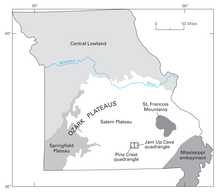

Figure 1.—Map of Missouri showing the location of the Jam Up Cave and Pine Crest 7.5-minute quadrangles and the geomorphic subdivisions of the State. The St. Francois Mountains region is underlain mostly by Cambrian and Mesoproterozoic rocks, the Salem Plateau by Cambrian and Ordovician rocks, the Springfield Plateau by Mississippian rocks, the Central Lowland by Ordovician to Pennsylvanian rocks and Quaternary periglacial sediments, and the Mississippi embayment by Cretaceous to Quaternary sediments (adapted from Imes and Emmett, 1994).

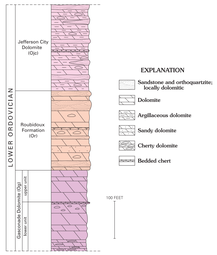

Figure 2.—Columnar section of outcropping formations in the Jam Up Cave and Pine Crest quadrangles showing informal units of the Gasconade Dolomite.

Figure 3.—*Cryptozoon* chert at the top of the lower unit of the Gasconade Dolomite. ***A***, Ledge of uppermost *Cryptozoon* chert (marked by white bar) exposed along creek in Johnny Hollow, central Jam Up Cave quadrangle. Bed thickness about 2 ft. ***B***, Boulder of *Cryptozoon* chert showing the distinctive columnar stromatolites and prismatic jointing peculiar to this unit. Person's foot is at the stratigraphic "up" end.

Figure 4.—Main (downstream) entrance to Jam Up Cave, looking north toward the Jacks Fork River. Contact between the Gasconade Dolomite and the overlying Roubidoux Formation is at top of the opening. Note human figures (arrow) for scale. The cave captures surface-water flow from Jam Up Creek, about 900 ft south of this location, diverting it directly to the river.

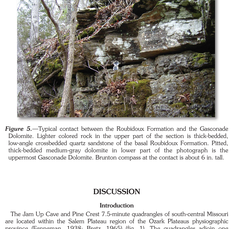

Figure 5.—Typical contact between the Roubidoux Formation and the Gasconade Dolomite. Lighter colored rock in the upper part of the section is thick-bedded, low-angle crossbedded quartz sandstone of the basal Roubidoux Formation. Pitted, thick-bedded medium-gray dolomite in lower part of the photograph is the uppermost Gasconade Dolomite. Brunton compass at the contact is about 6 in. tall.

DISCUSSION

Introduction

The Jam Up Cave and Pine Crest 7.5-minute quadrangles of south-central Missouri are located within the Salem Plateau region of the Ozark Plateaus physiographic province (Fenneman, 1938; Bretz, 1965) (fig. 1). The quadrangles adjoin one another, with Pine Crest located west of Jam Up Cave. Most of the land in the quadrangles is privately owned and used primarily for grazing cattle and horses and growing timber. A large minority of the land within the quadrangles is publicly owned, either by the Mississippi State Forests or by the Ozark National Scenic Riverways, administered by the National Park Service. The map area has topographic relief of about 660 feet (ft), with elevations ranging from about 690 ft where the Jacks Fork River exits the northeastern corner of the Jam Up Cave quadrangle to about 1,350 ft in upland areas along the north-central edge and southwestern corner of the Pine Crest quadrangle. The most prominent physiographic feature of the study area is the valley of the Jacks Fork River, which trends roughly west to east to northeast across the central part of the map area.

STRATIGRAPHY

Mesoproterozoic Basement Rocks

Unexposed basement rocks in the study area are part of a Mesoproterozoic age granite or rhyolite terrane that is extensively distributed in the Midcontinent region. Drill hole MOSH-100, located in the southeastern part of the Jam Up Cave quadrangle, penetrated a basement granite (table 1). A zircon uranium-lead isotopic age of 1,323±6.0 Ma was reported for this rock (Van Schmus and others, 1996). Outcrops of this terrane occur in the nearby Eminence-Ellington Buren volcanic field (Orndorff and others, 1999; Harrison and others, 2000; Lowell and Harrison, 2001; Harrison and others, 2002; and Lowell and others, 2005), where they have been mapped in the Alley Spring (Weary and Orndorff, 2012), Big Spring (Weary and McDowell, 2006), Eminence (Orndorff and others, 1999), Powder Mill Ferry (McDowell and Harrison, 2000), Stegall Mountain (Harrison and others, 2002), and Van Buren North (Weary and Weems, 2004) quadrangles to the east and in the St. Francois Mountains to the northeast (fig. 1).

Paleozoic Stratigraphy

The Jam Up Cave and Pine Crest quadrangles are underlain by a total thickness of about 2,400 to 3,100 ft lower Paleozoic-age marine strata that chiefly consist of dolomite, chert, sandstone, and orthoquartzite. The Paleozoic strata generally decrease in thickness from west to east as the unconformable surface of the Mesoproterozoic basement rises toward outcrops to the east of the map area. From oldest to youngest, the succession is divided into the Upper Cambrian Lamotte Sandstone, Bonneterre Formation, Davis Formation, Derby-Doerun Dolomite (usage of Missouri Geological Survey, 1979), Potosi Dolomite, and Eminence Dolomite, and the Lower Ordovician Gasconade Dolomite, Roubidoux Formation, and Jefferson City Dolomite. Only the last three units are exposed in the map area. The columnar section, figure 2, summarizes their general lithologies and thicknesses. Only one drill hole (MOSH-100; see table 1) in the map area penetrated below the Gasconade Dolomite. Since formational contact elevations are not reported from it, thicknesses of the lower six Paleozoic formations listed in the Description of Map Units, and portrayed in the cross section, are estimates based on data reported from nearby quadrangles.

The Gasconade Dolomite is the oldest bedrock unit exposed in the Jam Up Cave and Pine Crest quadrangles. As much as 250 ft of the formation is exposed in the valley of the Jacks Fork River in the northeastern corner of the Jam Up Cave quadrangle. The Gasconade Dolomite was named by Nason (1892) for exposures along the Gasconade River in Laclede, Pulaski, and Phelps Counties, central Missouri. The basal Gunter Sandstone Member and some of the formation above the Gunter are not exposed in the map area.

Pratt and others (1992) described a lower unit and an upper unit of the Gasconade Dolomite that are separated by a laterally persistent *Cryptozoon* chert (fig. 3). This distinctive chert is located about 80 to 100 ft below the top of the Gasconade (fig. 2). In the field it serves as a key reference bed for locating the Roubidoux Formation-Gasconade Dolomite contact, which commonly is obscured by residual deposits. In addition to being a lithostratigraphic horizon, the top of the *Cryptozoon* chert also is correlative with the temporal boundary between the underlying conodont *Rossodus manitouensis* Zone and the overlying "Low Diversity Interval" (of Ethington and Clark, 1971).

Triangular outcrops on the map indicate locations where the *Cryptozoon* chert was observed in outcrop or as highest float. The chert and the underlying lower unit of the Gasconade are exposed only in the northeastern part of the map area. Westermost exposures of the chert occur along the Jacks Fork River, in the central part of the Jam Up Cave quadrangle to sec. 25, T. 28 N., R. 6 W.

The upper unit of the Gasconade Dolomite above the *Cryptozoon* chert is thick-bedded dolomite. It is the main cave-bearing interval in the map area. Caves and springs typically are concentrated just below the overlying sandstones of the Roubidoux Formation (Orndorff and others, 2006). Numerous large cave entrances formed in this interval can be seen in the bluffs above the Jacks Fork River, including the Jam Up Cave (figs. 4, 5).

In the Mountain View quadrangle (adjoining Pine Crest on the south), a drill hole located about 1 mile (mi) south-southeast of the southeastern end of cross section *A-A′* reveals a 200-ft thickness of rhyolite flows of the Irondale Bluff volcanic field (Orndorff and others, 1999; Harrison and others, 2000; Lowell and Harrison, 2001; Harrison and others, 2002; and Lowell and others, 2005), where they have been mapped in the Alley Spring (Weary and Orndorff, 2012), Big Spring (Weary and McDowell, 2006), Eminence (Orndorff and others, 1999), Powder Mill Ferry (McDowell and Harrison, 2000), Stegall Mountain (Harrison and others, 2002), and Van Buren North (Weary and Weems, 2004) quadrangles to the east and in the St. Francois Mountains to the northeast (fig. 1).

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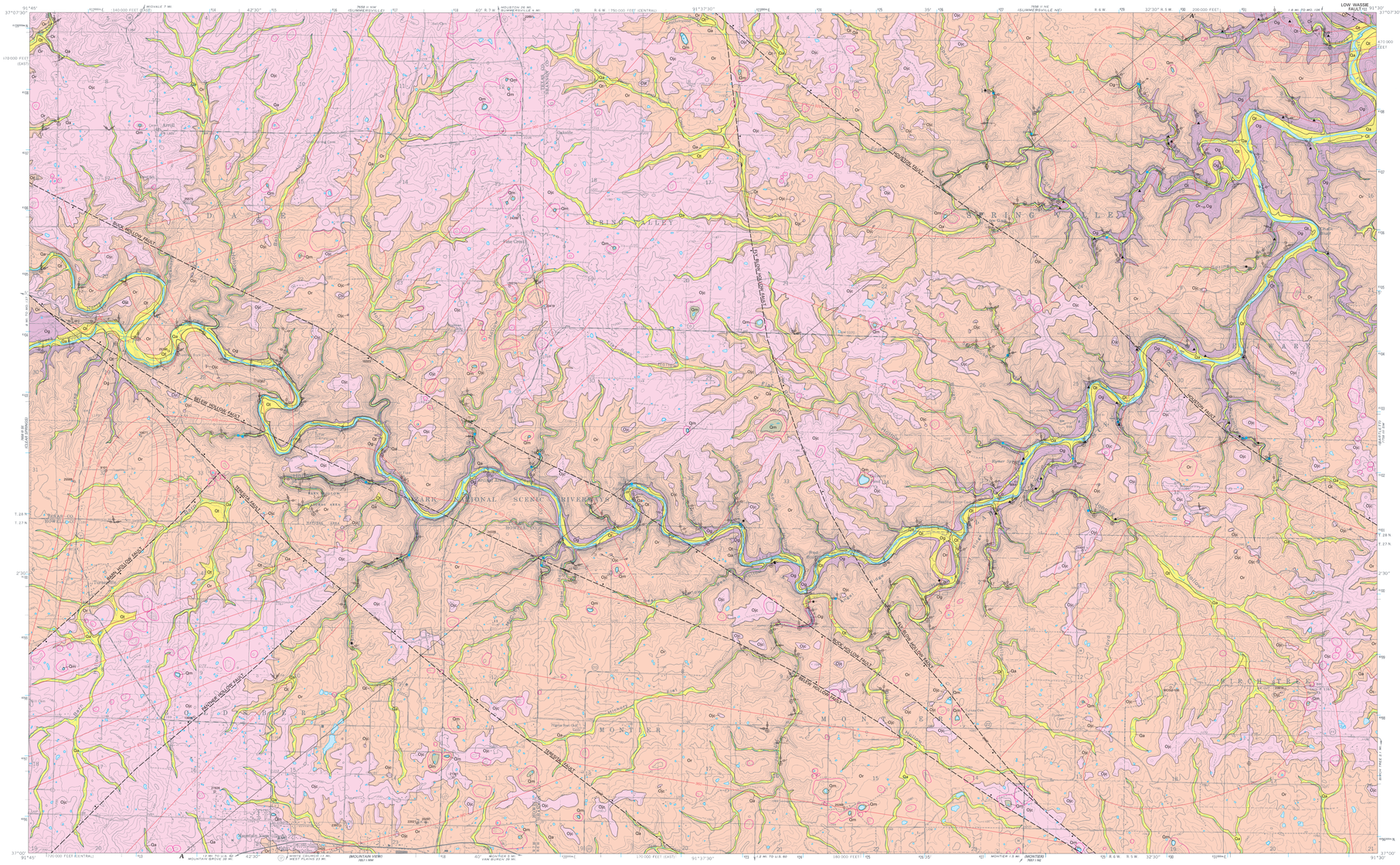
LOW WASSIE FAULT
SPRING VALLEY
DARDENNE
SHANNON
BLACK HOLLOW FAULT
BELIEVE HOLLOW FAULT
FLY BLOW HOLLOW FAULT
BUCK HOLLOW FAULT
TRESTLE FAULT
PANTHER HOLLOW FAULT
DONKEY FAULT
BUCKHORN FAULT
BUCKHORN FAULT
Jacks Fork
Alley Spring
Oakdale
Pine Creek
Highway 106
Highway 19
Highway 103
Highway 103
Highway 103