



## BEDROCK TOPOGRAPHY OF OHIO

A complex system of hills and valleys lies buried beneath glacial sediments that blanket all but the southeastern part of Ohio. In many areas of the state, especially in the western half of Ohio, a relatively flat landscape conceals a buried terrain of deep valleys and steep hills. In other areas, the landscape is dominated by low mounds or ridges of earth of glacial origin that overlie a relatively flat, undissected bedrock surface of little relief. Knowledge of the bedrock surface configuration and the thickness of the glacial drift that overlies bedrock has practical applications in construction activities, the search for resources such as minerals and ground water, environmental problems, and many other diverse uses.

The bedrock surface in southern and western Ohio was complexly dissected over several million years by a preglacial drainage system known as the Teays River system (see GeoFacts No. 10). Other parts of the state were similarly dissected by other preglacial drainage systems. These drainage networks were destroyed and new drainage systems were established when glaciers advanced across Ohio at the beginning of the Pleistocene Ice Age about 2 million years ago.

A quick review of the definitions of some key words will be helpful. *Topography* is the surface configuration of the landscape. This configuration is commonly shown on a map by *contour* lines, which connect points of equal elevation. *Relief* is the difference between the highest and lowest elevation points of the land surface. The term "topography" also can be used to describe the configuration and relief of the bedrock surface, even though it is buried by glacial sediments.

### WHAT IS A BEDROCK-TOPOGRAPHY MAP?

Geologists portray this buried bedrock surface by means of specialized geologic maps known as bedrock-topography maps. Such maps have been compiled by the Division of Geological Survey for many parts of Ohio, especially in the areas that have been completely or partially covered by one or more glaciers of the Pleistocene Ice Age. In these areas, clay, silt, sand, pebbles, and boulders—collectively referred to as glacial drift—were transported and deposited by or in association with continental ice sheets, which are speculated to have been as much as 4,000 feet thick. These ice sheets scoured the land surface as they crossed Ohio and, upon melting, left an irregular, blanketlike deposit of unconsolidated drift that filled in the valleys and covered the hills of the preglacial bedrock surface. Therefore, in

glaciated areas of the state, the surface topography of the landscape commonly provides little indication of the topographic surface of the bedrock beneath it.

A bedrock-topography map depicts the configuration and elevation of the bedrock surface as if all the glacially derived sediments and soil had been removed. These maps are, in essence, contour maps of the irregular and dissected terrain developed on the bedrock surface. The contour interval used on a bedrock-topography map depends on the local buried topography but is commonly 20, 50, or 100 feet.

### MAKING A BEDROCK-TOPOGRAPHY MAP

Compilation of bedrock-topography maps is a detailed and time-consuming process. A Division of Geological Survey geologist begins by obtaining copies of the water-well logs (drillers' reports) from files at the Ohio Department of Natural Resources, Division of Water, Water Resources Section. These well logs are the most important set of data for determining the bedrock topography. Water-well drillers commonly note on the log the depth that bedrock was encountered. The precise location of each water well is field checked. The locations of these wells are plotted on base maps, generally at a scale of 1:24,000 (1 inch equals 2,000 feet). The elevation of the bedrock surface is computed by subtracting depth to bedrock from the surface elevation at the well site and plotting the bedrock elevation on the base map. Other geologic data useful in the compilation of these maps include outcrops of bedrock and glacial drift, soils maps for areas where bedrock lies less than 5 feet below the surface, bore holes from engineering tests, and logs of oil and gas wells. In short, any information on the depth to and the elevation of the bedrock surface is useful in compiling bedrock-topography maps.

After all of this information is compiled and plotted on a base map, the geologist then draws contour lines that connect points of equal elevation. Such contouring requires considerable skill and experience because the distribution of data points across a particular map is generally highly variable. In areas of low data density, the geologist must have a detailed understanding of preglacial and interglacial drainage systems and other aspects of buried topography in order to project and interpolate contour lines. Data from surrounding areas also must be considered in order to insure continuity between adjacent areas.

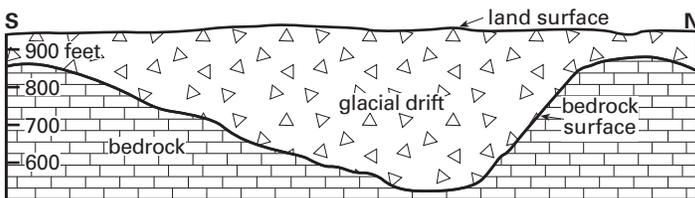
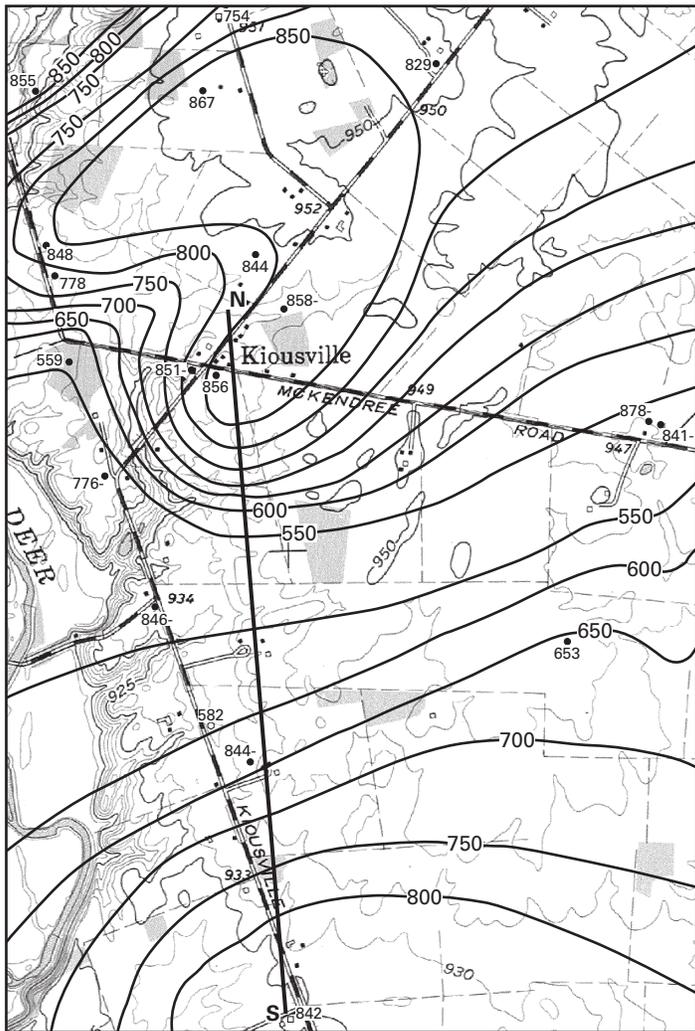
### USES FOR BEDROCK-TOPOGRAPHY MAPS

Bedrock-topography maps are fundamental interpretations of geologic information that have important implications concerning environmental protection, mineral exploration, and land-use planning. The delineation of pre-Pleistocene and Pleistocene valleys and the drainage history of a region is of great potential value in locating aquifers that may be sources of large quantities of ground water. Detailed knowledge of the location of buried valleys and the thickness of glacial drift can be used in siting water wells and in selecting building sites for homes and for industries that require a large supply of ground water.

Knowledge of the depth to bedrock in a particular area is valuable information for a variety of users including homeowners, construction companies, and mineral industries; such information can save considerable money and frustration. Consider the difficulty and added expense of digging a basement or a ditch for a pipeline and suddenly discovering that blasting or other expensive excavation techniques must be used to remove rock when it was anticipated that only easily removed un lithified sediments would be encountered. Obviously, prior knowledge of the depth to the bedrock would result in the selection of a homesite or route for a pipeline that would avoid shallow bedrock. Alternately, shallow bedrock can



Map showing glaciated and unglaciated parts of Ohio.

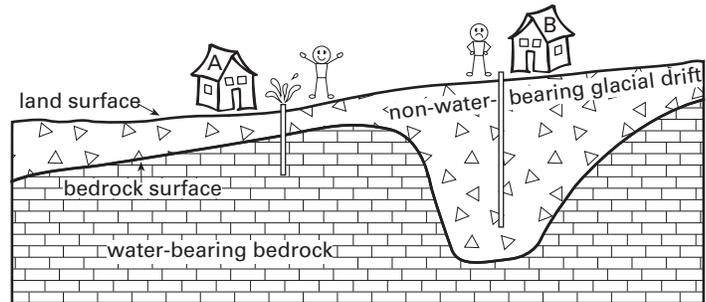


A bedrock-topography map of a portion of the Big Plain 7.5-minute quadrangle located in portions of Fairfield, Oak Run, and Pleasant Townships in Madison County. The contour interval is 50 feet. The cross section shows the bedrock uplands in the north and south portions of the map and the east-west-trending bedrock valley in the center of the map. Topographic relief between uplands and the valley is about 350 feet; the land-surface relief is only about 40 feet. Data point locations are marked by different symbols to indicate the various published and unpublished sources of water-well data.

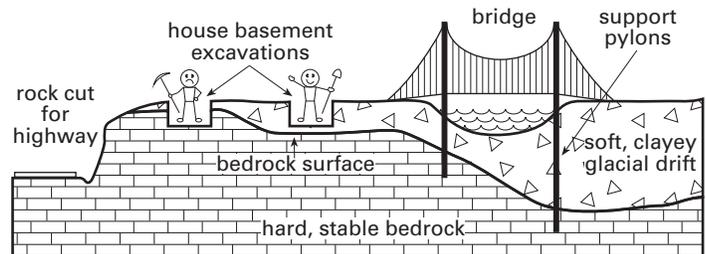
be beneficial, as it provides necessary stability for pylons for large construction projects such as bridges or tall buildings.

Bedrock-topography information is valuable for siting stone quarries, where sites that have minimal overburden (material overlying a useful mineral deposit) are most desirable; in anticipating the length of surface casing necessary for oil and gas wells; and in siting landfills and other waste-disposal facilities. Such information also is valuable for zoning of potential seismic-risk areas because shallow bedrock is commonly less prone to severe ground motion than are thick, unconsolidated sediments.

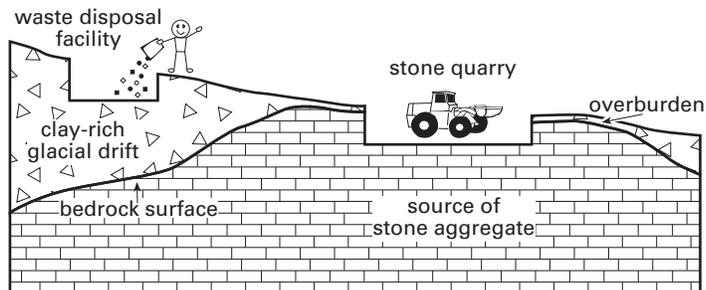
It is apparent that bedrock-topography maps are of great value to a large number of Ohio citizens, and they can be of critical importance in locating homes, businesses, and industries and in insuring that the public health is protected.



Generalized cross section showing how bedrock topography can affect the depth that needs to be drilled to reach a dependable water supply. Landowner A built a house where water-bearing bedrock was close to the ground surface. Only a shallow water well needed to be drilled to obtain a plentiful water supply. Landowner B built a house over a buried valley filled with nonwater-bearing glacial drift. A deeper and more expensive well was drilled without reaching an adequate water supply.



Generalized cross section showing uses of a bedrock-topography map for engineering and building purposes. Depth to bedrock is important when bridge pylons need to be set in solid bedrock; deeper bedrock increases the length of the pylons and the construction cost of the bridge. The cost of building a highway or digging a basement for a house increases if blasting is required to remove hard bedrock, in contrast to using heavy equipment to remove softer glacial drift.



Generalized cross section showing a stone quarry located where bedrock is close to the surface, reducing the amount of overburden to be removed. Also depicted is the location of a solid-waste disposal facility where a bedrock valley filled with clay-rich glacial drift is a favorable geologic setting for isolating solid waste from the ground water.

### OBTAINING A BEDROCK-TOPOGRAPHY MAP

The Division of Geological Survey has prepared open-file bedrock-topography maps at a scale of 1:24,000 (1 inch equals 2,000 feet) for most 7.5-minute quadrangle maps in Ohio. These maps have bedrock-topography contours of 20, 25, 50, or 100 feet; most show the data that were used to make the map. These maps supersede earlier county bedrock-topography maps at a scale of 1:62,500 (1 inch equals about 1 mile). Paper copies of bedrock-topography maps are available from the Survey for individual 7.5-minute quadrangles for \$4.00 each, plus tax and shipping. A free brochure, *Ohio topographic maps* (Educational Leaflet 16) is available from the Survey; the brochure includes an index to the 7.5-minute quadrangles for Ohio. For more information on bedrock-topography maps contact the Division of Geological Survey, 4383 Fountain Square Drive, Columbus, OH 43224-1362, telephone (614) 265-6576, fax (614) 447-1918, e-mail [geo.survey@dnr.state.oh.us](mailto:geo.survey@dnr.state.oh.us).