Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
Illinois Geologic Quadrangle Map: IGQ Villa Grove-PO
William W. Shilts, Chief
2000

Multi-Dimensional Geologic Mapping of the Villa Grove Quadrangle, Douglas County, Illinois

Illinois State Geological Survey
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INTRODUCTION

The Illinois State Geological Survey (ISGS) has begun an ambitious geologic mapping program to address the environmental and economic challenges faced by the State. Detailed information showing the complex variability of geologic materials below the ground surface provides for meaningful and informed decisions concerning land use and environmental protection. Three-dimensional mapping is essential in this regard. Under the program, all 1,071 of the 7.5-minute quadrangles in Illinois will eventually be mapped. The intent is to increase awareness of geology and geologic processes by developing maps and associated database products for use by local, state, and federal agencies, educational institutions, private industry, and the public.

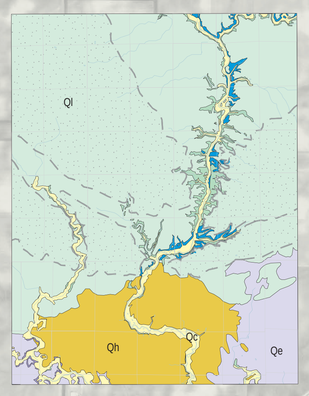
METHODOLOGY

Recent advances in computer technology, geographic information systems (GIS), and 2-D and 3-D modeling software now provide earth scientists with innovative methods to gather, display, and analyze scientific information in ways not previously possible. These advances have led to a change in the function of geologic maps. For the first time, they form the basis for interactive decision-support systems that can result in user-friendly derivative map products geared toward addressing specific societal needs. Maps showing environmental conditions (such as aquifer sensitivity) and mineral resources (such as coal and aggregate materials) are now digitally derived directly from interpretations of the basic geology. Geologic map products are available at a scale of 1:24,000 are portrayed at a reduced scale on this poster. A digital orthophotograph with a 2-meter ground resolution comprises the background of the poster.

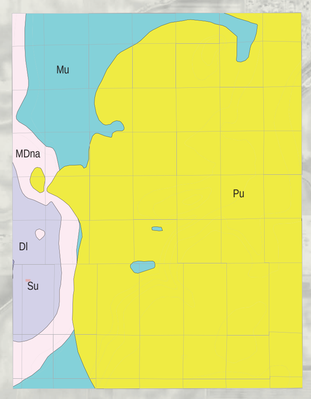
Methods for computing a three-dimensional geological atlas have been tested through a pilot mapping program in the Villa Grove Quadrangle, in Douglas County, east-central Illinois. Three-dimensional models of both Quaternary (glacial and post-glacial) deposits and bedrock deposits are key components of the mapping program. Obtaining the necessary data to build these digital models required considerable effort. In mapping the Villa Grove Quadrangle, existing data from well logs, cores, and drill cuttings on file at the ISGS were examined to verify data quality and locations, and new data were obtained from test drilling, hand augering, other field work, and laboratory analyses.

Location of Quadrangle

Surficial Geology



Bedrock Geology



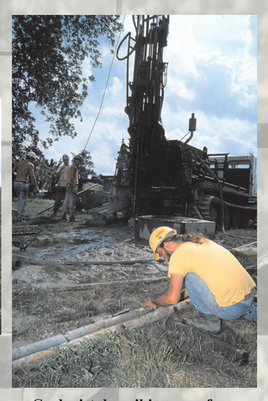
DERIVATIVE MAPS

A derivative map presents an interpretation of geologic materials for specific environmental or resource purposes. A three-dimensional understanding of the continuity, thickness, and properties of a geologic material is required for such interpretations. Detailed geologic mapping and derivative maps provide a scientific and objective basis for land-use and environmental planning and mineral resource development. For the Villa Grove Quadrangle, derivative maps have been produced showing the potential sensitivity of aquifers to contamination, potential groundwater resources, and available coal and aggregate resources. Because of the digital nature of the map data, it would be possible to produce many more derivative map products than those shown here.

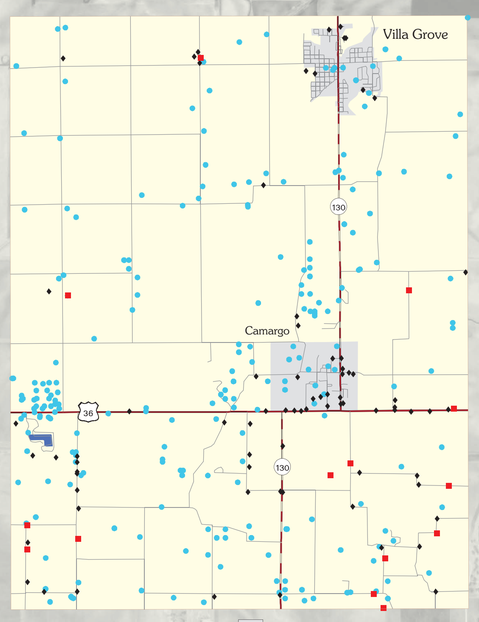
- The groundwater resources maps show sand and gravel aquifers within 100 feet of the land surface and deeper than 100 feet, and the depth to and distribution of bedrock aquifers that yield potable water.
- The general aquifer sensitivity map, based on depth to the shallowest aquifer and aquifer thickness, shows areas most vulnerable to waste disposal operations and potential spills of hazardous substances.
- A second sensitivity map combines aquifer depth and thickness with soil properties to derive a map showing potential contamination of aquifers from nitrates, which are generated from fertilizers and septic effluent.
- The map showing the thickness and distribution of the Herrin (#6) Coal suggests a potential resource in the southeastern portion of the quadrangle.
- Limestone and dolomite resources are currently mined at the Tuscola quarry. Potential for expansion is limited by thickness of overburden and character of the bedrock. The map indicates that additional surface-minable resources are present near the quarry where the depth to bedrock is less than 60 feet deep.

Scale for inset maps
0 4 Miles
0 4 Kilometers

Hand-augered boring



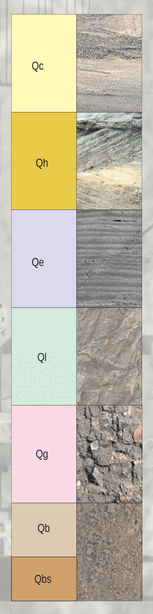
Geologist describing core from deep test boring



Wells
ISGS test borings
Hand augered test borings
Municipal boundary
Quarry
U.S. Highway
State Highway
Uninproved road
0 1 2 Miles

Exposure of Quaternary materials overlying Devonian bedrock at Tuscola Quarry

Glacial drift and post-glacial (Quaternary) Units



Cahokia Formation:
up to 20 feet of stratified silt with sand and clay lenses

Wisconsin Episode
Peoria Silt over Dolton facies of the Henry Formation:
1 to 4 feet of massive silt overlying up to 11 feet of stratified sand and silt

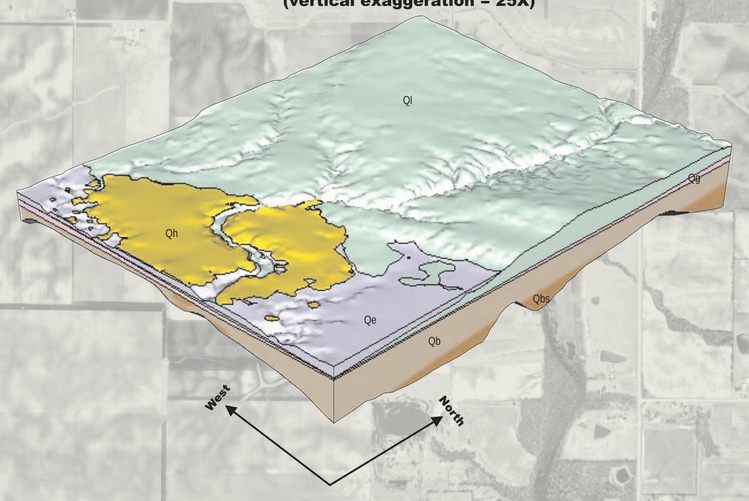
Peoria Silt over Equality Formation:
1 to 4 feet of massive silt overlying up to 20 feet of laminated silt with clay lenses

Peoria Silt over Batestown Member of the Lemont Formation:
1 to 4 feet of massive silt over silt loam diamicton, may be underlain by thin Tiskilwa Formation (pink loam diamicton)
Moraines shown in stippled pattern

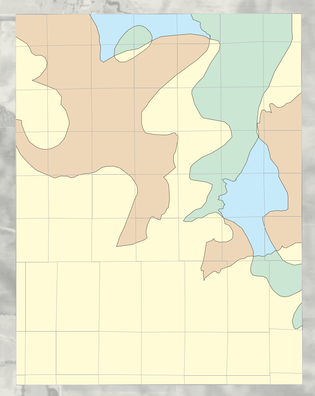
Illinois Episode
Glasford Formation:
up to 50 feet of loam diamicton, may be underlain by undifferentiated diamictons, sand and gravel may occur at top or base

Pre-Illinois Episodes
Banner Formation:
up to 235 feet of undifferentiated silt to silt loam diamictons; may be underlain by up to 50 feet of sand and gravel (shown with brownish-red)

3-Dimensional view of glacial and post-glacial units (vertical exaggeration = 25X)

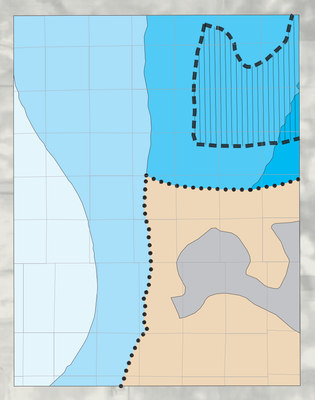


Drift Aquifers



Depth to drift aquifer, in feet
- Aquifer shallower than 100 feet
- Aquifer deeper than 100 feet
- Aquifer present within both intervals
- Aquifer not present

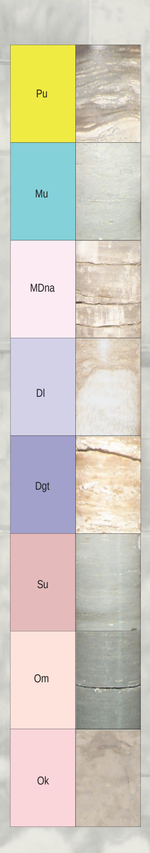
Bedrock Aquifers



- Pennsylvanian coal seam
- Pennsylvanian sandstone

Depth to Devonian carbonate aquifer in feet
- Less than 250
- 250 - 500
- 500 - 750
- Greater than 750
- Aquifer not present
- Inferred limit of potability
- Inferred extent

Bedrock (Paleozoic) Units



Pennsylvanian (undifferentiated)
gray, silty shale, with layers of coal, claystone and black, laminated shale; lower part is dominated by light gray, quartz sandstone, near the top is a brownish-gray limestone bed

Mississippian (undifferentiated)
greenish-gray, noncalcareous siltstone with layers of fine-grained quartz sandstone in the lower part; light brownish-gray crinoidal limestone at bottom of unit

New Albany Shale (Mississippian to Devonian): light greenish-gray shale to brownish-black organic-rich shale

Lingle Limestone (Devonian):
light gray to brownish-gray fossiliferous limestone overlain by medium-crystalline, brown, fossiliferous dolomite with oil-rich zones

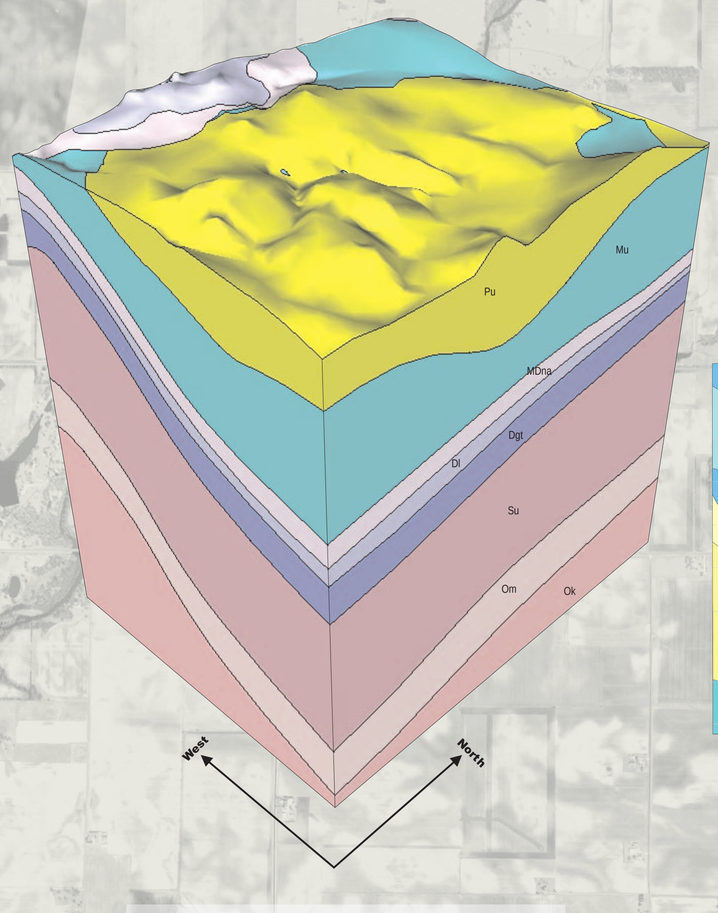
Grand Tower Dolomite (Devonian):
light tan, microcrystalline dolomite with common stromatalitic laminations and a prominent, thin bentonite bed near the top

Silurian (undifferentiated)
layered limestone and gray lime mudstone in lower part; dark greenish-gray, clayey, cherty dolomite and shale in middle part; massive gray-brown dolomite with crinoids, bryozoans, and oil-rich zones in upper part

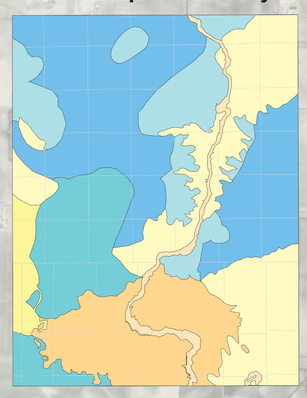
Maquoketa Shale (Orodovician):
dark gray, organic-rich shale with a prominent limestone bed near the middle

Kimmswick Limestone (Orodovician):
mottled tan to light gray-brown to nearly white bioclastic grainstone with oil-rich zones and layers of lime mudstone

3-Dimensional view of bedrock units (vertical exaggeration = 25X)

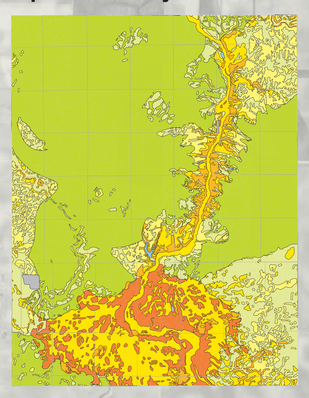


General Aquifer Sensitivity



- Thin aquifer within 5 feet of land surface
- Thin aquifer between 5 and 20 feet of land surface
- Thick aquifer between 20 and 50 feet of land surface
- Thin aquifer between 20 and 50 feet of land surface
- Thick aquifer between 50 and 100 feet of land surface
- Thin aquifer between 50 and 100 feet of land surface
- Aquifer not present within 100 feet of land surface

Aquifer Sensitivity to Nitrate Leaching



- Very high
- High
- Moderate
- Somewhat low
- Low
- Very low
- Disturbed land

THREE-DIMENSIONAL GEOLOGIC MAPPING

The block diagram showing Quaternary deposits shows that broad regions of the quadrangle are occupied by diamictons of the last three glaciations separated in some areas by sand and gravel. The drift thickness map indicates that about one-half of the quadrangle has Quaternary material over 200 feet thick. The form of the surface between the Quaternary deposits and bedrock is best shown on the bedrock topography map. Deep valleys carved into the bedrock surface are prevalent in the northern and eastern portions of the quadrangle. Uppermost bedrock materials consist mostly of shales that range in age from Devonian to Pennsylvanian and dip in a southeastward direction. Structure within the bedrock is dominated by the La Salle Anticlinorium, an upward bend in the Earth's crust. This results in much older bedrock units being very close to the surface in the west-central portion of the quadrangle and allows for economic extraction of the older rock for aggregate at the Tuscola Quarry.

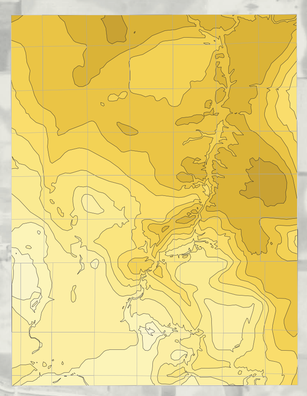
AVAILABLE PRODUCTS

Digital Orthophoto Image Map, 1999, IGQ Villa Grove-OI
Surficial Geology Map, 1999, IGQ Villa Grove-SG
Drift Thickness Map, 1999, IGQ Villa Grove-DT
Bedrock Topography Map, 1999, IGQ Villa Grove-BT
Aquifer Sensitivity Map, 1999, IGQ Villa Grove-AS
Coal Resources, 1999, IGQ Villa Grove-CR

OTHER PRODUCTS (AVAILABLE SOON)

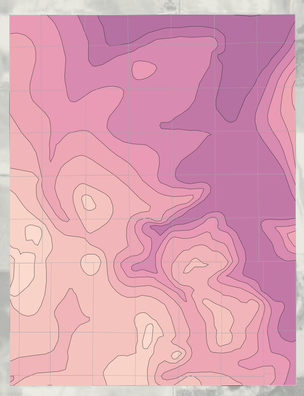
3-Dimensional Depiction of Quaternary Materials
Bedrock Geology Map
3-Dimensional Depiction of Bedrock Units
Groundwater Resource Map
Aggregate Resources
Geotechnical Properties

Drift Thickness



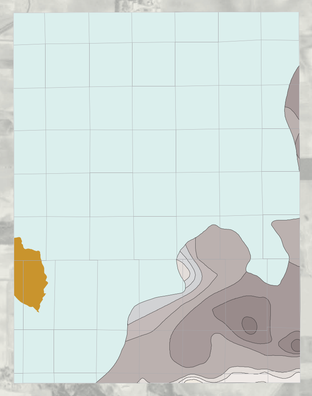
Drift thickness in feet
- Less than 25
- 25 - 50
- 50 - 75
- 75 - 100
- 100 - 125
- 125 - 150
- 150 - 175
- 175 - 200
- 200 - 225
- 225 - 250
- Greater than 250

Bedrock Topography



Feet above sea level
- Less than 425
- 425 - 450
- 450 - 475
- 475 - 500
- 500 - 525
- 525 - 550
- 550 - 575
- 575 - 600
- Greater than 600

Coal and Aggregate Resources



Herrin (#6) Coal Thickness (in feet)
- 3.25
- 3.75
- 4.25
- 4.75
- 5.25
- 5.75
- 6.25
- 6.75
- 7.25
- 7.75
- Potential Aggregate Resources

For more information, please contact:

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