and published maps and reports. The depth to bedrock is mapped in parts of Clark, Greene, Miami, and Montgomery Counties.

GEOLOGIC SETTING

The consolidated rocks in the region consist of Ordovician- and Silurian-age carbonates and shales (table 1). Unconsolidated glacial deposits overlie the consolidated rocks.

Most of the consolidated rocks in the region are of the Richmondian stage of Late Ordovician age. The rocks of the Richmondian stage are fossiliferous, interbedded shale and limestone. The shale is fine-grained, soft, and fissile and contains limestone. Shale layers are as thick as 20 ft. The limestone is hard and dense and consists of thin layers that range from a few inches to 2 ft in thickness (Walton and Scudder, 1960; Dumouchelle and de Roche, 1991). Limestone beds commonly comprise 25 to 50 percent of the sequence. The rocks are green-gray or blue-gray; however, red-shaded zones also are present (Norris and others, 1950). The Richmondian-stage rocks are exposed throughout Montgomery County (Norris and others, 1948) and in the Mad River valley in southwestern Clark County (Norris and others, 1952); the upper part is exposed in a railroad cut at the southern end of the Huffman Dam in Greene County (Norris and others, 1950).

The Brassfield Limestone of Early Silurian age is present in the upland areas. The Brassfield Limestone is massive and evenly bedded near the base of the formation but forms thin and irregular beds near the top. At some locations, the base consists of a granular limestone. The limestone contains abundant crinoid fossils in the upper beds; however, few fossils are present in the massive lower section. The Brassfield ranges from dark gray to pink (Norris and others, 1948). The Brassfield Limestone is exposed in Clark County along Mud Run and in some places south of New Carlisle (Norris and others, 1952). In Greene County, the limestone has been quarried near Fairborn and crops out in several other locations (Norris and others, 1950). In the north and northwestern parts of Montgomery County, the limestone is present at the surface in scattered locations (Norris and others, 1948).

In some places in the study area, other Silurian-age rocks overlie the Brassfield Limestone and consist of two calcareous shale formations and several formations of dolomite and limestone. The dolomite and limestone are massive and porous to well-bedded and dense (Norris and others, 1948). The contact between the Brassfield Limestone and the overlying younger rocks has not been identified in the study area.

The axis of the Cincinnati arch passes in a north-south direction through western Ohio. Generally, the strata along the flank of the arch dip to the northeast at about 5 ft/mi. In Montgomery County, the rocks dip to the northeast at less than 1 ft/mi (Norris and others, 1948); in Clark County, the dip is about 15 ft/mi (Norris and others, 1952).

In the Fairborn area, the dip of the rocks is affected by a small fold about 0.5 mi east of WPAFB. The fold extends from the southwestern corner of Greene County to southwestern Clark County. About 4 mi east of WPAFB, the rocks are almost horizontal. Northwest of the base, the rocks dip to the northwest at about 15 ft/mi (Walton and Scudder, 1960). Wisconsinan glacial deposits cover most of the bedrock in the region. Illinoian and pre-Illinoian glacial deposits may underlie the Wisconsinan deposits in the deepest areas of the buried valleys. The deposits can be separated into ground moraine or till, and outwash, kames, and valley-train deposits consisting of stratified sands and gravels. Clay-rich, poorly sorted till covers most of the upland areas. The till ranges from less than 1 ft to more than 80 ft in thickness and can contain sand and gravel stringers. Bedrock valleys are filled with valley-train deposits, which range from fine-grained sands to gravels. Lenses of till are present locally within these deposits. The valley-train deposits can be as much as 200 ft in thickness. A geologic section of the study area is shown in figure 1. Along some of the valley walls, generally well-sorted coarse-grained kame deposits are present. Modern stream valleys in the region contain thin deposits of alluvium (Walton and Scudder, 1960).

Table 1.--Generalized geologic column for section of the Wright-Patterson Air Force Base area

[Modified from Walton and Scudder, 1960, table 1]

System or Period	Series or Epoch	Stage or Formation	Thickness (feet)	Character of material
	Holocene		5+	Flood-plain deposits, chiefly silt and clay.
Quaternary	Pleistocene	Wisconsinan stage	260+	Outwash sand and gravel (deposited as kames and valley train by meltwaters from the glacier); aod (or) till, a heterogeneous mixture of clay, sand, gravel, and boulders in which clay predominates (deposited directly by the glacier).
		Pre-Illinoian stage	Unknown	Sand and gravel or till in the deepest part of the burind valleys heneath the Wisconsinan deposits.
Silurian	Middle Silurian		55+	Massive and porous to well-bedded and dense dolomites and limestones. Calcareous shales with limestone layers.
	Lower (or Early) Silurian	Brassfield Limestone	30+	Limestone in layers ranging from thick and massive layers near the base to thin near the top.
Ordovician	Upper (or Late) Ordovician	Richmondian, Mayvillian, and Edenian Stages, undivided	1,000+	Shale, soft, calcareous, interbedded with thin layers of hard limestone.

GEOLOGIC HISTORY

During most of the Paleozoic Era, 570 to 275 million years ago, the Fairborn area was submerged beneath a shallow sea. The rocks in the region originated from the bottom sediments of this sea. The sea regressed from what is now western Ohio near the end of the Paleozoic Era, and erosion by surface streams began to remove the sediments. During the late Tertiary Period, about 10 to 15 million years ago, this region was uplifted, and, as a result, streams began to erode deep valleys (Norris and Spieker, 1966).

The major bedrock valleys in the map area were formed as part of the Teays River system, which existed from the Late Tertiary Period to the Pleistocene Epoch. The main stem of the Teays River flowed northwestward across Ohio and into Indiana (fig. 2), passing about 30 mi northeast of Dayton. The streams in the bedrock valleys shown on this map could have flowed southwestward toward a preglacial Ohio River (Norris and Spieker, 1966; R.A. Sheets, U.S. Geological Survey, oral commun., 1991).

The Teays drainage system ended with the advance of Pleistocene continental glaciers. Deposits left by the glaciers altered the Teays River system as new stream systems developed. The new system, called the Deep Stage, cut the bedrock valleys to their present depths. The Holocene (modern) drainage system developed after the retreat of the ice sheets. The modern stream system is similar to the Deep Stage system. The current surficial topography is the result of the deposits left by the continental glaciers and modern stream erosion (Norris and Spieker, 1966).

METHODS

More than 1,000 well logs and soil borings were examined to determine the altitude of the top of bedrock throughout the region. Published reports and maps also were used in determining the altitude of the top of bedrock. (See data-credit note at bottom right corner of map.) The depth to bedrock indicated on the well log was subtracted from the land-surface altitude at that location to determine the top-of-bedrock altitude. Land-surface altitudes generally were determined from USGS topographic-quadrangle maps having 10-ft contour intervals. If the well did not reach bedrock, the log provided an upper limit for the altitude of the top of bedrock.

Unpublished USGS seismic-refraction data from surveys on WPAFB provided estimates of the depth to bedrock in some areas. The seismic data represent an approximate bedrock altitude at that point (generally, ±20 ft).

More than 1,000 data points were used to interpret the bedrock surface. The altitude of the top of bedrock is contoured at 50-ft intervals. Where the altitude of the bedrock is near the land surface, the altitudes shown on the USGS topographic maps were used for additional control. The dotted contour lines indicate that the altitude of the bedrock was estimated on the basis of the seismic data, whereas the dashed lines indicate that contours in areas where well and seismic data are sparse are estimated.

The data used for this report are available on computer file at the USGS office in Columbus, Ohio, and are available upon request. For additional information, write to:

District Chief
U.S. Geological Survey
975 W. Third Ave.
Columbus, OH 43212-3192

ALTITUDE OF TOP OF BEDROCK

Several deep buried valleys in the bedrock surface are shown on the map. A major buried valley trends generally north-south; however, it trends northeast-southwest beneath WPAFB. Data on the depth of this valley are sparse, particularly in the north around Medway where few wells that reach bedrock were found. According to a map of Clark County by Norris and others (1952), the main buried valley continues to the northwest past New Carlisle. The north-central branch (near Donnelsville) is a tributary valley that disappears 1.5 to 2 mi to the north, and the northeastern branch (near Enon) narrows about 1 mi to the east before joining another valley.

Part of another major buried valley is shown in the southwestern corner of the map near the confluence of the Miami and Mad Rivers. According to the maps by Norris and others (1948) and Norris and Spieker (1966), this valley continues south through Montgomery County. A third deep and narrow buried valley is present along the western edge of the map. The extent of this valley is unknown. The valley is not completely infilled, and the Taylorsville Dam was constructed in it. In the lower central part of this map, a narrow valley connects the two broader valleys and is probably younger than either. This narrow valley is also not completely infilled, and Huffman Dam was constructed in it.

Bedrock is near land surface in most of the upland areas of the region. The effects of erosion by surface streams on the bedrock topography can be seen in several areas. In Miami County, the bedrock contours indicate a small valley beneath Mud Creek. Other examples are present in Greene County east of Beaver Creek and in Montgomery County northwest of Huffman Dam.

The contact between the Ordovician and Silurian rocks shown on this map is based on the maps by Norris and others (1948, 1950, and 1952), and Walton and Scudder (1960). The contact has not been mapped in Miami County and is estimated on the basis of the other maps

SELECTED REFERENCES

Bernhagen, R.J., compiler, 1945, Record of wells in Montgomery County: Ohio Water Resources Board Bulletin 1, 67 p.
Dumouchelle, D.H., and de Roche, J.T., 1991, Lithologic, natural-gamma, grain-size, and well-construction data for Wright-Patterson Air Force Base, Ohio: U.S. Geological Survey Open-File Report 91-181, 94 p.
Norris, S.E., Cross, W.P., and Goldthwait, R.P., 1948, The water resources of Montgomery County, Ohio: Ohio Water Resources Board Bulletin 12, 83 p.
—— 1950, The water resources of Greene County, Ohio: Ohio Department of Natural Resources, Division of Water Bulletin 19, 52 p
Norris, S.E., Cross, W.P., Goldthwait, R.P., and Sanderson, E.E., 1952, The water resources of Clark County, Ohio: Ohio Department of Natural Resources, Division of Water Bulletin 22, 82 p.
Norris, S.E., and Spieker, A.M., 1966, Ground-water resources of the Dayton, Ohio area: U.S. Geological Survey Water-Supply Paper 1808, 167 p., 9 pl.
Ohio Department of Natural Resources, Division of Geological Survey [n.d.], Open-File Bedrock Topography Manuscript Map of Greene County, Ohio: scale 1:62,500, 1 sheet.
Ohio Department of Natural Resources, Division of Geological Survey, 1986, Open-File Bedrock Topography Manuscript Map of Montgomery County, Ohio: scale 1:62,500, 1 sheet.
Walton, W.C., and Scudder, G.D., 1960, Ground-water resources of the valley-train deposits in the Fairborn area, Ohio: Ohio Department of Natural Resources, Division of Water Technical Report 3, 57 p.
Wright State University, Department of Geology, 1980, Environmental geology for campus planning, Dayton Campus area: 2 v

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
square mile (mi^2)	2.590	square kilometer
gallon (gal)	3.785	liter

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called "Sea Level Datum of 1929."

ALTITUDE OF TOP OF BEDROCK IN THE VICINITY OF WRIGHT-PATTERSON AIR FORCE BASE, OHIO

By Denise H. Dumouchelle

1992

★U.S. GOVERNMENT PRINTING OFFICE: 1992-0-651-138

For sale by U.S. Geological Survey, Books and Open-File Reports Section
Box 25425, Federal Center, Denver, CO 80225