DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-920-C

SOME ENVIRONMENTAL GEOLOGY CONSIDERATIONS IN MONTGOMERY COUNTY, MARYLAND

The Montgomery County folio is intended for use by planners, engineers, hydrologists, and citizens interested in evaluating geologic and hydrologic conditions that may be limiting factors to certain types of land use. The scale of the maps, 1:62,500 (1 inch = approx. 1 mile, contour interval 20 ft), permits only a regional overview, or guide, on a county basis. The maps and accompanying tables and texts provide source and supplementary information to facilitate preliminary area evaluations for some uses, but the data are considered to be reliable only at the published scale. The maps are not intended for enlargement, nor are they, or the engineering data, intended to replace site investigations by qualified technical personnel. Local details at any given site may be quite different from the generalities portrayed on these county maps. These local details must also be considered in planning for a specific land use, although remedial actions and treatments can commonly be engineered at reasonable cost so that otherwise limiting factors can be overcome.

The folio consists of a series of derivative maps that provide a perspective of the surface and shallow subsurface of Montgomery County not readily apparent from published geologic, soils, and ground-water studies on which they are primarily based. Engineering properties of rock and overburden are provided in generalized tabular summaries. The maps are designed as multipurpose products to be used independently and in combination with other maps or data published or available elsewhere, such as soils, ground-water, flood-prone areas, slope, vegetation, population, zoning, land use, or geophysical maps. By combining the maps in a variety of ways depending on the relevant limiting factors for any given land use, a series of maps can be derived by the user that focuses on specific problems. For example, the user will be able to evaluate several given areas for a sanitary landfill considering a group of factors using certain map combinations, then be able to assess the limitations or advantages of the same areas for park land or urban development by using other factors and other map combinations. By selecting criteria or guidelines, unique single-purpose derivative maps can be made. Once the essential guidelines to a specific problem are established, other secondary criteria can be modified by trading off or moderating conflicting uses. Current problems, such as evaluating sites for sanitary landfills, sewage-treatment and disposal plants, evaluating areas with limitations for heavy construction, locating transportation or utility corridors, siting septic-tank leaching fields, extracting mineral resources, assessing ground-water resources, determining limitations for surface disposal of treated waste water, selecting areas for park land or rural open space, and many other urban area problems can be more rationally assessed from these maps, at least on a regional basis. Potential uses and possible derivative products from other combinations are discussed in the texts accompanying each map.

SELECTED REFERENCES

Alabama Geological Survey, 1971, Environmental geology and hydrology, Madison County, Alabama, Meridianville quadrangle: Alabama Geol. Survey Atlas Series I.

Hughes, G. M., 1972, Hydrogeologic considerations in the siting and design of landfills: Illinois Geol. Survey, Environmental Geology Notes, no. 51, 22 p.

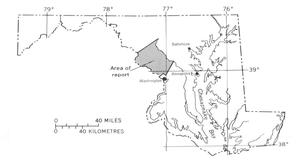
Jacobs, A. M., comp., 1971, Geology for planning in St. Clair County, Illinois: Illinois Geol. Survey Circ. 465, 35 p.

Leopold, L. B., 1968, Hydrology for urban land planning—A guidebook on the hydrologic effects of urban land use: U.S. Geol. Survey Circ. 554, 18 p.

Leopold, L. B., Clarke, F. E., Hanshaw, B. B., and Balsley, J. R., 1971, A procedure for evaluating environmental impact: U.S. Geol. Survey Circ. 645, 13 p.

Maryland-National Capital Parks and Planning Commission, 1971, Land use maps of Montgomery County: Silver Spring, Md., Maryland-National Capital Parks and Planning Commission, scale 1:12,000.

Pessl, Fred, Jr., Langer, W. H., and Ryder, R. B., 1972, Geologic and hydrologic maps for land-use planning in the Connecticut Valley with examples from the folio of the Hartford North quadrangle, Connecticut: U.S. Geol. Survey Circ. 674, 12 p.



INDEX MAP OF MARYLAND

Base from Maryland Geological Survey, 1973

CONTOUR MAP OF THE BASE OF SAPROLITE, MONTGOMERY COUNTY, MARYLAND

In the area underlain by crystalline rocks, the solid contours show a generalized configuration of the saprolite-hard rock interface. This interface is essentially the contact between almost impermeable (except for fractures) bedrock below and porous, relatively permeable, weathered material above. Outcrop control points and drill holes (mainly water wells) used as subsurface elevation control points are also shown. The dashed contours are the projection of the regional bedrock surface where the base of the saprolite is missing, usually across valleys or in upland areas underlain by ultramafic rocks; where contoured horizons project above the topographic surface, the area is underlain by unweathered bedrock.

In a countywide overview, the base of the saprolite generally parallels the topographic surface of the county. The closed local "highs" and "lows" are superimposed on the regional slope of the saprolite-bedrock interface.

A comparison of this map with the thickness of overburden map (Froelich, 1975b) and the bedrock map (Froelich, 1975a) shows that many of the bedrock "highs (or domes)" are coincident with areas of thin saprolite on mafic and ultramafic rocks, and many of the closed "basins" are formed on schist or gneiss overlain by thick saprolite.

The "basins" and "domes" are usually alined parallel to the regional northeast-trending foliation, and it seems likely that routes and rates of fluid migration would be influenced by the orientation and inclination of micas and clays in the saprolite mantle formed on schists and gneisses. Parallel and intersecting joint systems would also influence routes and rates of fluid migration.

Despite excellent studies by Nutter and Otton (1969), Otton (1972), and Stewart (1962, 1964), not enough is currently known to predict accurately the physiochemical nature and hydrologic properties of the saprolite and soil produced from different rock types in different physiographic settings. Additional work is needed to evaluate these factors more precisely.

POSSIBLE USES OF THE MAP

The base of saprolite map used in conjunction with the bedrock map (Froelich, 1975a) may help predict movement of ground water and routes of subsurface fluid migration from septic tank fields, sanitary landfills, sewage disposal plants, and sludge pits. Used with the topographic map, the base of saprolite map may suggest avenues where ground water may emerge to mingle with surface streams. Areas of closed subsurface basins which are overlain by a thick mantle of porous saprolite, as shown on the thickness of overburden map (Froelich, 1975b), may be favorable sites for developing ground-water supplies from bedrock wells that utilize the storage capacity of the overlying saturated saprolite.

SELECTED REFERENCES

Cleaves, E. T., 1968, Piedmont and Coastal Plain geology along the Susquehanna Aqueduct, Baltimore to Aberdeen, Maryland: Maryland Geol. Survey Rept. Inv. 8, 45 p.

Cloos, Ernst, and Cooke, C. W., 1953, Geologic map of Montgomery County and the District of Columbia: Baltimore, Md., Maryland Dept. Geology, Mines and Water Resources, scale 1:62,500.

Dingman, R. J., and Meyer, Gerald, 1954, The water resources of Howard and Montgomery Counties, Maryland: Maryland Dept. Geology, Mines and Water Resources Bull. 14, 260 p.

Froelich, A. J., 1975a, Bedrock map of Montgomery County, Maryland: U.S. Geol. Survey Misc. Inv. Ser. Map I-920-D.

———1975b, Map showing thickness of overburden, Montgomery County, Maryland: U.S. Geol. Survey Misc. Inv. Ser. Map I-920-B.

Hopson, C. A., 1964, The crystalline rocks of Howard and Montgomery Counties, *in* The geology of Howard and Montgomery Counties: Maryland Geol. Survey, p. 27-215.

Johnston, P. M., 1964, Geology and ground-water resources of Washington, D. C., and vicinity: U.S. Geol. Survey Water-Supply Paper 1776, 97 p.

———1966, Unpublished appendix of well logs and drill-hole data for Johnston, 1964 (U.S. Geol. Survey Water-Supply Paper 1776), unpaged [available in U.S. Geol. Survey Library, Reston, Va., catalog no. (200)qJ646ge].

Larrabee, D. M., 1969, Serpentinite and rodingite in the Hunting Hill quarry, Montgomery County, Maryland: U.S. Geol. Survey Bull. 1283, 34 p.

Muesser, W. H., and others, 1967, Final report, subsurface investigation—Washington Metropolitan area rapid transit authorized basic system, Connecticut Avenue Route: U.S. Dept. Commerce, Natl. Tech. Inf. Service, PB-179653, v. 1.

Muesser, W. H., and others, 1969, Preliminary subsurface investigation—chapter 12, Rockville Route (A), study section no. 7: U.S. Dept. Commerce, Natl. Tech. Inf. Service, PB-184066, p. 19-20.

Nutter, L. J., and Otton, E. G., 1969, Ground-water occurrence in the Maryland Piedmont: Maryland Geol. Survey Rept. Inv. 10, 56 p.

Otton, E. G., 1972, Solid waste disposal in the geohydrological environment of Maryland: Maryland Geol. Survey Rept. Inv. 18, 59 p.

Stewart, J. W., 1962, Water-yielding potential of weathered crystalline rocks at the Georgia nuclear laboratory: U.S. Geol. Survey Prof. Paper 450-B, p. B106-B107.

———1964, Infiltration and permeability of weathered crystalline rocks, Georgia Nuclear Laboratory, Dawson County, Georgia: U.S. Geol. Survey Bull. 1133-D, 57 p.

Stewart, J. W., Callahan, J. T., and Carter, R. F., 1964, Geologic and hydrologic investigation at the site of the Georgia Nuclear Laboratory, Dawson County, Georgia: U.S. Geol. Survey Bull. 1133-F, 90 p.

U.S. Geological Survey, 1967, Engineering geology of the Northeast Corridor, Washington, D. C., to Boston Massachusetts—Bedrock geology: U.S. Geol. Survey Misc. Geol. Inv. Map I-514-A.

SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 0 1 2 3 4 5 6 7 KILOMETRES

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
NUMBERED TICKS INDICATE THE 10,000 FOOT MARYLAND STATE GRID
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

EXPLANATION

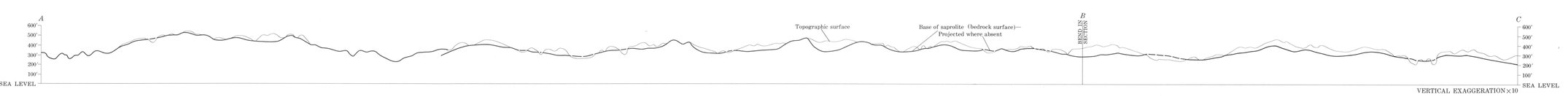
DATA CONTROL POINT

×480 Bedrock outcrop, unweathered, showing approximate altitude, in feet. Not all outcrops or elevations shown

•302 Drill hole, approximately located, showing approximate altitude of unweathered bedrock, in feet, estimated from drillers' logs or inferred from depth of casing in water wells. Not all wells shown

240 Spring, showing approximate altitude, in feet

100' GENERALIZED CONTOURS ON BASE OF SAPROLITE, IN FEET ABOVE SEA LEVEL.—Contour interval 50 feet. Hachures indicate possible basins. Dashed contours are projection of regional bedrock surface where saprolite is absent. Queried where inferred



INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1975

CONTOUR MAP OF THE BASE OF SAPROLITE, MONTGOMERY COUNTY, MARYLAND

By
Albert J. Froelich

1975

For sale by U.S. Geological Survey, price $.75