U-SERIES DATING AND STABLE ISOTOPE ANALYSIS OF TRAVERTINE DEPOSITS NEAR PONDEROSA, NEW MEXICO: IMPLICATIONS FOR DEFINING THE EASTERN LIMIT OF THE VALLES OUTFLOW PLUME

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The well-known Valles caldera hydrothermal outflow plume, which flows along the Jemez Fault Zone (JFZ) in Cañon de San Diego (CdSD) in the SW Jemez Mountains, New Mexico, possibly extends to the east of the currently accepted limits. Recent geologic mapping on the Cat Mesa and Jose fault zones (CMFZ and JoFZ), 3-6 km east of the JFZ, has identified several Quaternary hydrothermal features. Also, a hot well with temperatures of 129°C at 829 m depth (AET-4) located just east of the CMFZ implies an eastward extension of the plume. Indications of Quaternary hydrothermal activity include four generations of travertine deposition, goethite/hematite/barite mineralization in fault zones and coating terrace gravels, and one sinter deposit on the JoFZ. The highest elevation and oldest travertine in the area rests on a terrace 190 m above the Jemez River. Stable isotope values for this travertine are δ¹³C of 5.18‰ PDB and δ¹⁸O of 23.74‰ SMOW. The other travertine mounds lie on much lower terraces of around 40 m above the Jemez River and have an estimated age of around 155 ka. The sinter deposit intrudes into the JoFZ contact between Jurassic Entrada Sandstone and Tertiary Zia Formation and is indicative of very high temperature water. The deposit is of an unknown age and appears to be an exhumed vent.

Recent detailed geologic mapping along the JFZ on the Pueblo of Jemez has identified three generations of travertine deposition. The oldest is at an elevation of 44 m above the river and has an age of 233 ka. This travertine deposit rests on fine illite clay that was deposited across the JFZ. After the first travertine deposition, hematite-rich fluids cemented alluvial fan deposits, which were then overlain by a 144 ka travertine deposit. The third travertine occurs near Salt Spring at an elevation of 9 m above the river and has an age of 166 ka. Stable isotope data from these travertines ranges from δ¹³C values of 3.47‰ - 3.73‰ PDB and δ¹⁸O values of 22.40‰ - 22.52‰ SMOW. These data are fairly consistent with published U-series dates and stable isotope values from Soda Dam. The travertines on Jemez Pueblo are thought to have the same outflow plume origin as Soda Dam. U-series dates and stable isotope data will be evaluated to determine if the outflow plume is responsible for deposition of the CMFZ and JoFZ travertines.

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Valles caldera hydrothermal outflow plume, geologic mapping, U-series dating, geochronology

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