Accepted Manuscript

Carbonic springs as distal manifestations of geothermal systems, highlighting the importance of fault pathways and hydrochemical mixing: Example from the Jemez Mountains, New Mexico

Chris McGibbon, Laura J. Crossey, Karl E. Karlstrom, Tanner Grulke

PII: S0883-2927(18)30232-4

DOI: 10.1016/j.apgeochem.2018.08.015

Reference: AG 4152

To appear in: *Applied Geochemistry*

Received Date: 7 March 2018

Revised Date: 12 August 2018

Accepted Date: 20 August 2018

Please cite this article as: McGibbon, C., Crossey, L.J., Karlstrom, K.E., Grulke, T., Carbonic springs as distal manifestations of geothermal systems, highlighting the importance of fault pathways and hydrochemical mixing: Example from the Jemez Mountains, New Mexico, *Applied Geochemistry* (2018), doi: 10.1016/j.apgeochem.2018.08.015.

Carbonic springs as distal manifestations of geothermal systems, highlighting the importance of fault pathways and hydrochemical mixing: Example from the Jemez Mountains, New Mexico

By

Chris McGibbon[ab], Laura J. Crossey[a], Karl E. Karlstrom[a], Tanner Grulke[a]

[a] Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, NM 87131, USA

[b] Corresponding author

ABSTRACT

We examine a series of carbonic warm and hot springs in northern New Mexico, USA: 1) Tierra Amarilla springs 2) Penasco Springs and 3) Soda Dam, Jemez and Indian hot springs. Spring geochemistry is compared to waters from the Valles Caldera geothermal system and to groundwater in nearby sedimentary aquifers. Multiple hydrochemical tracers are applied to quantitatively evaluate flow paths and mixing at varying distances from the caldera. We test three hypotheses for source and transport of waters to Tierra Amarilla and Penasco Springs: San Juan basin origin, meteoric flow from the Nacimiento Mountains, and/or influence from the Valles Caldera geothermal system. Geochemically, carbonic spring groups are distinct from meteoric and sedimentary aquifer waters. Based on isotopes of He and Sr, and concentrations of Cl, SO_4, Li and B we interpret these carbonic springs to be distal manifestations of fluid circulation along faults with a mixture of Valles Caldera geothermal waters, local meteoric and Paleozoic aquifer waters, with the potential for small contributions from the San Juan Basin aquifers. Semi-confined fault conduits, the Jemez fault and Nacimiento fault systems provide connectivity and help explain geochemical similarities and mixing trends within carbonic spring systems, and between these systems and the distal Valles Caldera. In addition, Penasco Springs are interpreted to reflect a component of outflow from the geothermal system that crosses the Nacimiento Mountain basement block along NE-trending faults. Input of deeply sourced waters can degrade water quality by