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GENESIS AND CHARACTERISTICS OF TUMBLING ROCK CAVE, A VALLEY WALL CONDUIT IN JACKSON COUNTY, ALABAMA

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Tumbling Rock Cave (TRC) is an extensive valley-wall conduit developed along Mud Creek valley on the margin of the Cumberland Plateau Escarpment. We investigated the hydrology & morphology of the cave, geochemistry of deposits, and paleomagnetism of clastic sediments within the cave in order to understand the genesis and function of the conduit. Relatively broad, flat-floored valleys that terminate in steep coves along the Escarpment characterize this region. Bedrock on the upper portion of the Escarpment is gently dipping Pennsylvanian-Mississippian clastic units. The valley floor and the lower parts of the Escarpment (where the cave is found) are Mississippian age limestone.

The cave functions as a drain for Round Cove, a closed depression at the head of Mud Creek Valley. Total drainage area for the cave is about 16 square kilometers. Mud Creek sinks in the floor of the valley, and then appears in the northernmost portions of TRC. The Creek subsequently flows southward through the cave, resurging at a spring near the mouth of the cave. The conduit is sub-parallel to, and within, the eastern valley wall, suggesting an origin through stress-relief fracturing. Additional water is input by vadose shafts, such as the 120 m Topless Dome, which developed more recently. Total length of TRC is 10 km. Total relief is 138 m, though for the most part the cave is focused along one bedding plane contact. The system is sinuous in plan view, but the orientation of specific segments is controlled by joints, or by joint swarms. Clastic fluvial sediments are found throughout the cave. These range in size from clay to gravel. We collected 8 oriented samples for paleomagnetic analysis. Six of these showed normal polarity, suggesting deposition within the present chron. Two of the samples, taken from a brown clay deposit about 10 meters above present stream level, were magnetically reversed. This indicates a minimum age of 780 ka for the growth of this conduit. Conduit growth apparently initiated phreatically and became vadose some time prior to 780 ka. As the cave developed, new levels were formed, and shafts developed concurrently. The cave mainly serves to transport water and sediment from Round Cove. Escarpment retreat processes presently dominate over valley lowering, possibly due to stratigraphic control of the underlying St. Louis limestone.

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