DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
IOWA GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1222


## EXPLANATION

Log data
Bedrock penetrated

Log data
Bedrock not penetrated

Published data
Bedrock penetrated

Published data
Bedrock not penetrated

Quarry or outcrop

Seismic station

1000 — 1050
Bedrock contours
Show altitude of bedrock surface.
Dashed where approximately located.
Contour interval 50 ft (15 m).
Datum is mean sea level.

## INTRODUCTION

The bedrock in Iowa (Hershey, 1969) is generally overlain by unconsolidated deposits consisting of glacial drift, alluvium, and loess. Loess deposits are most extensive in areas bordering the Missouri River flood plain, attaining a thickness of over 200 ft in some places. The total thickness of the unconsolidated sediments ranges from less than 1 ft to more than 450 ft. The configuration of the underlying bedrock surface is the result of a complex system of ancient drainage courses that were developed during the long period of preglacial erosion and during shorter, but more intense, periods of interglacial erosion.

The following conversion factors can be used to convert inch-pound units in this report to the International System of Units (SI):

| Inch-pound | Multiply by | Metric (SI) |
|---|---|---|
| foot (ft) | 0.3048 | meter (m) |
| gallon per minute (gal/min) | 0.0630 | liter per second(L/s) |

## BEDROCK TOPOGRAPHY

Primary control for the map is geological log data and information from quarries, outcrops, and seismic refraction surveys. Published data (Norton, 1912) provide additional control, but they are not as precise as log data and are used principally in areas where primary log data is limited. More detailed information concerning the control data is available in the files of the Iowa Geological Survey and the U.S. Geological Survey, Iowa City, Iowa.

The accuracy of the map is directly related to the density of control points; the greater number of points in a given area, the more reliable the placement of the contours. Because of the lack of control points in eastern and south-central parts of the map area, dashed contours, indicating a lack of good control, are used extensively. Much of the interpretation of the bedrock topography along the eastern edge is inferred from comparison with an adjacent bedrock topographic map (Cagle, 1973). Dashed contours are used in other parts of the map where it seems reasonable to continue a ridge or valley, but where no control point was available to confirm the contours.

The principal features of the bedrock surface are the deeply buried bedrock channels and the present-day bedrock-incised stream valleys. Several bedrock channels are located in eastern and western parts of the map area; the most prominent of these is the Fremont Channel which extends northward through Fremont, Mills, and Pottawattamie Counties. The buried channels characteristically are (1) relatively wide with gently-sloping walls where they have been cut in easily erodible, dominantly shale bedrock; (2) narrow and steep walled where they have been cut in more resistant, dominantly carbonate bedrock. Bedrock uplands form the divides between and adjacent to the buried channels; they have a maximum altitude of about 1250 ft.

The bedrock surface in the central part of the area has been sculptured primarily by present-day streams. The streams have deeply incised the bedrock uplands and have extended their valleys by headward erosion. These bedrock-incised valleys tend to be narrow and steep walled. Occasionally, the present-day streams are situated over buried channels and, because they have not eroded into bedrock, relatively broad valleys have developed.

The buried-bedrock channels in the map area are the headward extensions of ancient bedrock drainage courses that continue into Missouri. Heim and Howe (1963) applied the names Albany Valley, Grand River Valley, and Maryville Valley to buried valleys in Missouri that originate in or cross the map area. In the present report the names Albany and Maryville have been retained, but the name Fremont has been assigned in place of Grand River. Furthermore, in the present study, the term "channel" is used instead of "valley" to conform to general usage in Iowa reports.

## USES OF THE MAP

The bedrock map, when used in conjunction with land-surface altitudes, is a valuable tool in studying hydrologic, environmental, and geologic problems.

*Hydrology*—The map is an aid in locating supplies of ground water. The sources of these supplies are water-bearing sand and gravel in the deposits of glacial drift and alluvium that overlie the bedrock.

Drill-hole data show a relationship between the physical features of the bedrock surface and the occurrence of ground water in the overlying surficial deposits. The areas most favorable for the development of supplies are buried-bedrock channels and the alluvial valleys of present-day streams that may or may not have incised the bedrock.

Drift-filled buried channels often are favorable sites for obtaining ground-water supplies at relatively shallow depths because they frequently contain extensive sand-and-gravel deposits. Recent hydrologic studies of the drainage basin of the Nishnabotna River have confirmed the presence of water-bearing sand-and-gravel deposits in parts of the Fremont Channel (Sendlein, 1971), but few data are available for the bedrock channels in other parts of the map area. Although sand-and-gravel aquifers often are distributed irregularly and are not present at all places within the drift-filled bedrock channels, they do occur more frequently and are more extensive within areas underlain by bedrock channels than in areas underlain by bedrock uplands. Alluvial aquifers are somewhat more regularly distributed and predictable in their occurrence. Test drilling should precede the development of ground water from these sources.

Yields from buried-channel aquifers generally range from 1 to 15 gal/min; however, yields of as much as 100 gal/min have been recorded from individual wells tapping buried sand-and-gravel aquifers within the Fremont Channel. The alluvial aquifers will yield from 20 to 300 gal/min.

This map will aid drilling contractors in planning the construction of a well. By determining the depth to bedrock, the contractor can estimate casing needs and therefore prepare more accurate cost estimates. Where the overburden is thick, he can be better prepared for problems attendant to drilling this material.

Other uses for the map include river-basin hydrology studies and determining surface-water and ground-water relationships at selected locations.

*Environment*—Bedrock information is particularly valuable to State, regional, and local planners concerned with environmental problems such as the location of landfill sites. The thickness of the overburden, which can be determined with the aid of this map, is an important consideration in the protection of aquifers from potential sources of contamination, such as landfills.

*Geology*—The bedrock map shows the location of bedrock highs—information of value to quarry operators and to construction engineers concerned with foundation problems. The map also aids in the interpretation of drainage changes caused by glacial movements and in mapping the areal distribution of consolidated rocks.

## ACKNOWLEDGMENTS

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## SELECTED REFERENCES

Arey, M. F., 1916, Geology of Taylor County: Iowa Geological Survey Annual Report, v. 27, p. 65–103.
Cagle, J. W., 1973, Bedrock topography of south-central Iowa: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-763.
Calvin, Samuel, 1900, Geology of Page County: Iowa Geological Survey Annual Report, v. 11, p. 397–460.
Condra, G. E., 1949, The nomenclature, type localities and correlation of the Pennsylvanian subdivisions in eastern Nebraska and adjacent states: Nebraska Geological Survey Bulletin 16.
Condra, G. E., and Upp, J. E., 1931, The Red Oak-Sennett Lexie traverse of Iowa: Nebraska Geological Survey Paper 3.
Condra, G. E., and Reed, E. C., 1938, The Redfield anticline of Nebraska and Iowa: Nebraska Geological Survey, Paper 12, 19 p.
Geological Society of Iowa, 1964, Guidebook: Southwestern Iowa field trip.
Gow, J. E., and Tilton, John, 1916, Geology of Adair County: Iowa Geological Survey Annual Report, v. 27, p. 277–346.
Heim, G. E., and Howe, W. B., 1963, Map of bedrock topography of northwestern Missouri, in Groundwater maps of Missouri: Missouri Geological Survey and Water Resources.
Henderson, J. R., and others, 1963, Preliminary interpretation of an aeromagnetic survey in central and southwestern Iowa: U.S. Geological Survey Open File Report.
Hershey, H. G., 1969, Geologic map of Iowa: Iowa Geological Survey.
Hershey, H. G., and others, 1960, Highway construction materials from the consolidated rocks of southwestern Iowa: Iowa Highway Research Board Bulletin No. 15.
Keyes, C. R., 1895, Carboniferous formations of southwestern Iowa: American Geologist, v. 15.
Lonsdale, E. H., 1894, Geology of Montgomery County: Iowa Geological Survey Annual Report, v. 4.
Miller, R. D., 1964, Geology of the Omaha-Council Bluffs area, Nebraska-Iowa: U.S. Geological Survey Professional Paper 472, 70 p.
Moore, R. C., 1948, Classification of Pennsylvanian rocks in Iowa, Kansas, Missouri, Nebraska, and northern Oklahoma: American Association of Petroleum Geologists Bulletin.
Norton, W. H., and others, 1912, Underground water resources of Iowa: Iowa Geological Survey Annual Report, v. 21, p. 1100–1186.
——— 1912, Underground water resources of Iowa: U.S. Geological Survey Water-Supply Paper 293.
Parker, M. C., 1971, Resume of oil exploration and potential in Iowa: Iowa Geological Survey Public Information Circular No. 2, 11 p.
Ruhe, R. V., and others, 1967, Landscape evolution and soil formation in southwestern Iowa: Soil Conservation Service, U.S. Department of Agriculture Technical Bulletin.
Sendlein, L. V. A., and others, 1971, Interrelationship of surface and subsurface flow in the Nishnabotna drainage basin: Iowa State Water Resources Research Institute, 179 p.
Shimek, B., 1911, Pleistocene of the vicinity of Omaha, Nebraska, and Council Bluffs, Iowa: Geological Society of America Bulletin, v. 22.
Tuthill, S. J., and others, 1972, Hydrogeologic considerations in solid waste storage in Iowa: Iowa Geological Survey Public Information Circular No. 4.
Udden, J. A., 1900, Geology of Pottawattamie County: Iowa Geological Survey Annual Report, v. 11.
——— 1903, Geology of Mills and Fremont Counties: Iowa Geological Survey Annual Report, v. 13.
Woods, L. W., 1935, The road and concrete materials in southern Iowa: Iowa Geological Survey Annual Report, v. 36.
——— 1941, Geology of Adams County: Iowa Geological Survey Annual Report, v. 37.

# BEDROCK TOPOGRAPHY OF SOUTHWEST IOWA

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