ABSTRACT

The Grand Canyon Region contains well-documented examples of paleo-landsliding, including large slide complexes near Deer Creek, Carbon Butte, and within Surprise Valley. A large number of unmapped landslides are present throughout the Grand Canyon, especially downstream of river mile 200, along the Hurricane fault and in the Lower Granite Gorge.

Tapeats Cave Canyon is a tributary of Tapeats Creek, developed along the Tapeats Fault and one of its splays. Tapeats Spring and Cave are structurally controlled by the fault and the spring discharges 48 million gallons of water per day, making it the largest spring in Grand Canyon. The flow from this spring provides the majority of water in Tapeats Creek and has eroded most of the old landslide dams that once blocked the channel.

Multiple landslides have occurred in Tapeats Cave Canyon, choking its channel and the outlet of Tapeats Spring with slide debris. This spring likely played a pivotal role in triggering some of the landslides surrounding it. These slides may have once dammed the canyon to a considerable depth as dissected deposits of fine-grained stratified sediments are present near the head of the canyon. The late Pleistocene lava dams in the western Grand Canyon may also be responsible as resulting lake extended into Tapeats Cave Canyon. It may be possible to sample these materials for analysis using palynology in order to determine the age and possible climatic conditions at the time of the landslides.
Closer view of the Tapeats Fault splay and hanging valley. The main fault (left) and the splay controlling Tapeats Spring (right) are shown in red.

Channel profile of Tapeats Spring branch is characteristic of modest debris choking, shown between two arrows in this diagram. The landslides impacting the channel are relatively small in comparison to those in the Surprise Valley, Deer Creek, Cranberry and Fishtail watersheds, nearby. Another factor may be the nearly 50 million gallons of water per day that flows out of Tapeats Spring, which provides considerable stream power to erode blockages.

The Tapeats Spring branch of Tapeats Creek is typified by picturesque waterfalls, choked with coarse debris, indicative of a channel out-of-equilibrium. The channel profile exhibits classic signs of modest hydraulic choking over a considerable distance.

These images show a shallow bedrock landslide near the head of Tapeats Cave Canyon with a basal slip surface developed in the Bright Angel Shale. Note the diversion of Tapeats Spring to the west (left) around the old landslide dam and the back-rotated bedding and direction of movement in red (right). The landslide still chokes the channel with debris and has buried the pre-slide outlet of Tapeats Spring.
Conor standing in one of the pools below Tapeats Spring. The springs appear as water coming out of the ground in a series of small waterfalls and pools. This is because water is percolating through landslide debris that blocks the spring's pre-slide outlet.

Indurated sediments mantle the Bright Angel slope in much of Tapeats Cave Canyon. Some of these are coarsely stratified parallel to the slope and appear to be talus accumulations. Others, which tend to be horizontally stratified and more fine-grained, appear to be lacustrine sediments mixed with debris flow packages that were likely deposited in temporary reservoirs caught behind landslide dams or lava dams formed in the Western Grand Canyon during the Pleistocene. Based on the depths and vertical extent of these lacustrine materials, we can deduce that significant portions of much larger landslide dams have been excavated by discharge from Tapeats Spring if these were deposited behind landslide dams.

The slide debris blocking the outlet of Tapeats Spring has diffused the water so that it discharges over a much wider area. It discharges through the debris relatively gently and not a raging torrent like nearby Thunder River Spring (below).

Tapeats Cave and the underground flow conduit supplying Tapeats Spring are accessible via an approximately 3.5 m high entrance passage. The entrance passage, developed along a splay of the Tapeats Fault, joins a large main passage developed along the main fault in which the underground river supplying Tapeats Spring flows.

(right) The main passage in Tapeats Cave carries water to the spring and takes on enormous dimensions. It is commonly 80 or more feet in height and Huntoon (1970) reports that deeper portions of the passage reach heights of 300 feet. This passage ends abruptly at a wall of slide debris. The water supplying the spring flows through this rubble.