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ILLINOIS STATE GEOLOGICAL SURVEY
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KARST TERRAINS AND CARBONATE ROCKS OF ILLINOIS

1997

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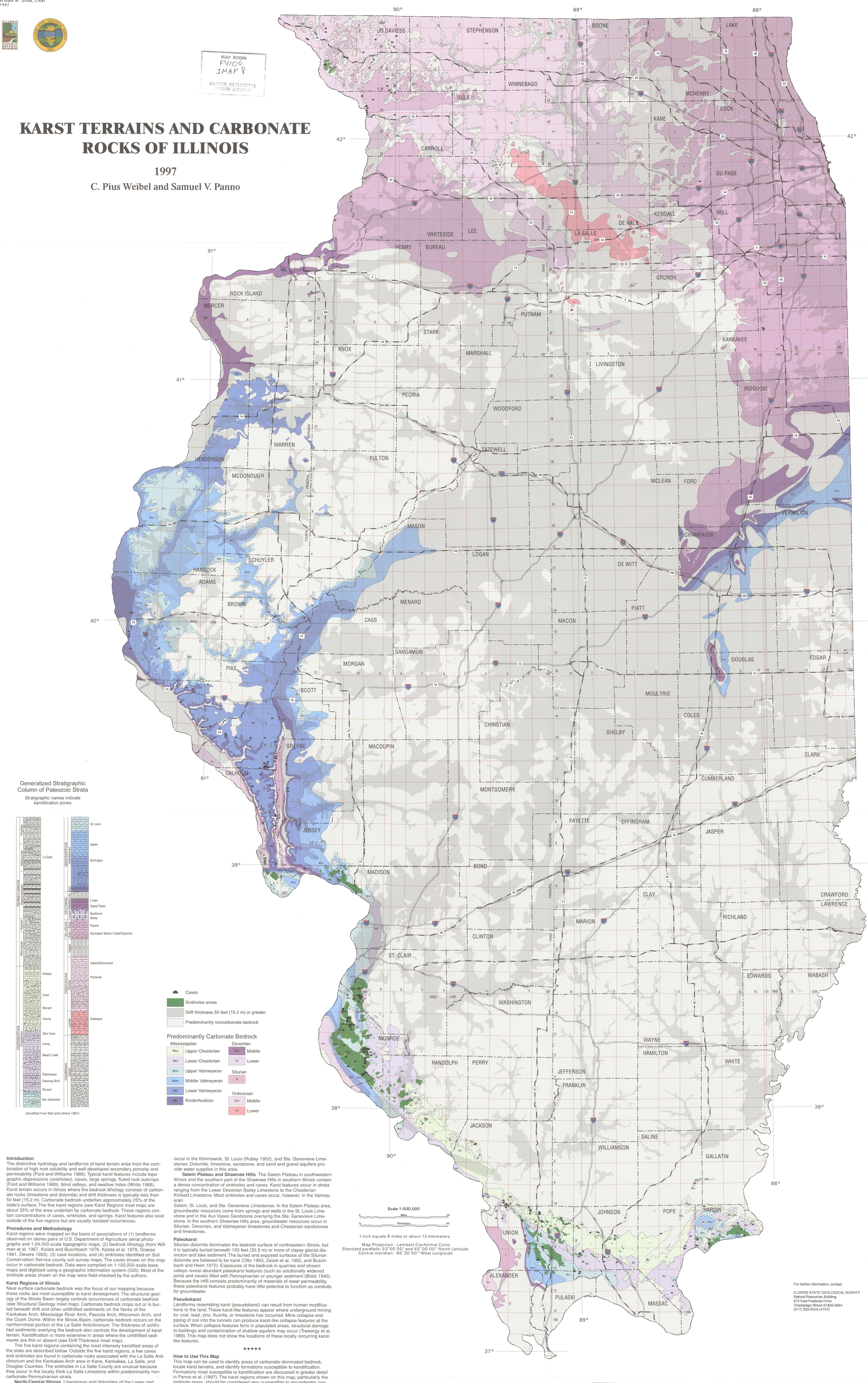

Generalized Stratigraphic Column of Paleozoic Strata

Stratigraphic names indicate karstification zones

(modified from Bell and others 1961)

Caves
Sinkholes areas
Drift thickness 50 feet (15.2 m) or greater
Predominantly noncarbonate bedrock

Predominantly Carbonate Bedrock

Mississippian		Devonian	
Mcu	Upper Chesterian	Dm	Middle
Mcl	Lower Chesterian	Dl	Lower
Mvu	Upper Valmeyeran	Silurian	
Mvm	Middle Valmeyeran	S	
Mvl	Lower Valmeyeran	Ordovician	
Mk	Kinderhookian	Om	Middle
		Ol	Lower

Scale 1:500,000

0 Miles 25
0 Kilometers 40

1 inch equals 8 miles or about 13 kilometers

Map Projection - Lambert Conformal Conic
Standard parallels: 33°00′00″ and 45°00′00″ North Latitude
Central meridian: 89°30′00″ West Longitude

Introduction

The distinctive hydrology and landforms of karst terrain arise from the combination of high rock solubility and well-developed secondary porosity and permeability (Ford and Williams 1989). Typical karst features include topographic depressions (sinkholes), caves, large springs, fluted rock outcrops (Ford and Williams 1989), blind valleys, and swallow holes (White 1988). Karst terrain occurs in Illinois where the bedrock lithology consists of carbonate rocks (limestone and dolomite) and drift thickness is typically less than 50 feet (15.2 m). Carbonate bedrock underlies approximately 25% of the state's surface. The five karst regions (see Karst Regions inset map) are about 35% of the area underlain by carbonate bedrock. These regions contain concentrations of caves, sinkholes, and springs. Karst features also exist outside of the five regions but are usually isolated occurrences.

Procedures and Methodology

Karst regions were mapped on the basis of associations of (1) landforms observed on stereo pairs of U.S. Department of Agriculture aerial photographs and 1:24,000-scale topographic maps, (2) bedrock lithology (from Willman et al. 1967, Kolata and Buschbach 1976, Kolata et al. 1978, Graese 1991, Devera 1993), (3) cave locations, and (4) sinkholes identified on Soil Conservation Service county soil survey maps. The caves shown on this map occur in carbonate bedrock. Data were compiled on 1:100,000-scale base maps and digitized using a geographic information system (GIS). Most of the sinkhole areas shown on the map were field-checked by the authors.

Karst Regions of Illinois

Near-surface carbonate bedrock was the focus of our mapping because these rocks are most susceptible to karst development. The structural geology of the Illinois Basin largely controls occurrences of carbonate bedrock (see Structural Geology inset map). Carbonate bedrock crops out or is buried beneath drift and other unlithified sediments on the flanks of the Kankakee Arch, Mississippi River Arch, Pascola Arch, Wisconsin Arch, and the Ozark Dome. Within the Illinois Basin, carbonate bedrock occurs on the northernmost portion of the La Salle Anticlinorium. The thickness of unlithified sediments overlying the bedrock also controls the development of karst terrain. Karstification is more extensive in areas where the unlithified sediments are thin or absent (see Drift Thickness inset map).

The five karst regions containing the most intensely karstified areas of the state are described below. Outside the five karst regions, a few caves and sinkholes are found in carbonate rocks associated with the La Salle Anticlinorium and the Kankakee Arch area in Kane, Kankakee, La Salle, and Douglas Counties. The sinkholes in La Salle County are unusual because they occur in the locally thick La Salle Limestone within predominantly noncarbonate Pennsylvanian strata.

North-Central Illinois Limestones and dolomites of the Lower and Middle Ordovician Shakopee Dolomite and Platteville and Galena Groups form the bedrock surface in north-central Illinois. These rocks occur near the apex of the Wisconsin Arch and crop out in low-lying areas. Sinkholes are the principal evidence of karstification in this area. Natural cave openings have not been found in this area, although Bretz (1923) and Knappen (1926) reported that caves were encountered during drilling and quarrying operations. The Platteville-Galena dolomite is a reliable aquifer in this area and contains abundant joints, fractures, and solution cavities. These features, which form the water-producing zones, are irregularly distributed (Csallany and Walton 1963).

Driftless Area Karstic features in the Driftless Area consist of sinkholes and caves in Middle Ordovician and Silurian carbonate rocks. Sinkholes are most common in the Silurian rocks, and caves are most common in the Ordovician rocks. The principal groundwater resources in this region occur in joints and solution cavities in the Platteville-Galena dolomite (Csallany and Walton 1963). Groundwater resources are also found in Silurian dolomite outliers, which overlie the Upper Ordovician Maquoketa Shale (Hackett and Bergstrom 1956).

Lincoln Hills Area Karstic features of the Lincoln Hills area in western Illinois occur in the Middle Ordovician Kimmswick Formation, the Silurian Sexton Creek Limestone, and the Valmeyeran Burlington, Salem, St. Louis, and Ste. Genevieve Formations (Lamar 1928, Rubey 1952). Most sinkholes occur in the Kimmswick, St. Louis (Rubey 1952), and Ste. Genevieve Limestones. Dolomite, limestone, sandstone, and sand and gravel aquifers provide water supplies in this area.

Salem Plateau and Shawnee Hills The Salem Plateau in southwestern Illinois and the southern part of the Shawnee Hills in southern Illinois contain a dense concentration of sinkholes and caves. Karst features occur in strata ranging from the Lower Devonian Bailey Limestone to the Chesterian Kinkaid Limestone. Most sinkholes and caves occur, however, in the Valmeyeran Salem, St. Louis, and Ste. Genevieve Limestones. In the Salem Plateau area, groundwater resources come from springs and wells in the St. Louis Limestone and in the Aux Vases Sandstone overlying the Ste. Genevieve Limestone. In the southern Shawnee Hills area, groundwater resources occur in Silurian, Devonian, and Valmeyeran limestones and Chesterian sandstones and limestones.

Paleokarst

Silurian dolomite dominates the bedrock surface of northeastern Illinois, but it is typically buried beneath 100 feet (30.5 m) or more of clayey glacial diamicton and lake sediment. The buried and exposed surfaces of the Silurian dolomite are believed to be karst (Otto 1963, Zeizel et al. 1962, and Buschbach and Heim 1972). Exposures of the bedrock in quarries and stream valleys reveal abundant paleokarst features (such as solutionally widened joints and caves) filled with Pennsylvanian or younger sediment (Bretz 1940). Because the infill consists predominantly of materials of lower permeability, these paleokarst features probably have little potential to function as conduits for groundwater.

Pseudokarst

Landforms resembling karst (pseudokarst) can result from human modifications to the land. These karst-like features appear where underground mining for coal, lead, zinc, fluorite, or limestone has occurred. Mine collapse and piping of soil into the tunnels can produce karst-like collapse features at the surface. When collapse features form in populated areas, structural damage to buildings and contamination of shallow aquifers may occur (Treworgy et al. 1989). This map does not show the locations of these locally occurring karst-like features.

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How to Use This Map

This map can be used to identify areas of carbonate-dominated bedrock, locate karst terrains, and identify formations susceptible to karstification. Formations most susceptible to karstification are discussed in greater detail in Panno et al. (1997). The karst regions shown on this map, particularly the sinkhole areas, should be considered very susceptible to groundwater contamination (Panno et al. 1996). Where the bedrock is susceptible to karstification and the overlying drift is thin, particularly less than 50 feet (15.2 m) thick, shallow aquifers have a high susceptibility for contamination. Susceptibility to contamination depends on the thickness and permeability of the overlying unlithified sediments.

Limitations

The map should not be used for detailed site-specific assessments because of the generalizations required for construction of maps at this scale. Some karst terrain and features may therefore exist in areas not shown as karst on this map. Larger-scale maps of the karst regions and more detailed descriptions of the regions are given in Panno et al. (1997).

Caution

Caves and sinkholes can be dangerous. Never enter them without obtaining the permission of landowners and without taking proper safety precautions.

Acknowledgments

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Karst Regions

Scale 1:3,000,000

Structural Geology

Scale 1:3,000,000

(modified from Treworgy 1981)

Drift Thickness

Scale 1:3,000,000

(modified from Piskin and Bergstrom 1975)

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