ABSTRACT

TITLE:	Field Evidence for Cyclic Subsurface Eruptions During Diatreme Emplacement, Cathedral Cliff, Navajo Volcanic Field
AUTHOR(S):	Walter, Sterling; Gonzales, David
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ABSTRACT: Diatremes in the Navajo volcanic field were emplaced in steep pipes or dome-shaped "blind" eruptions. Aprons of bedded and stratified deposits envelope some of these complexes, providing insight into their eruptive histories. The pyroclastic apron at Cathedral Cliff diatreme preserves deposits and bedforms indicative of high energy emplacement of gas-charged magma. Field studies document multiple (18+) eruptive cycles from distinct, episodic discharges of gas and pyroclastic material at depths of 1500 to 2000 feet. Erupted material in each cycle is 6 to 15 feet thick and contains three main deposit types. Basal deposits in each cycle are unbedded, matrix to clast supported, heterolithic tuff breccia with angular to subrounded fragments of essential, cognate and accidental material up to 30 cm in maximum dimension. This is overlain by thin bedded, crudely-graded tuff breccia with similar types of pebble-sized fragments. Cycles are usually capped by thinly-laminated to thin-bedded ash-rich tuffs that preserve cross stratification, impact structures, and erosional surfaces. Each cycle thus transitioned from highly explosive and chaotic deposition of material to finer ash-rich material dominated by transport bedforms. The tops of most cycles are scoured and truncated by basal deposits of the next cycle. Beds in the pyroclastic apron dip steeply toward the center of the diatreme. Cross lamination, scour surfaces, "bomb" sags, and graded bedding indicate that the oldest deposits are on the outer margin of the pyroclastic apron with successive deposits inward. The results of this investigation provide evidence for multiple and discrete subterranean eruptions during diatreme formation. This is consistent with models that involve the rise and expansion of gas-rich "bubbles" that ultimately exceed lithostatic pressure and erupt. These "bubbles" expand and release gas upwards, and then collapse in subsurface chambers, depositing subvertical masses of pyroclastic material. Our results, however, indicate a progression in each cycle from clast-laden material to low-density gas-rich and clast-poor material. The data lends support for multiple eruptive pulses during diatreme formation related to magmatic-gas decompression, as opposed to periodic interaction with groundwater reservoirs.