

# GIS APPLICATIONS IN BEDROCK MAPPING OF THE POPLAR BLUFF 30' X 60' QUADRANGLE, SOUTHEAST MISSOURI

Trevor Ellis  
Missouri Department of Natural Resources  
Missouri Geological Survey  
Geologic Mapping Unit, Geologic Resources Section



## Abstract

The "Bedrock Geologic Map of the Poplar Bluff 30' X 60' Quadrangle" is a compilation of previously mapped 7.5' quadrangles along with interpretations of bedrock patterns and geologic structures based on well log data where bedrock exposure is poor. The collection of field data was performed using GPS technology. Esri® GIS software was used to compile, integrate, and present the data. The data originally were compiled using ArcView with no projection information included, thus requiring a projection to be defined. Some geologic features were reinterpreted by using well logs and outcrop data to eliminate any discrepancies in the map pattern along quadrangle boundaries. Some polygons mapped at 1:24,000 scale were merged or deleted for portrayal at 1:100,000 scale. Bedrock geologic maps of individual 7.5' quadrangles were originally constructed by plotting field data, well logs, and mine and quarry data in ArcView 3.0 software. The locations and character of geologic contacts and structures were then identified or inferred. Stratigraphic columns, geologic cross-sections, and detailed descriptions of mappable units and structures were included on each 1:24,000 scale map. The resulting map pattern displays predominately flat-lying to gently dipping Cambrian and Ordovician units offset by generally NE-SW trending normal faults. Sporadic Mesoproterozoic igneous outcrops are found as well as Cenozoic sediments in the southeast. This STATEMAP-funded project allows information to be made available to the public through printed maps and web-based applications and serves as the foundational data upon which regional scale geologic interpretations are made. The web-based application GeoSTRAT allows geologic information housed at the Missouri Departments of Natural Resource's Missouri Geological Survey to be accessed by the public.

## Introduction

The Missouri Geological Survey mapping program constructs 7.5' geologic bedrock maps across the state of Missouri, funded in part by the STATEMAP program. These individual 1:24,000 scale quadrangles (fig 1) are constructed from data collected in the field, supplemented by well log, measured section, and mine and quarry data in order to accurately define the nature and extent of geological features such as mappable units, folds, faults, sinkholes, and springs. Each 7.5' bedrock map is accompanied by a detailed stratigraphic column (fig 2), cross-section, and lithologic descriptions. These maps serve as the base data for further interpretation. Individual 1:24,000 scale maps are then compiled into 1:100,000 scale 30' X 60' quadrangles (figure 3) to provide detailed, regional geologic information. The location of the Poplar Bluff 30'x60' is shown in black in figure 4.

## Procedure

Data irregularities and inconsistencies within the data, visible in figure 1, were eliminated through a reinterpretation of the data resulting in the correction of contacts, structures, and other features as necessary. Polygons deemed too small to be accurately displayed at the 1:100,000 scale were merged or eliminated, while those representing particularly significant formations were exaggerated in order to ensure visibility. The map data, including polygons and polylines, are compiled in a geodatabase.

The published map is accompanied by supplementary data including a Correlation of Map Units table, a Source Index Map, and detailed descriptions of mapped units and structures. Each feature was produced using Esri® GIS software.

## Results

The contacts between mapped units are clearly delineated, as are the structures present within the study area and the relationship between geologic features and infrastructure and cultural and political boundaries.

These maps are made available to the public through printed and online media, and used in-house, and serve as the basis for further geologic interpretation. Geologic hazards, economic mineral deposits, and the various interactions between man-made systems and the environment may be assessed through interpretation of these maps.

Recently, the Missouri Department of Natural Resources launched the web-based application Geosciences Technical Resource Assessment Tool, or GeoSTRAT. GeoSTRAT is a web-based tool, built using Google Earth™ and Esri® GIS mapping technology that enables users to interact with and customize satellite imagery and geologic and hydrologic data in ways relevant to them. GeoSTRAT includes geologic structures, dye paths, and information about water and oil wells. Statewide 1:500,000 scale bedrock information is available along with some 1:100,000 and 1:24,000 scale data. New and updated data are added as they become available.



Figure 1. Examples of individual 7.5' quadrangles highlighting inconsistencies and incongruities between individual 1:24,000 maps. Examples include difference in mapped units and the truncation of map patterns and structures

## Stratigraphy

The map area includes parts of three physiographic provinces: the uplands of the Ozark Plateau, the lowlands of the Mississippi Embayment, and an upland remnant rising from the Embayment roughly parallel to the escarpment between the two, Crowley's Ridge. The uplands are comprised predominantly of Paleozoic sedimentary strata with a slight dip to the southeast. The Paleozoic stratigraphy is primarily Ordovician, but some Cambrian units are exposed in the northwest portion of the map area. Isolated exposures of Mesoproterozoic intrusives are found in the extreme northwest of the map area. Mesozoic and Cenozoic units are present in the southeast, capping parts of Crowley's Ridge. Neogene Mounds Gravel is also found in scattered locations in the upland area. Quaternary alluvium is not represented on the map, however a thick section is present in the Mississippi Embayment. Units present beneath the alluvium include the Ordovician Roubidoux Formation, Cretaceous McNairy and Owl Creek formations and Paleogene Midway and Wilcox groups. Several large unconformities are present within the stratigraphic section.

## Structure

The strata present on the Poplar Bluff 30' X 60' quadrangle are deformed by a series of folds and faults that display prominent trends. Complex relationships exist between these structures and they are often found to be in close proximity to one another, suggesting a genetic link. These relationships are especially visible in the north-central portion of the quadrangle, particularly in the Williamsville, Stringtown, and Hendrickson 7.5' quadrangles. The faults typically trend NE-SW, though an orthogonal NW-SE trend also exists. The majority of the faults on the quadrangle are normal, juxtaposing Roubidoux and Gasconade in a series of grabens, however sinistral strike-slip faults are present. Offsets along faults are highly variable, emphasized by the presence of wrench faults such as the Widow Creek Fault found west of Poplar Bluff. Displacements may be as little as four feet to as much as 220 feet. The character of the structures is similarly variable. Many of the faults are discrete offsets while the Brown's Crossing Fault and the Bull Run Fault occupy wide zones up to 3,000 feet wide. Syndines, anticlines, and monoclines are all present within the field area. Folds are often found along strike of faults or linking faults across horst and graben structures, possibly indicating a genetic relationship. Often, these folds exhume older units, exposing them at the surface. It is possible that the most severe deformation on the quadrangle is a result of activation of the NE-SW trending structures associated with downwarping of the Mississippi Embayment. Nelson, (1992) suggests similar reactivation occurred near Cape Girardeau. Several lines of evidence have been proposed implying the existence of active structures at depth (Vaughn, 1992).

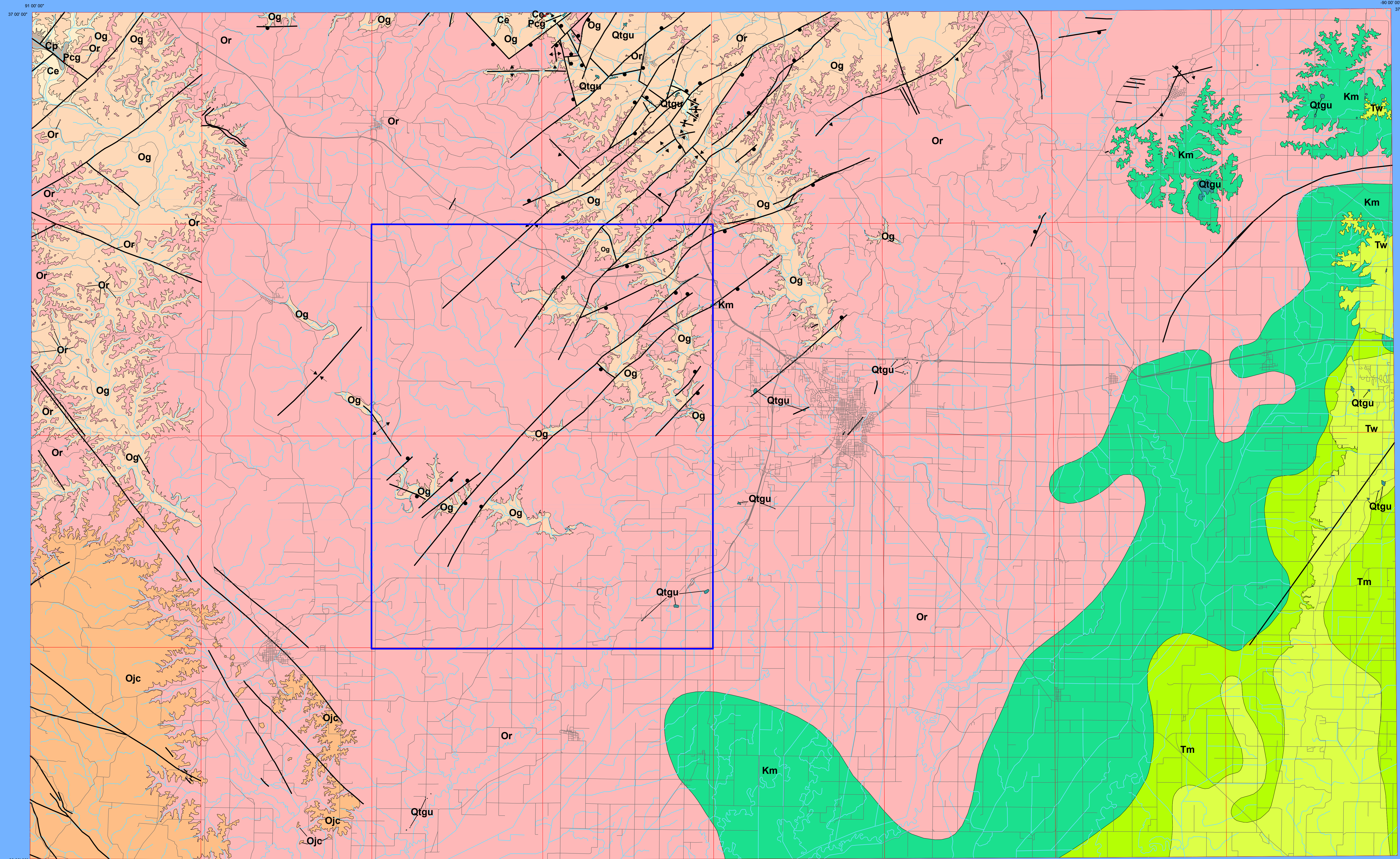


Figure 3. Bedrock Geologic Map of the Poplar Bluff 1:100,000 Quadrangle. The blue box highlights the location of the maps in Figure 1

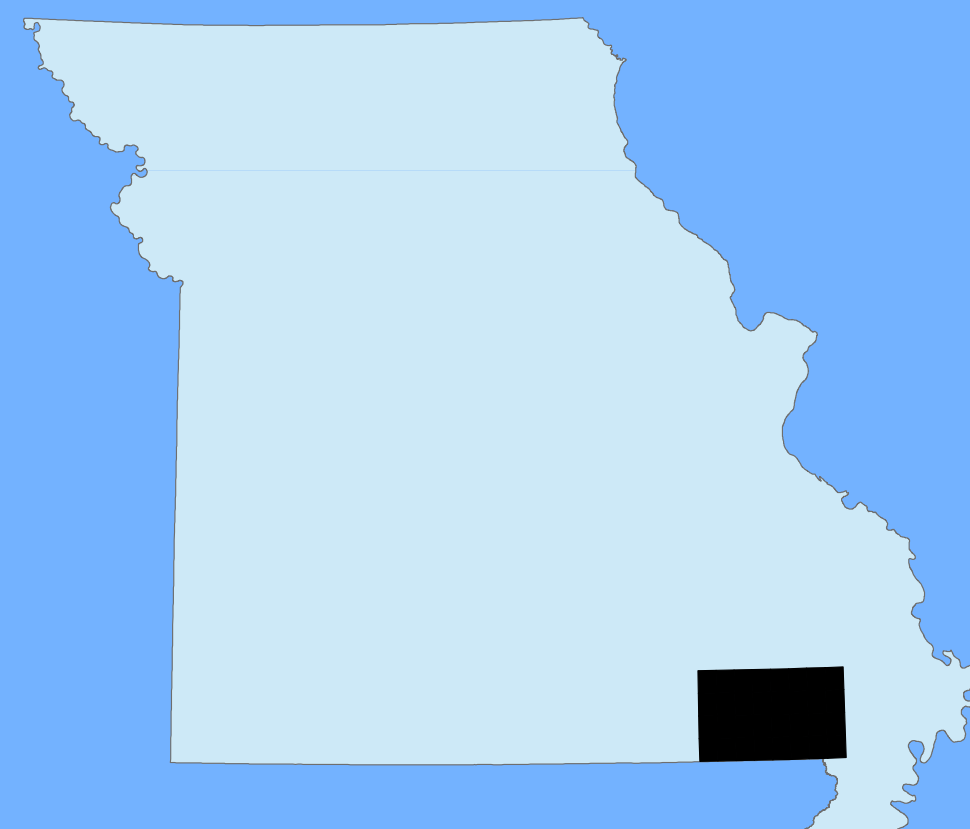


Figure 4. Map of the state of Missouri, denoting the location of the Poplar Bluff 30' x 60' quadrangle

## Bibliography

Nelson, J. W., 1992, Tectonic history of southeastern Missouri and southwestern Illinois; in Louis Unfer Jr. Conference on the Geology of the Mid-Mississippi Valley, Clendenin, C.W., organizer, Missouri Department of Natural Resources, pp1-5

Vaughn, J.D., 1992, Active tectonics in the western lowlands of southeast Missouri: An initial assessment; in Louis Unfer Jr. Conference on the Geology of the Mid-Mississippi Valley, Clendenin, C.W., organizer, Missouri Department of Natural Resources, pp 54-59

Figure 2. An example of a Stratigraphic Column included with the maps in the 1:24,000 series. Black features represent chert, bedded and nodular. Taken from the Stringtown 7.5' Quadrangle.