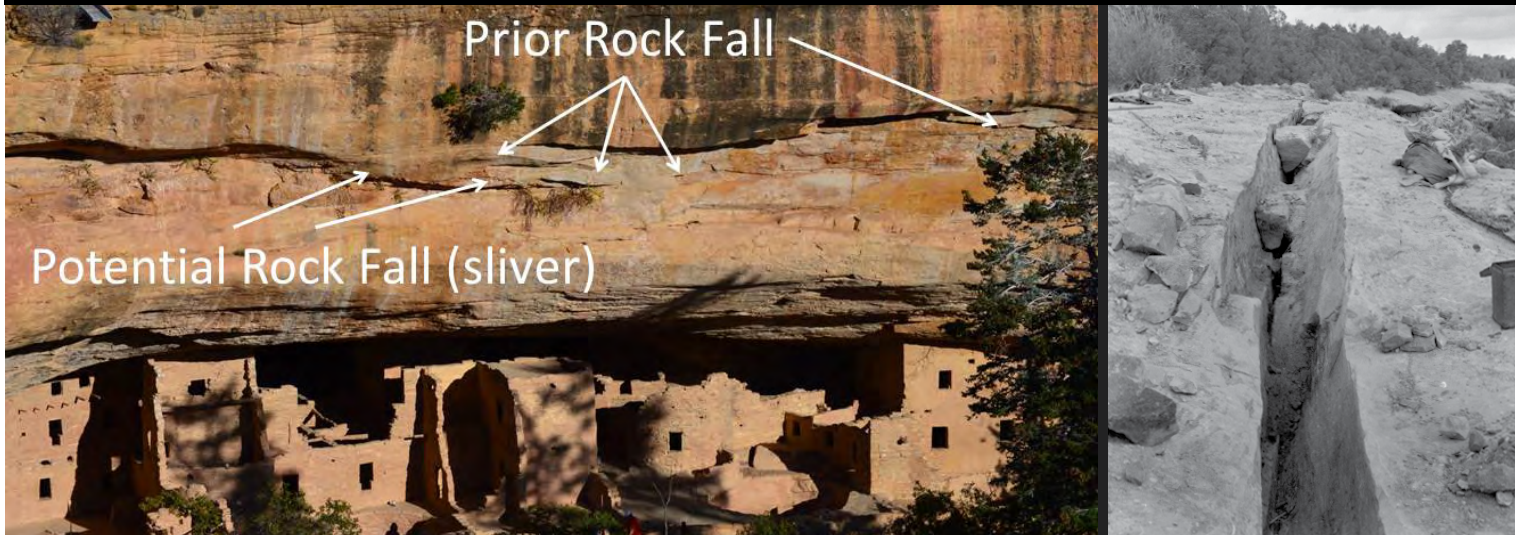
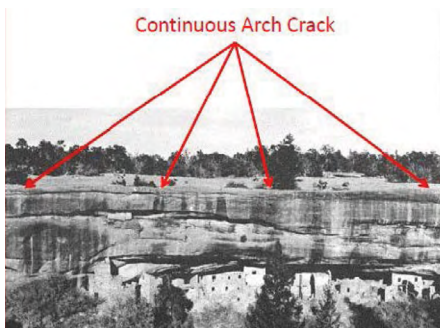


Spruce Tree House Alcove

National Park Service
U.S. Department of the Interior
Mesa Verde National Park



Left: Areas of previous and potential rockfalls. Right: 1940 photo of widest section of crack above Spruce Tree House.



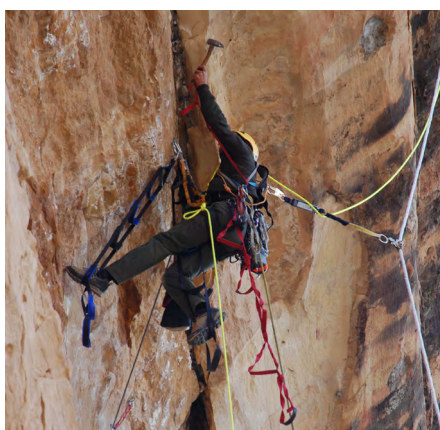
The arch crack spans Spruce Tree House.

The forces of nature that formed the shelters that contain Mesa Verde's cliff dwellings are still active, and the alcove containing the dwelling of Spruce Tree House has become particularly unstable. Due to a series of rockfalls, a geologic assessment was conducted last fall to ensure the safety of visitors and staff entering the site. Preliminary results revealed the risk of continued rockfalls, especially along pathways into and within the site. Until a full geotechnical assessment is conducted and work is done to reduce this threat, Spruce Tree House is closed.



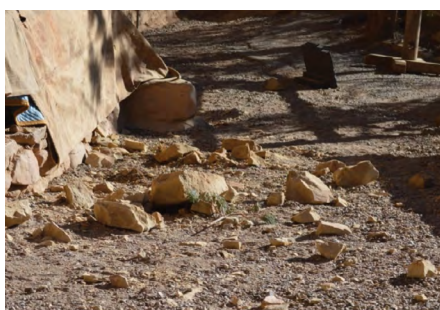
1960 rock fall. Note large debris field on lower right. One 10-ton rock fell, and a second, loose 5-ton slab was pulled down.

The primary concern is a large, naturally forming arch located within one of several cracks that exist in the cliff above Spruce Tree House, nearly parallel to the outer edge (above right). In 1940, an attempt was made to slow the erosional processes by cleaning the crack of plants and rock debris which were acting like wedges, exerting force and widening the crack. Following cleaning, a protective covering was constructed over the crevice in an attempt to make it water proof. In 1960, a large, 10-ton rock fell from a ledge under the lip of the cliff overhanging the south end of Spruce Tree House, impacting the public trail as well as a small portion of the site. This resulted in the 1961-2 anchoring of the natural rock arches. The earlier covering was removed, the arches were pinned to the cliff face, and the crack was filled with aggregate and cement grout. Forty two rock anchor bolts, some 16 feet long, were drilled horizontally into the cliff face to secure the arches.



Scaling operation in the fall of 2015. Note the rock anchor (bolt) in the rock along the right side of photo, just above climber.

In the fall of 2015, the arches, specifically the large one in the south end of the site, were again the focus of concern. A number of smaller rock falls, some which fell on public trails, occurred within the alcove in the area of the large arch. The site was closed in order to conduct an assessment and remove loose rock material from the cliff face and ledges. The scaling operation brought down about 60 cubic feet (cf) of material from the alcove edge. Some of the rock removed had a harder, desiccated outer surface with a substantially softer interior, revealing that sections of the sandstone are weakening due to water leaching the calcium carbonate matrix that binds the sand particles within the sandstone.



About 60 cubic feet (cf) of loose material fell along the public trail from the alcove edge above during the scaling operation.

The park service has contracted with a geotechnical firm to conduct a detailed assessment of the alcove through core drilling to determine composition and integrity of the rock. The process will involve Light Detection and Ranging (LiDAR), sophisticated laser imaging, and performing a 3-D computer analysis of the data to model alcove stability. The assessment will result in recommendations for treatment that, if necessary, will use modern engineering technology to ensure that the alcove is stable and safe for public visitation.