Research Project: SP009B4M
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RESEARCH SUMMARY

GEOLOGY AND SINKHOLE DEVELOPMENT OF THE HAGERSTOWN VALLEY: PHASE II

Problem

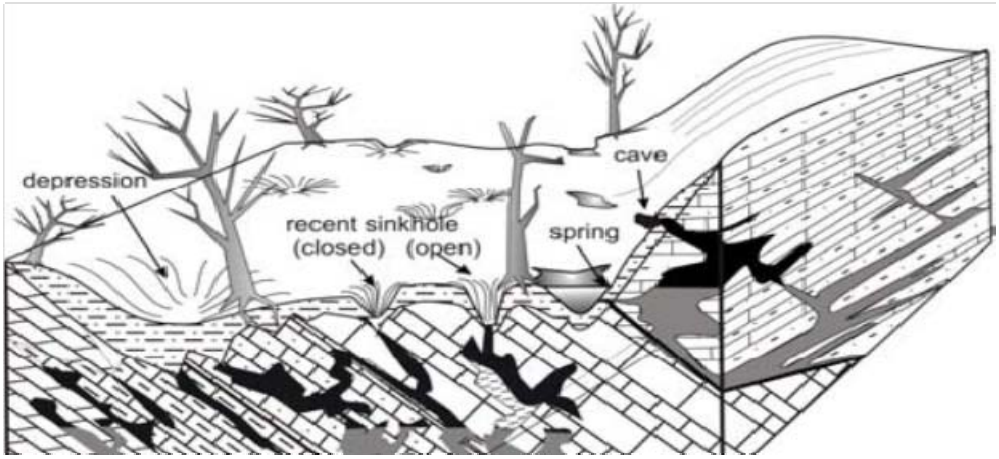
Areas underlain by carbonate rocks such as limestone, marble, and dolomite are prone to sinkholes because ground-water can cause them to dissolve over time. This dissolution of bedrock produces distinctive topographic features that characterize what is known as karst terrane. While karst terranes are present to some degree in all areas underlain by all carbonate rocks, they develop at varying levels based on changes in the chemical makeup and geologic structure of the bedrock. It is therefore impossible to characterize or predict the distribution, type, abundance, or size of karst features in any particular terrane without first assembling data and evaluating the distribution of mapped bedrock units, their intrinsic geologic structure, and proximity to major hydrologic features such as streams or rivers. In addition to geologic factors, the activities of humans, such as road construction and housing development can have a significant impact on the development of karst features. Unlined drainage and stormwater runoff ponds are key human factors that affect sinkhole development. Because these factors are commonly employed in highway projects and the Hagerstown Valley is susceptible to sinkhole development, the State Highway Administration (SHA) was interested in developing a better understanding of the geological and topographic factors in the region.

Objective

The objective of this study was to map the western half of the Hagerstown Valley to determine the distribution of karst features relative to bedrock geologic units using a global positioning system (GPS).

Description

Four types of karst features were identified during the study: depressions, active sinkholes, karst springs, and caves. The figure below illustrates these features.



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RESEARCH SUMMARY

More than 2,100 karst features were identified and located during the geologic mapping of the Hagerstown, Mason-Dixon, Shepherdstown, Clear Spring, and Hedgesville quadrangles. These geographic areas were canvassed during geologic field mapping, and definable karst features were precisely located and identified utilizing a GPS receiver. In some circumstances features that could not be entered because of property permission constraints, were located by calculating the azimuth (i.e. the angle formed between a reference direction, typically north, and a line from the observer to the point of interest), and then the distance was delineated using a laser range finder. In addition to the geographic coordinates, data acquired at each location included the karst feature type, bedrock unit identification, presence or absence of Quarternary deposits that might cover the feature, and other possibly significant characteristics, such as location in a drainage lowland, drainage ditch, or stormwater management reservoir.

Results

The following observations were made in this study: (1) There is a generally identifiable relationship between the type of karst feature and the bedrock units; (2) In addition to bedrock composition, joints and faults appear to have played important roles in the development of the karst systems in the area; (3) Preliminary findings suggest the impact of human activity on karst development is less pronounced than in the Frederick Valley; and (4) unlined drainage appear to be just as frequent culprits in sinkhole activity as they are in the Frederick Valley. Likewise, areas surrounding quarries and stormwater runoff ponds are common sites of sinkhole development.

SHA's Office of Materials Technology (OMT) will refer to the maps developed in this study when conducting construction and access permits reviews. The reviews will help determine the following:

- If the access permit site is on a carbonate rock and whether stormwater facilities will require impermeable lining systems;
- If construction projects are in carbonate rock areas and the relative density of karst activity;
- The potential need to include sinkhole remediation and/or subsurface grouting in contract document provisions; and
- The potential need for on-site geophysical surveys for karst conditions.

OMT will also refer to the maps to reference geologic karst activity prior to site visits. The GPS locations for new sinkholes will be provided to the Maryland Geological Survey as they are identified.

Report Information

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Link to Final Report

http://www.roads.maryland.gov/OPR_Research/MD-14-SP009B4M_Geology-and-Sinkhole-Mapping-Of-The-Hagerstown-Valley-Phase-II_Final-Report.pdf