

THE BEDROCK SURFACE AND FORMER DRAINAGE SYSTEMS OF MONTGOMERY COUNTY, OHIO¹

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INTRODUCTION

The bedrock surface of Montgomery County, Ohio (in which Dayton is situated), has been contoured in considerable detail. Elevations at more than 500 points on the bedrock surface were obtained in the course of a well survey conducted by the Ohio Water Resources Board and the U. S. Geological Survey in the summer of 1946. This survey was made to obtain data for a report on the water resources of the county, which is to be published in 1948 by the Ohio Water Resources Board.²

The bedrock underlying the glacial drift of Montgomery County consists of interbedded shales and limestones of Upper Ordovician age, capped over large areas by Middle Silurian limestones and dolomites. The rocks of both systems are so resistant that the casing in drilled water wells ordinarily can be driven only to the top of the bedrock surface. In wells that are drilled into the rock, therefore, the length of casing generally can be taken as the depth to the rock surface. In wells where the length of casing is the same as the total depth of the well it may be assumed that the well was finished in unconsolidated formations, bedrock not having been penetrated. In the field survey of wells these assumptions were used as a basis for acquiring the data for the bedrock contour map. The length of casing in wells was determined by means of an electrical device invented by the author and submitted for patent by the U. S. Department of Justice. The elevation of the rock surface was computed by subtracting the length of casing from the elevation of the land surface at the well, as shown by the topographic maps of the U. S. Geological Survey.

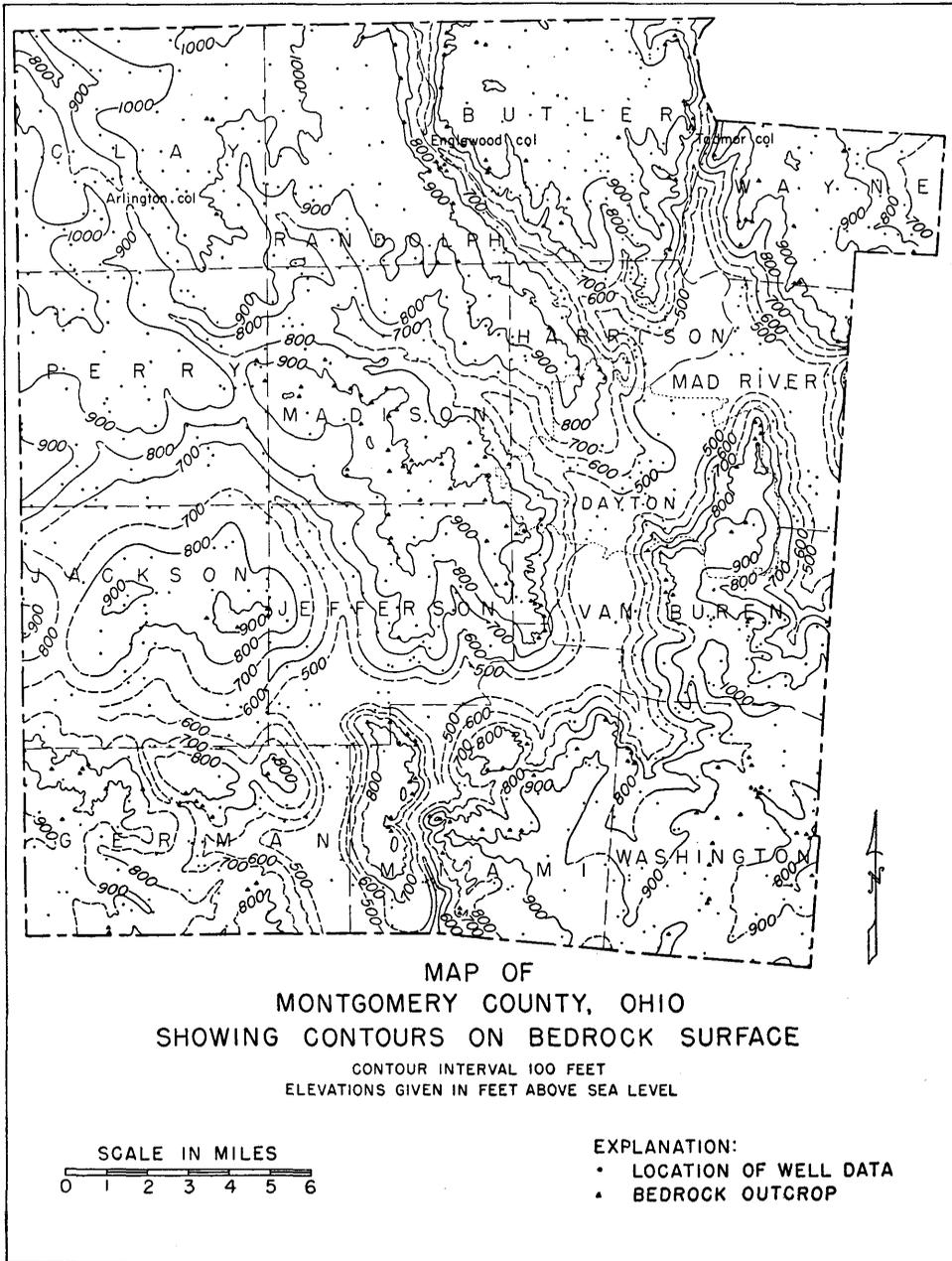
Montgomery County comprises parts of four quadrangles, namely, the Brookville, Dayton, Miamisburg, and Waynesville quadrangles. These quadrangle maps were used as a base on which to contour the bedrock surface. The accompanying plate is a reduced tracing of the bedrock contours developed on this base map. A full-scale copy of this bedrock contour map, showing 50-foot contour intervals, is to be included in Bulletin 12 of the Ohio Water Resources Board.

PREGLACIAL TOPOGRAPHY OF MONTGOMERY COUNTY

Before Pleistocene glaciation Montgomery County probably resembled the part of the Bluegrass region of Kentucky that lies just south of the glacial border. The topography of both areas is of similar origin with respect to the structure and stratigraphy of the underlying rocks. They are areas of regional uplift in which rocks of Upper Ordovician age, with a border of Silurian limestones, are exposed at the surface. The present Bluegrass area consists of a fairly smooth, gently rolling surface deeply dissected by short tributaries and broad, entrenched rivers, similar to the bedrock topography of Montgomery County. The covering of glacial drift over Montgomery County has subdued its former relief and masked all but the most prominent features of the ancient drainage.

¹Presented at the meeting of the Ohio Academy of Science, Toledo, Ohio, on May 7, 1948. Published by permission of the Director of the U. S. Geological Survey.

²Norris, S. E., Cross, W. P., and Goldthwait, R. P., The water resources of Montgomery County, Ohio: Ohio Water Resources Board Bull. 12 (in preparation).



GEOLOGY BY S.E. NORRIS

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PREGLACIAL (TEAYS STAGE) DRAINAGE IN MONTGOMERY COUNTY

The earliest recognizable drainage system in Ohio is called the Teays system and all streams in existence at that time are referred to as "Teays Stage" drainage.³ The Teays system, it is thought, antedated the earliest of the glacial stages of the Pleistocene epoch. The master Teays River rose in the Piedmont area in the southeastern part of the United States and flowed across Ohio in a northwesterly direction in a course that lay a few miles north of Montgomery County. The Teays drainage system must have endured for a considerable length of time, for the streams eroded broad, deep channels and developed an immature peneplain or base level known as the Parker Strath.

Montgomery County, because of a drainage divide in its northern part, was drained only partially by the main Teays River. The greater part of the county was drained by a large Teays tributary named by Stout⁴ the Hamilton River. The Hamilton River flowed southward through Montgomery, Butler, and Hamilton Counties, then turned westward and entered the Teays River somewhere in Indiana.

The former course of the Hamilton River through Montgomery County is defined by the bedrock contours shown on the accompanying plate. In Teays time it entered Montgomery County from the east near the boundary line between Mad River and Van Buren Townships. From this point the Hamilton flowed northward to about the Middle of Mad River Township and from there it flowed westward to Dayton, cutting that part of its valley now occupied by the Mad River. At the site of Dayton the Hamilton River received from the north and northwest the waters of three large tributaries whose courses are now occupied by the Miami River, which flows in part along the western border of Wayne Township; the Stillwater River, whose present course is in part along the western border of Butler Township; and Wolf Creek, which flows through Madison Township. In Teays time these tributaries terminated in the uplands of Montgomery County in col areas respectively at Tadmor, Englewood, and Arlington. The valleys on the northern sides of these cols were cut by north-flowing tributaries of the main Teays River.

From Dayton to the southeastern corner of Jefferson Township the Hamilton River cut a broad course that is now occupied by the Miami River. The course of the Hamilton from that point was westward through the southern part of Jefferson Township, and thence southward through the eastern part of German Township to the county line. In the southwestern part of Jefferson Township the Hamilton was joined by two large tributaries, both of which entered Montgomery County from the west.

A col or drainage divide existed in Miami Township in Teays time, at the site of the city of Miamisburg. This col separated two short opposite-flowing Hamilton tributaries. Two other cols existed in north-central German township.

The width of the Hamilton River valley in Montgomery County, as shown by the map contours, averaged more than 1 mile at river level and up to 3 miles at the divide levels. In Teays time the main stream was entrenched some 200 feet below divide levels.

In Montgomery County streams of later drainage stages greatly deepened the valleys originally developed in Teays time and only a few scattered remnants of the Teays valley levels are now to be found. These remnants of the Teays valley floor occur as terraces along the sides of some of the more recent valleys at elevations ranging from 750 to 770 feet for former tributaries in the northern part of the county, to elevations as low as 650 feet along the main stream in the

³Stout, Wilber, Ver Steeg, Karl, and Lamb, G. F., *Geology of Water in Ohio: The Ohio Geological Survey Bull. 44, 4th Ser., 1943.*

⁴Stout, Wilber, Ver Steeg, Karl, and Lamb, G. F., *op. cit.*

southern part of the county. Not enough well records are available to determine the gradient of the floor of the main Teays-stage Hamilton valley.

The existence of the Teays drainage system, according to Stout and others,⁵ was terminated by the advance to the central Ohio area of a very early pre-Illinoian glacier, perhaps of the Kansan stage. This early glacier, it is thought, did not reach the area of Montgomery County, but it did advance to a point where it blocked the main Teays River to the north. This caused major diversions of the drainage lines and inaugurated the succeeding "Deep Stage" drainage system. The Deep Stage system is so called because during this time the streams cut deep, narrow valleys many feet below the levels established in Teays time. This down cutting might have resulted in part from regional uplift of the land surface shortly after the start of the Deep Stage drainage cycle.

DEEP STAGE DRAINAGE IN MONTGOMERY COUNTY

It seems evident that the Hamilton River in Deep Stage time persisted in its original course in Montgomery County, as did its principal tributaries. Well records at several points in the Hamilton valley in Montgomery County show no evidence of lake deposits, indicating that the south-flowing Hamilton River probably was not ponded by the pre-Illinoian glacier, as were parts of the main Teays system. The cols at Tadmor, Englewood, and Arlington might have been cut through in Deep Stage time with the extension northward of three Hamilton tributary valleys. The reduction of these cols, if it happened in early Deep Stage time, might have resulted from the overflow of waters from ponded Teays valleys to the north. Available well records in the valleys north of these cols in Montgomery County show a considerable thickness of very fine sand, but no silts or lake clay deposits. Apparently, if ponding did occur, any lake deposits in these valleys must have been of small extent or were removed by later streams before the glaciers deposited their materials.

Deep Stage valleys in Montgomery County are comparatively wide, perhaps as much as a mile in the Hamilton valley. The lowest elevation of the valley floor recorded at Dayton is about 513 feet above sea level, nearly 200 feet lower than the Teays level. A test well in southeastern Jefferson Township, and thought to be near the axis of the Deep Stage channel, struck bedrock at the depth of 212 feet, or at an elevation of about 500 feet above sea level. If this point and the one at Dayton are in the deepest parts of the valley, a gradient of about 1 foot per mile is indicated for the main Hamilton valley in Deep Stage time, which is probably too low.

EFFECTS OF GLACIATION ON THE DRAINAGE IN MONTGOMERY COUNTY

The Illinoian glacier, the first ice sheet to cover Montgomery County, ended the Deep Stage drainage cycle and began a new drainage system which was probably much like the present system as it has evolved since the more recent Wisconsin glaciation.

It is probable that the Illinoian glacier caused a minor drainage diversion in the west-central part of Miami Township, where it forced the main Hamilton drainage through a narrow col which in Teays and Deep Stage times had separated two short tributaries. Drainage diversions were likewise caused in German Township where two smaller cols were breached by ice-diverted drainage or by melt water from the glacier. It is also possible that the cols at Tadmor, Englewood, and Arlington were cut through in this way.

The work done by the post-Illinoian streams consisted mainly of the removal of part, and in some areas probably most, of the valley deposits laid down by the

⁵Stout, Wilber, Ver Steeg, Karl, and Lamb, G. F., *op. cit.*

Illinoian glacier. The post-Illinoian interglacial period was brought to a close by the advance of the Wisconsin glacier, the latest ice sheet to cover this area.

The Wisconsin glacier probably caused some changes in the drainage lines of post-Illinoian time in Montgomery County. Perhaps the Wisconsin ice caused some of the changes in the Deep Stage system that are credited herein to the Illinoian glacier. It is believed, however, that the main effect of the Wisconsin ice sheet on the former drainage was in supplying the greater part of the unconsolidated materials that now fill these valleys.

It is planned by the Ohio Water Resources Board and the U. S. Geological Survey to extend a well survey, such as the one completed in Montgomery County, into the adjacent counties of Greene, Clark, Miami, and Champaign. Detailed maps of the bedrock surface in these areas will undoubtedly help to define in detail the drainage history of the entire southwestern part of Ohio.
