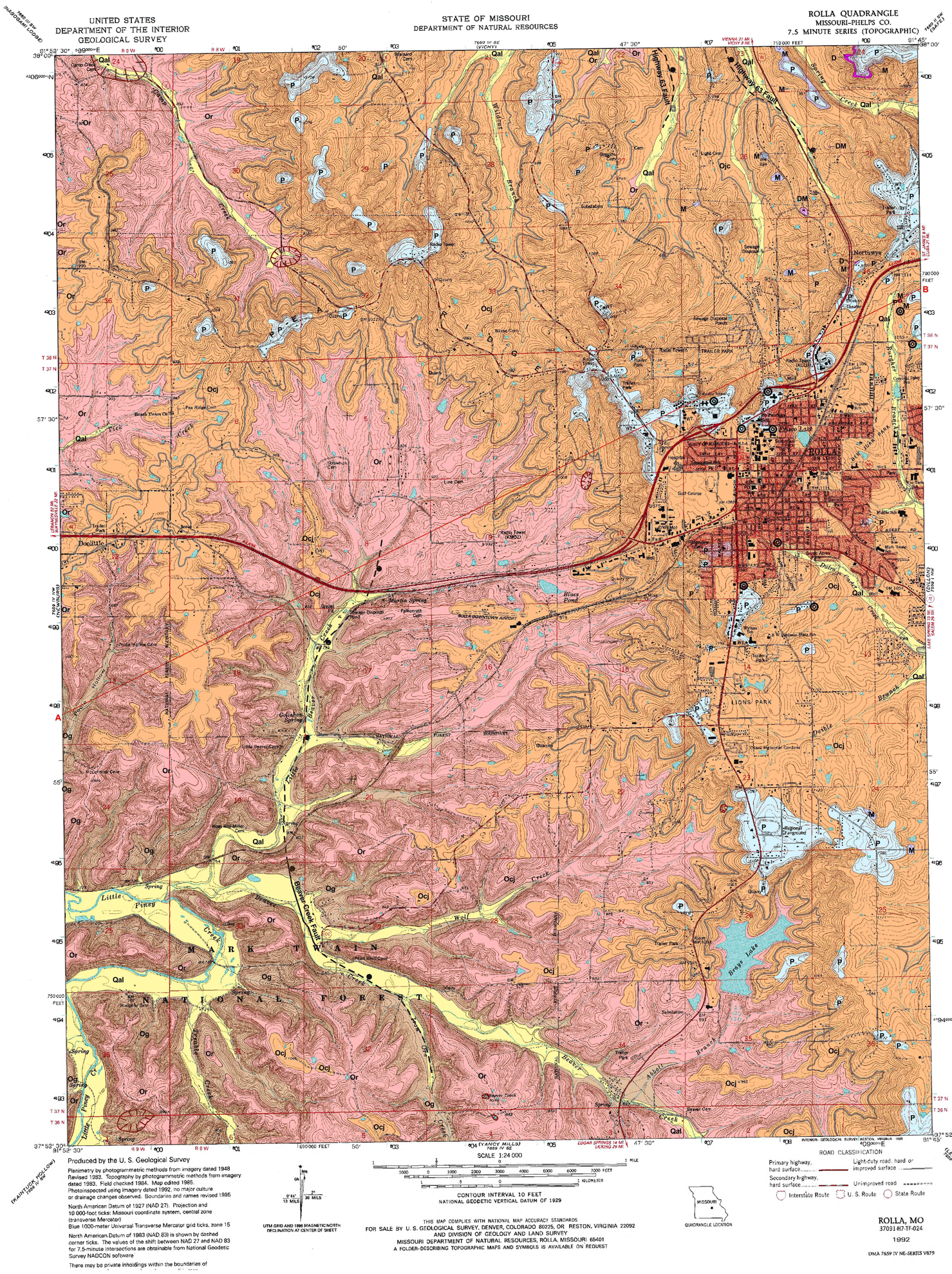



Produced by the U. S. Geological Survey

Planimetry by photogrammetric methods from imagery dated 1948
Revised 1983. Topography by photogrammetric methods from imagery dated 1983. Field checked 1984. Map edited 1985.
Photoinspected using imagery dated 1992, no major culture or drainage changes observed. Boundaries and names revised 1995

North American Datum of 1927 (NAD 27). Projection and 10 000-foot ticks: Missouri coordinate system, central zone (transverse Mercator)
Blue 1000-meter Universal Transverse Mercator grid ticks, zone 15

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are obtainable from National Geodetic Survey NADCON software

There may be private inholdings within the boundaries of

UTM GRID AND 1995 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
AND DIVISION OF GEOLOGY AND LAND SURVEY
MISSOURI DEPARTMENT OF NATURAL RESOURCES, ROLLA, MISSOURI 65401
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route

ROLLA, MO
37091-H7-TF-024
1992

DMA 7659 IV NE-SERIES V879

# GEOLOGIC MAP OF THE ROLLA 7.5' QUADRANGLE


Geology by
A. C. Spreng and Paul D. Proctor

Digital Compilation by
Karen L. Loveland



July 25, 2000
Revised October 15, 2001

OFM-99-351-GS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
GEOLOGICAL SURVEY PROGRAM
P.O. Box 250, Rolla, MO 65402
(573) 368-2100


**Access permission needs to be granted to visit any privately owned land**

**This geologic map has a user rating of 1:100,000-reliability as determined by the Geologic Mapping Standards of Missouri, 1997**

## DESCRIPTION OF MAP UNITS

**Qal** Alluvium - Stream sediments are shown where the thickness is approximately 4 feet or more. The sediments are composed dominantly of fragments of chert, quartzitic sandstone, and quartz sand and range in size from sand up to cobbles and sometimes boulders. Soil is developed over most stream sediments and is up to 4-feet-thick or more in the larger stream valleys. Small-scale gravel operations exist or have existed along Beaver, Little Beaver, and Little Piney creeks.

**P** Pennsylvanian sediments - Rocks assigned to the Pennsylvanian consist of interbedded, variably colored shales, claystones, sandstones, and conglomeratic sandstones. Sandstones and conglomeratic sandstones are the mostcommon rock exposed and are draped over underlying formations. Limited exposures occur as scattered outliers on topographic highs and in karst and sinkhole fillings in the Cotter-Jefferson City map unit in the northeastern portion of the quadrangle. Clays occur in the immediate Rolla area as sinkhole fillings. No fossils have been found in these rocks in this area, yet they are considered Pennsylvanian in age on the basis of similarity to fossiliferous deposits to the north.

Although the Pennsylvanian sediments mostly overlie the Cotter-Jefferson City dolomites, they also overlie some Mississippian outliers. Thickest accumulations occur in the northeastern part of the quadrangle where karst fills, up to 30-feet-thick, are steeply-dipping and sometimes faulted due to compaction of the fill.

**M** Mississippian sediments - This system is represented by fossiliferous sandstones, silicified sandstones, or cherts, occurring as outliers on hilltops and hillsides in the northeastern part of the quadrangle. At Northwye, MO, these rocks are associated with Pennsylvanian karst fill; elsewhere, they occur as isolated remnants on the Cotter-Jefferson City map unit. Fossils, recovered from residual sandstones and cherty sandstone layers, occur as molds and internal casts. They are mainly brachiopods, bryozoans, and corals. Collections studied by J. Bridge (1917), as well as the senior writer, indicate an Osagean-Kinderhookian age although some boulders have faunas that suggest a slightly younger, Meramecian, age. The fossiliferous layers are not more than 1- to 2-feet-thick and are usually not in place.

**D** Devonian sediments - Exposures of Devonian rocks are limited to three small areas in the quadrangle. Cobble-sized, unfossiliferous, gray, micritic limestone fragments occur in karst fills at Northwye, MO as described by Howe (1995). These limestones are considered to be Devonian in age on the basis of similarities to Middle Devonian Cedar Valley lithologies in the Devonian outcrop belt to the north, along the Missouri River. Another exposure, described by Bridge and Charles (1922), is in a valley on the east side of Highway E, NW¼, SW¼, NE¼, Sec03, T37N, R08W. The exposure, as originally described, is limited laterally and is from 3- to 6-feet-thick. It consists of white, sandy quartzite and contains numerous corals, bivalves, and brachiopods. These indicate equivalent age to the Grand Tower Limestone of southeastern Missouri and other Middle Devonian deposits (Onondaga Limestone) in the Ohio River valley. A thin horizon of silicified, sandy, crinoid, columnal biosparite which occurs near the junction of Highways E and HH suggests a continuation of these beds toward the northwest.

A better exposure of similar white quartzite occurs below a ridgetop in the very northeastern part of the quadrangle in the S½, Sec24, T38N, R08W. No fossils, however, have been recovered from this exposure. Lithographic limestone exposed in a foundation excavation within a Mississippian outlier in the SE¼, SE¼, Sec26, T 38N, R08W is possibly Devonian in age and similar to the small limestone blocks found at Northwye, MO.

**Ocj** Cotter-Jefferson City dolomites (undifferentiated) - These formations comprise the most widespread map unit exposed on the quadrangle. This map unit consists mainly of thin- to medium-bedded, finely crystalline dolostone which weathers to a light-buff to which the name "cotton rock" has been applied. A distinctive hard, gray, burrowed, massive- to medium-bedded, ledge forming dolostone, up to 15-feet-thick occurs near the base of the formation. It is informally known as the "Quarry Ledge" and is a useful mapping horizon. Its outcrop line is shown on the geologic as well as the inset map. Several similar, but thinner, lithologies occur higher in the formation so that care is required in recognizing the basal "Quarry Ledge." In this area thin, sandstone layers occur both in the lowest part of the Jefferson City below the "Quarry Ledge" and in the highest part of this formation. A thicker sandstone, about 2.5 to 3-feet-thick, occurs about 150 feet above the base, in the northeastern part of the quadrangle. This is presumably the sandstone designating the base of the Cotter Dolomite by Grawe and Cullison (1931). Light-gray-green and light-blue-green, illitic clay-shales occur sparingly in layers 1- to 4-inches-thick, sometimes interlaminated with dolostone. These occur both in the lower part of the map unit, below the "Quarry Ledge," as well as in the uppermost portion of the map unit. Locally, small 1- to 3-feet-high cryptalgalaminate mounds occur in the upper parts of the map unit on this quadrangle. Several small mounds also are exposed in the "Quarry Ledge" beds in the northeastern part of the quadrangle and along Highway 63 just north of the map area. Residuum is light-brown clay, containing platy, buff dolostone fragments and, usually, some banded white and gray, or rarely oolitic chert fragments and nodules. The thickest exposures of this map unit are in the northeastern part of the quadrangle, where the thickness is about 250 feet as determined from field exposures. The contact with the underlying Roubidoux Formation is gradational and readily observed in only a few roadcuts. The contact is drawn where the sandy sediments of the Roubidoux end and the buff dolostones of the Jefferson City begin. This change occurs about 35 feet below the top of the "Quarry Ledge." Where this change is not exposed, the contact is arbitrarily drawn about 35 feet below the top of the "Quarry Ledge" which is more frequently exposed.

**Or** Roubidoux Formation - This formation consists of dolostone, sandy dolostone, sandstone, nodular and oolitic chert, and some shale. The dolostone is poorly exposed. Where observed, they are finely to coarsely crystalline, thin- to medium-bedded and are often interbedded with light-colored, nodular chert. Much of the chert is sandy, which distinguishes it from the chert of the Cotter-Jefferson City dolomites, as well as from most of the cherts in the Gasconade Dolomite. Even though infrequently exposed, well cuttings indicate this dolostone dominates the formation. In the Rolla Quadrangle area, two sandstone intervals often characterize the surface expression of the formation. One sandstone, 15- to 20-feet-thick, occurs at or near the base, and a thicker sandstone, 20- to 25-feet-thick, occurs in the upper part of the formation. In the northeastern portion of the quadrangle, the subsurface Roubidoux contains two similar thick sandstone intervals as seen in water well residue logs.

The sandstone constituents are dominantly angular to subangular quartz. The sands contain diagnostic heavy minerals, which were studied by Cordry (1928). The tops of both the upper and lower sandstone intervals contain sand-sized and larger fragments of tripolitic chert. Some of the dolostone layers are also sandy. In Lee's (1918) mapping of the Rolla 15' quadrangle, he recognized seven members of the formation. The lower sandstone corresponds to Lee's "member one". The upper sandstone may represent both "member three" and "member five" with the intervening dolostone as "member four" not present on the Rolla 7.5' quadrangle. A third sandstone, less than 1-foot-thick, caps the Roubidoux along the western edge of Rolla 7.5' quadrangle. It is equivalent to Lee's "member seven". Cross bedding, ripple marks, and possible raindrop imprints occur in the two thicker sandstones. Mudcracks occur in the thin-bedded dolostone. The Roubidoux produces a distinctive brick-red, sandy soil containing considerable chert. The residue in the lower part of the formation contains mudcracked sandstones, often with well-preserved, chertified crack fillings, pebble molds in chert, and "honeycombed" chert. Cryptozooal cherts are associated with the dolostones between the two thicker sandstone intervals. The algal structures are about one-foot-wide, smaller than those in the Gasconade Dolomite. Stromatolitic structures appear to be present also, but are not clearly evident because of dolomitization. A molluscan fauna, common in some other areas where the formation occurs (Heller, 1954), does not appear to be present here. The large gastropod, Lecanospira, a marker in the Roubidoux to the south, likewise has not been noted here. Thickness of the formation varies from about 100 feet in the west and southwest portion of the quadrangle to 140 feet in the central and south-central part of the quadrangle. The contact with the Gasconade is usually not exposed, but the exposure of the top of Lee's "member one", about 10 to 15 feet above the Gasconade/Roubidoux contact, is helpful in interpreting the contact in conjunction with the topmost, ledge-forming dolostone of the Gasconade, which is more frequently present.

**Og** Gasconade Dolomite - Predominantly a light-gray to gray, medium- to coarsely-crystalline dolostone. The formation is 260- to 290-feet-thick; however, less than one-half of this thickness is exposed above surface in this quadrangle. The dolostones are cherty and, regionally, the chert is more abundant in the lower part of the formation, part of which is exposed in the very southwestern portions of the quadrangle along Little Piney and Beaver creeks. These cherts occur not only as nodules, but also as white and sometimes gray layers. Evidence for lateral gradation of dolostones to chert is common. A horizon of algal mounds, 1- to 5-feet-thick, lies 60 to 70 feet below the top of the formation.
Other fossils are rare, but fragments of silicified cephalopods, gastropods, and trilobites occur at this horizon. Soil that develops on the Gasconade is brown to dark-brown, and contains light-colored chert fragments (not nodules). Cave development in the lower and upper parts of the formation is common.

## DESCRIPTION OF STRUCTURAL FEATURES

Structure contours drawn on the top of the Gasconade and at the top of Quarry Ledge (Inset) indicate a gentle dip of the formations toward the north and northeast. Folds indicated by the structure contour maps show northerly, northwesterly as well as E-W trending folds. These trends are not strong and the relief on the structure is not great- 20 to 50 feet.

BEAVER CREEK FAULT - West of Little Beaver Creek and south of Beaver Creek the top of the Gasconade Dolomite is 20 to 50 feet higher than on the eastern and northern sides of these streams. Lee (1913) interpreted the pattern as being due to a syncline. Structure contouring of the top of the Gasconade suggests the pattern may be interpreted as a fault with the displacement greatest near the junction of Little Beaver Creek and Beaver Creek in Secs. 29 and 32 at the southern edge of the Quadrangle. The north end of the fault ends in the area where Little Beaver Creek crosses I-44. The fault or a branch of the fault may be seen in the Gasconade-Roubidoux bluff along I-44 across from Martin Spring.

HIGHWAY 63 FAULT - Structure contouring of the top of the Quarry Ledge suggests a fault paralleling Highway 63 in the NNW trending valley north of Rolla. This structure had also been interpreted as a syncline by Lee. This fault appears to branch at the northern edge of the quadrangle with both faults extending into the Vichy Quad. to the north. The throw on the fault is 20 feet or less.

SUBSIDENCE STRUCTURES - Several solution structures involving the upper Roubidoux and lower Jefferson City formations are indicated on the map. All are found at the heads of valleys and probably resulted from solution of carbonates in the Roubidoux.

## REFERENCES


Bridge, Josiah, 1917, A study of the faunas of the residual Mississippian of Phelps County (Ozark region), Missouri, Jour. of Geol., vol.XXV, pp.558-575.

_____ and B.E. Charles, 1922, A Devonian outlier near the crest of the Ozark uplift, Jour. of Geol., vol.30, no.6, pp.450-458. (Also reported in Branson, E.B., 1922, The Devonian of Missouri., Missouri Bur. Of Geol. And Mines, vol.XVII, 2nd Ser., pp.276-279).

_____ and Dake, C.L., 1929, Initial dips peripheral to resurrected hills, Missouri Bur. of Geology and Mines, 55th Biennial Rept. State Geologist, 1927-28, App. 1, pp.93-99.

Cordry, Cletus D., 1929, Heavy minerals in the Roubidoux and other sandstones of the Ozark region, Jour. of Paleo., vol.3, no.1, pp.59-85; reprinted Univ. of Missouri, School of Mines and Metal. Bull., vol. 11/4, pp.1-26, 1928.

Erickson, R.L., E.L. Mosier and J.G. Viets, 1978, Generalized geologic and summary geochemical maps of the Rolla 1degree x 2 degree Quadrangle, Missouri. U.S.G.S Misc. Field Studies MF-1004A.

Lee, Wallace, 1913, The Geology of the Rolla Quadrangle, Missouri Bur. of Geology and Mines, 2nd Ser., vol.12, pp.111.

Murphy, Thomas D., 1929, A study of the basal Cherokee in the Rolla area, M.S. Thesis, Mo. Sch. of Mines.

Pratt, Walden P., Mark A. Middendorf, Ira R. Satterfield and Paul Gerdemann, 1922, Geologic map of the Rolla 1 degree x 2 degree Quadrangle, Missouri. U.S.G.S Misc. Invest. Series Map I-1998.

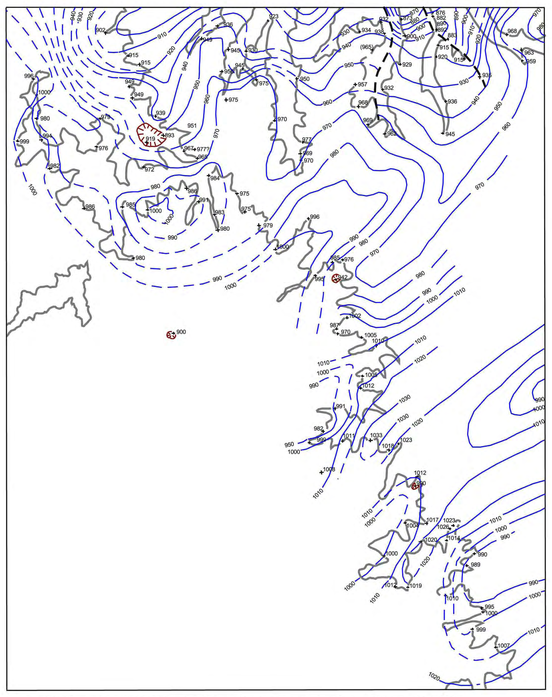
Spreng, A.C. and P.D. Proctor, 1993, Guidebook to the geology of the Waynesville, Rolla and St. James area. Univ. of Missouri-Rolla.

Whitfield, John W. et al., compilers, 1993, Quaternary geologic map of the Ozark Plateau 4 degrees x 6 degrees Quadrangle. U.S.G.S. Misc. Invest. Series Map I-1420.


## CORRELATION OF MAP UNITS/STRATIGRAPHIC COLUMN

| SYSTEM | SERIES | UNITS/MAP SYMBOLS | | COLUMN | THICKNESS IN FEET |
|---|---|---|---|---|---|
| QUATERNARY | RECENT | ALLUVIUM | Qal | | 0-4 |
| PENNSYLVANIAN | UNASSIGNED | UNASSIGNED | P | | 0-30 |
| MISSISSIPPIAN | OSAGEAN-MERAMECIAN | UNASSIGNED | M | | 0-3 |
| DEVONIAN | MIDDLE | UNASSIGNED | D | | 0-5 |
| ORDOVICIAN | CANADIAN | JEFFERSON CITY DOLOMITE | Ojc | | 225 |
| | | ROUBIDOUX FORMATION | Or | | 100-140 |
| | | GASCONADE DOLOMITE | Og | | 260-290 MAX EXPOSED: 140 |

## STRUCTURE CONTOUR MAP



Structure Contour map at the top of the "Quarry Ledge" and outcrop band of "Quarry Ledge"

Scale: 1"=5000'

## EXPLANATION OF MAP SYMBOLS

Stratigraphic contact - solid line where location is probable

Fault - solid line where location is probable; dashed line where location is possible; ball on downthrown side of structure

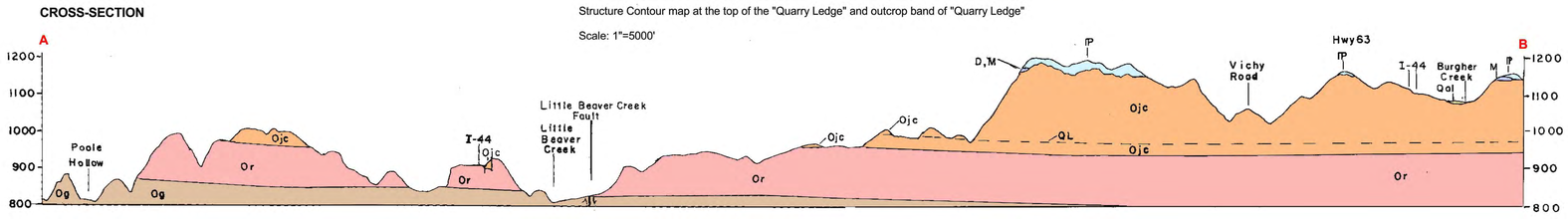
Quarry ledge

A—B Cross section - line locates the placement of the cross section with end line symbols

Subsidence structure. Actual shape of structure but more or less circular

Location of Pennsylvanian sink clay deposits in Rolla and vicinity. Most of these have been exposed by recent construction. Several older ones were sources bricks and possibly fire clay

## CROSS-SECTION




Missouri Department of
Natural Resources
Division of Geology and Land Survey