Clear as Black and White

Activity Source:
American Geosciences Institute

What are some of the factors that might unnecessarily exclude people from learning about or working in the geosciences? Culture? Ethnicity? Sex? Language? A disability? Where they live? How much they earn? Something else?

Let's examine a disability-related factor. Considering the important role that color plays in many geologic maps, one might suppose that color blindness would prevent a person from reading or using geologic maps. But that's not necessarily so. Map makers use multiple methods, including patterns and strategic selection of colors, to help make the information conveyed in multi-colored geologic maps intelligible to everyone, including color-blind viewers.

And then there are some geoscience professionals — such as land managers, the professionals who manage the use and development of urban and rural land resources — who can effectively read and work with geologic maps, like the one show here, which employ no color at all.

Materials

- Geologic Map of Boone and Winnebago Counties in Illinois (below)
- Computer with internet access

Procedure

1. Pretend you are a land manager in northern Illinois. As part of your job, you must help a real estate developer figure out where would be a good place to construct a five- level office building, including a parking garage below the earth's surface.

2. Discuss what kinds of information about the geology of the area you would need to help make such a determination. Surface earth material? Stability of earth material below the surface? Depth of groundwater beneath the surface? Risk of groundwater movement or contamination? Whether land is flat or sloping? Depth of bedrock? Other information?

3. In search of relevant information, you find a geologic map featuring an array of colors representing geologic materials at the land's surface. A cross-section featured in the map allows you to infer the geology beneath the surface from a diagram, but not in a precise way.

4. Discuss how useful this map would be in helping to plan a construction project. What does such a map tell you? What does it not tell you that you would like to know? Is this map likely to give the real estate developer the confidence needed to invest in construction?

5. Next you contact the Illinois State Geological Survey and ask for another map. The state geologist provides the Geologic Map of Boone and Winnebago Counties in Illinois shown here. In addition to describing the character of the geologic unit at the land's surface, this map represents the layers of geologic materials below the land's surface, telling how deep they go at various locations.

6. Examine the accompanying text and discuss what this geologic map tells you. What areas would be most favor- able for construction? What areas would be least favorable? Why? How would this information be important to a builder selecting a location to dig, lay a foundation, and construct an office building?

7. Now that you have explored northern Illinois, consider your hometown, your state, or another location. Visit the website of your state geological survey or state geolo- gist (**http://www.stategeologists.org/**) and the National Geologic Map Database (**http://ngmdb.usgs.gov/**). Find geological maps for the area you want to examine.

8. Discuss: What do you notice in these maps? Where do people choose to live and work? What can you tell about the area's geology? How do geologic maps present information in different ways to ensure that they are useful to everyone? How do the maps use — or not use — color? What about the map might be more or less easy to interpret if someone were color blind?

NGSS Connections

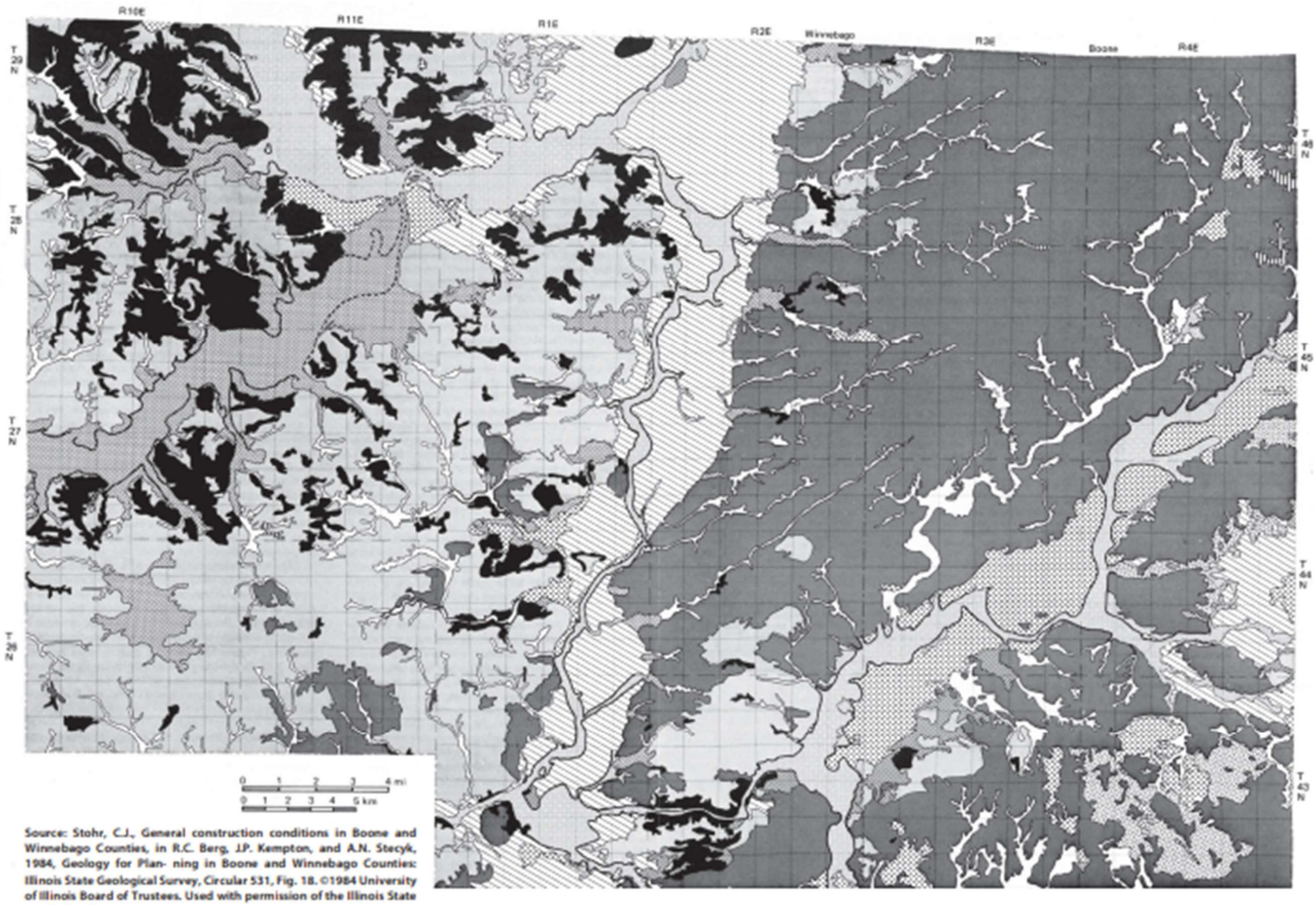
- Science and Engineering Practices — Obtaining, Evaluating, and Communicating Information
- Disciplinary Core Ideas — Earth and Human Activity
- Crosscutting Concepts — Systems and System Models

Metadata

Grade Level: 6, 7, 8, 9, 10
Tags: activity, geologic map, groundwater, colorblind
NGSS ESS Disciplinary Core Ideas (DCI's): Earth's Systems (ESS2), Earth and Human Activity (ESS3)
NGSS ESS Topics: Earth's Systems, Human Impacts

EARTH SCIENCE WEEK

GEOLOGIC MAP OF BOONE AND WINNEBAGO COUNTIES IN ILLINOIS



Source: Stohr, C.J., General construction conditions in Boone and Winnebago Counties, in R.C. Berg, J.P. Kempton, and A.N. Stecyk, 1984, Geology for Plan- ning in Boone and Winnebago Counties: Illinois State Geological Survey, Circular 531, Fig. 18. ©1984 University of Illinois Board of Trustees. Used with permission of the Illinois State Geological Survey.

EARTH SCIENCE WEEK

MOST FAVORABLE FOR GENERAL CONSTRUCTION

This category has units with well-drained profiles, moderate and high bearing capacities; can be excavated by light or heavy equipment; bedrock does not generally occur within 20 ft. Unit lies outside the 100-year floodline. Few or no geologic hazards are known. These units normally require less exploration on testing and foundation preparation for most small construction projects.

LOCATIONS: Major river valleys and terrace outwash plains of Rock and lower Pecatonica valleys

Unit is above the 100-year flood plain and will provide medium bearing capacity on well-drained, highly permeable materials of low frost susceptibility and low potential volume change. Materials of the unit have moderate erosion potential and are easily excavated, but slopes may be unstable.

LOCATIONS: Major river valleys and adjacent slopes

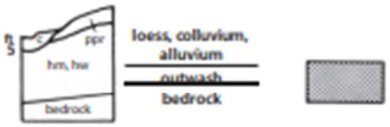
Unit is above the 100-year floodplain, and will provide medium bearing capacity. Materials are well-drained, have high-to-moderate permeability, low frost susceptibility, and probably low potential volume change. Materials of the unit are moderately susceptible to erosion and are easily excavated; however, slopes may be unstable.

Diagram labels: **c**: Cahokia Alluvium; **ec**: Carmi Member of Equality Formation; **g**: Glasford Formation; **gl**: Grayslake Peat; **hm**: Mackinaw Member of Henry Formation; **hw**: Wasco Member of Henry Formation; **Og**: Ordovician dolomite of Galena and Platteville Groups; **pl**: Parkland Sand; **ppr**: Peyton Colluvium, Peoria Loess, and Roxana Silt; **pr**: Peoria Loess and Roxana Silt; **py**: Peyton Colluvium; **wi**: Winnebago Formation

MODERATELY FAVORABLE FOR GENERAL CONSTRUCTION

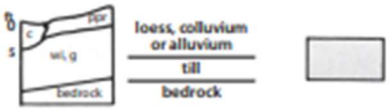
This category is characterized by moderate drainage in upper profile, poor drainage in lower profile, and moderate-to-high bearing capacities for outwash and till respectively. These materials typically can be excavated with heavy equipment with some difficulty. Ripping or blasting will probably be required for deep bedrock excavations. Low-lying areas are subject to flooding. Bedrock surface can be uneven adjacent to large streams and buried preglacial valleys. Karst features (such as sinkholes, caves, open joints) can be encountered in bedrock. Foundation exploration and/or testing is recommended; some foundation preparation may be necessary.

LOCATIONS: Lower Kishwaukee Valley and slopes



Less consolidated (upper) part of unit has medium bearing capacity, high-to-moderate permeability, high frost susceptibility, probably low potential volume change; not susceptible to flooding except near small streams. These materials are moderately susceptible to erosion, and easily excavated to bedrock. Slopes cut into outwash may be unstable. Bedrock has high bearing capacity but will impede downward water drainage; this may cause temporary ponding of water at the bedrock contact.

LOCATIONS: Uplands, slopes, and upland streams, particularly in Boone and western Winnebago County



Loess, colluvium, and alluvium are variable in thickness, have low bearing capacity, moderate-to-low permeability and drainage, and high frost susceptibility. Till and bedrock have a medium-to-high bearing capacity, but impede downward water drainage. Water will temporarily pond above the till and rock.

LOCATIONS: Uplands, slopes, and upland streams particularly in eastern Winnebago County

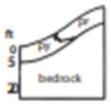
Loess, dune sand, colluvium, and alluvium vary in thickness, have low-to-medium bearing capacity and high frost susceptibility. Till has medium-to-high bearing capacity and impedes downward water drainage. More than one till unit may occur at a site.

EARTH SCIENCE WEEK

LEAST FAVORABLE FOR GENERAL CONSTRUCTION

Category is characterized by poorly drained profile with variable to low bearing capacity and variable excavation characteristics; subject to periodic flooding, flash flooding, or ponding of rainwater. Other geologic hazards include: compressible organic material, lacustrine silts and clays, and fluctuating groundwater levels potentially creating confined artesian conditions in some areas. Foundation exploration and testing are recommended. Foundation preparation may be extensive.

LOCATIONS: Uplands and slopes of the Pecatonica and Sugar River valleys and tributaries



loess, colluvium or dune sand
bedrock

Thin surficial materials have moderate drainage and bearing capacity and high frost susceptibility. Bedrock has high bearing capacity, but can impede downward water drainage, causing rapid runoff.

LOCATIONS: Upland Creeks and streams

alluvium
till orbedrock

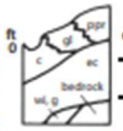
Poorly drained alluvium has variable bearing capacity and thickness, probably subject to occasional flooding. Till and bedrock have high bearing capacities but may have irregular surfaces.

LOCATIONS: Rock, Kishwaukee, Pecatonica, and Sugar River valleys

dune sand
alluvium
outwash

Poorly drained alluvium with extremely variable bearing capacity lies over dense gravel and sand outwash. Area is within the 100-year flood boundaries. Local dune sand can occur over outwash.

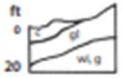
LOCATIONS: Pecatonica River valley and Rock River tributaries



loess, colluvium, dune sand, alluvium, peat or muck
lacustrine silt and clay
till, bedrock

Moderately drained loess, dune sand, and colluvium or poorly drained peat and muck lie over very poorly drained lacustrine silt and clay. These materials generally have low or variable bearing capacity, variable frost susceptibility, and very low permeability, and are subject to settlement and periodic flooding.

LOCATIONS: Isolated occurrence in the bottom of upland streams



alluvium
peat, muck
till

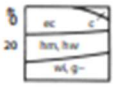
High compressible, frost susceptible, poorly drained organic materials lie over till. Subject to periodic flooding.

LOCATIONS: Isolated occurrences in Kishwaukee River valley

peat, muck
outwash

Compressible, frost susceptible, poorly drained peat and muck lie over well-drained, non-compressible sand and gravel.

LOCATIONS: Upland plain in southeast Boone County



alluvium
lacustrine silt and clay
outwash
till

Lacustrine deposits of multiple layered, compressible, frost susceptible silts and clays lie over well-drained outwash. Subject to periodic flooding. Potential exists for artesian conditions to develop in confined outwash aquifer. Thorough foundation exploration is recommended.

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