

A MULTI-DISCIPLINARY STUDY OF A COLD-WATER TUFA SPRING MOUND IN SANTA ROSA, NEW MEXICO

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Santa Rosa, New Mexico has tens of springs originating from outcrops of the San Andres limestone. One spring is actively precipitating a cold water tufa mound, rising at least 5 meters above surrounding topography. This research attempted to constrain why the spring mound was precipitating when none of the proximal springs (some as close as 30 meters) were depositing tufa.

Three control springs were chosen, two within 100 meters of the spring mound, and one ~2 km away that originates from at least 60 meters depth. Geochemical measurements on the spring waters indicate the same source water for all four springs. This eliminates a significant stratigraphic difference between the flowpaths of the springs. The deep control spring undergoes a change of pressure of 7 atmospheres and yet does not precipitate. This eliminates CO₂ offgassing as the motivator for precipitation. Stable isotope measurements of $\delta^{18}\text{O}$ were identical for the suite of springs and indicate the groundwater is fed by meteoric water and undergoes very little evaporation.

A core was taken of the tufa mound to a depth of 5 meters stopping when the tufa precipitation ended and a layer of paleosol was reached. The precipitation was unconsolidated and limey, with some solid pieces as large as 1 cm. Examination of the solid tufa indicated it formed around roots or stems of plants growing on the mound. The mound is populated with two sedges, a Cyperaceae and a Juncaceae, which were not observed at the other springs. The spring is artesian, in the process of coring the floor roughly doubled when a layer of plant matter was broken through at 3 meters.

The general chemistry measurements of the waters from the springs indicated all four were super saturated with respect to calcium carbonate. There was no significant variation between the four springs general or trace chemistry. The spring mound is covered with water that slowly flows down the mound. Most of the tufa deposition occurs in an area thinly covered by less than a centimeter of slowly moving spring water flowing downhill from the spring vent. To quantify the amount of evaporation and transpiration of this surficial water general and trace chemistry was conducted on the water. The measurements were not significantly different from the spring water.

One possible genesis for the tufa precipitation is microbial activity. Two wool substrates were placed on the spring mound in the region of the standing water. One substrate was stainless steel while the other was copper. The substrates were left in the spring mound for about 12 weeks. The weight of precipitation was measured and the amount of

precipitation was calculated versus surface area of substrate. The stainless steel substrate had 12 milligrams of precipitate per square centimeter of substrate while the copper substrate had 2.25 milligrams of precipitation per square centimeter of substrate. This could be due to the copper inhibiting organic precipitation because of its antimicrobial properties.

The precipitate from the spring mound was analyzed for total organic and inorganic carbon. The precipitate from the mound has 2.1% organic carbon and 0.5% inorganic carbon. It was not possible to analyze the precipitate on the metal wools because of the small amount of precipitation.

The nearly identical water chemistry between the spring water, the surficial spring water, and the control spring waters does not suggest an obvious geochemical reason for the tufa spring to be precipitating. Evaporation does not play a major role in the precipitation as indicated by the similarity of the surficial spring water and the spring water chemistries. Approximately 80% less precipitation occurred on a copper artificial substrate than a stainless steel artificial substrate indicating the precipitation mediator may be biotic. Further investigations into the possibility of biologically mediated precipitation are ongoing. The sedges growing on the surface of the mound may be influencing the precipitation work on this aspect of the study is ongoing.

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