

Findings:

The purpose of this investigation was to understand the rate at which water may flow through subsurface units to interact with a magmatic intrusion and produce an eruption. The phreatomagmatic eruption that created Rattlesnake Crater, approximately 14 km NE of the study area, is believed to have been largely driven by magma interacting with groundwater located in the Coconino Sandstone. The phreatomagmatic phase of the eruption of Colton Crater, approximately 43.5 km NW, could have also been driven by water movement through the sandstone unit. The nearest accessible outcrop of Coconino Sandstone to Rattlesnake Crater is located within Walnut Canyon. A small section of the upper Coconino outcrop in the area east of Santa Fe Dam was analyzed to estimate permeability of the unit. Investigation largely focused on fractures, which were measured for orientation, length, and width. A wooden square, measuring one square meter, was placed against the outcrop to limit some individual measurement areas. All data collected were in the form of recorded measurements and photographs.

The studied Coconino Sandstone is dominated by large fractures cutting through meters of the formation. Fractures are most commonly sub-vertical to vertical, but a few sub-horizontal features and bedding planes were also recorded. Most fractures strike NW-SE to E-W, with the exception of one section primarily trending ENE-WSW. Aperture measurements range from <0.5 mm to ~28 cm, and the average is ~3.2 cm. Permeability of the sandstone itself is estimated to be low, but the presence of faults and fractures significantly increase the ability of water to flow through the unit. Features similar to those observed in Walnut Canyon could have played an important role in allowing vapor and liquid water to move around the subsurface prior to and during the eruptions of Rattlesnake Crater and Colton Crater. The full data set and interpretations are presented in Anderson's MS thesis (reference below).

Anderson, Emily S., 2017, *An investigation of the role of thermal conditions, hydrologic processes, and country-rock permeability in maar eruptions* (Unpublished master's thesis, Geology). Northern Arizona University, Flagstaff, Arizona.

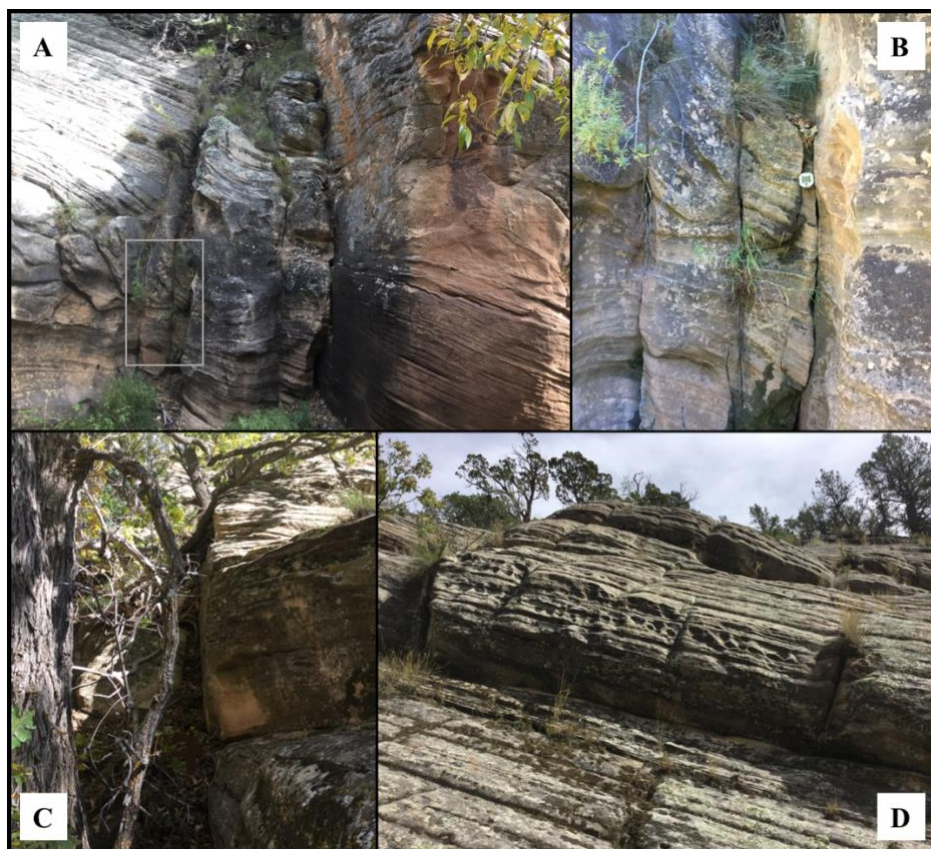


Figure 1: Field photographs of Coconino Sandstone in Walnut Canyon. (A) Section containing large-scale vertical fractures; (B) Closer view of the left-most vertical fractures in A (outlined), Brunton compass for scale; (C) View of a large-scale vertical fault; (D) Uppermost studied section of Coconino Sandstone. Some sub-horizontal bedding planes may be sufficiently open to serve as fluid flow conduits.

Status of Research

Completed.

Funding sources and amounts:

N/A

Whether specimens were collected:

No specimens were collected.

Confirmation of Research Dates:

A reconnaissance trip was conducted from the rim of the canyon on August 23, 2016.
Field research was conducted in Walnut Canyon, east of Santa Fe Dam, on October 12, 2016.