

THE ANALYSIS OF RABBITBRUSH (genus *CHRYSOTHAMNUS*) AND THE DETECTION OF A POSSIBLE HIDDEN GEOTHERMAL FIELD IN THE NORTHERN SAN LUIS VALLEY

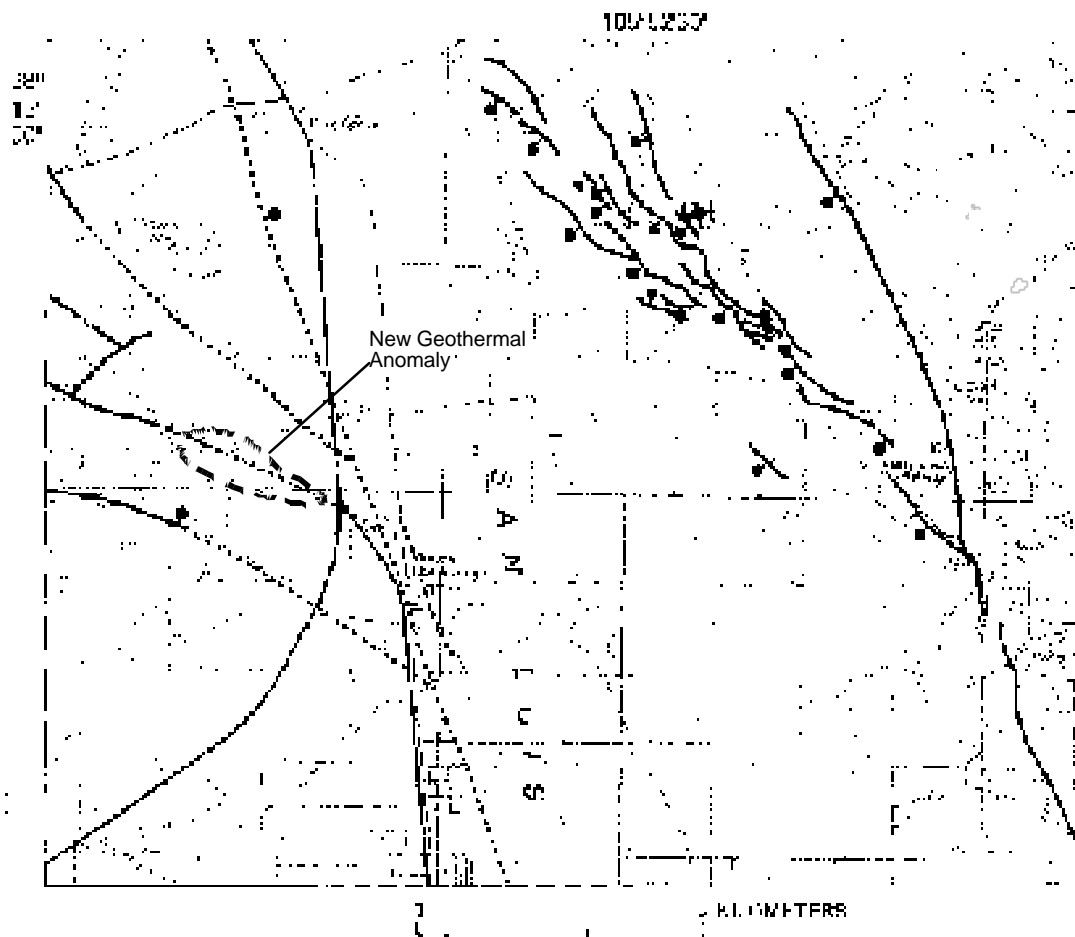


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ABSTRACT

The San Luis Valley lies between the low foothills of the San Juan Volcanic Field to the west and the steeply rising Sangre de Cristo Range to the east. Two Known Geothermal Resource Areas (KGRAs), Mineral Hot Springs and Valley View Hot Springs, lie in the northern part of the valley (figure).

Although these two hot springs are associated with the geomorphic expression of the northern San Luis Valley—the Rio Grande Rift—they are spatially and geochemically dissimilar (Barrett and Pearl, 1976, table 1; 1978). Mineral Hot Springs (springwater temperatures: 32°–55°C) is located in valley fill about midway between the San Juan



Location of possible hidden geothermal field in relation to mapped faults and the two Known Geothermal Resource Areas, northern San Luis Valley.

Volcanic Field and the Sangre de Cristo Range, about 9 km south of the town of Villa Grove, Colorado. Valley View Hot Springs (springwater temperatures: 31°–33°C) lies on the prominent range-front fault on the western edge of the Sangre de Cristos.

To seek evidence for possible extensions of these hot-spring systems, the U.S. Geological Survey conducted surveys of the area, funded by the U.S. Department of Energy's Geothermal Technology Division, using geochemical methods that included biogeochemistry—plant-tissue analysis. A total of 139 samples of rabbitbrush (*Chrysothamnus parryi* subspecies *howardii* [Parry] Hall and Clem. and, to a lesser extent, *C. nauseosus* ssp. *consimilis* [Greene] Hall and Clem.) were collected, mostly along road traverses. Soil-gas and minus-80 mesh soil samples—also collected along road traverses—totaled 396. Many of the geochemical anomalies coincided with the large fault systems of the valley. Although the surveys did not detect any extensions of the Valley View Hot Springs KGRA, a cluster of anomalous sites on the west side of the valley seemed to be related indirectly to the Mineral Hot Springs KGRA.

High concentrations of lithium, boron, and manganese in rabbitbrush samples (Erdman and VanTrump, 1993) suggest that a geothermal heat source may occur within the low hills of Lower Proterozoic granites just to the west of the Mineral Hot Springs. The location of this suite of element-concentration anomalies in the plants adjoins a traverse with high mercury concentrations in associated soils and anomalous carbon dioxide concentrations in soil gases (Hinkle, 1993; Motooka and others, 1994; Hinkle and Erdman, 1995).

Other geochemical spatial patterns, unrelated directly to geothermal resources, included the areal coincidence of surficial geochemical and biogeochemical anomalies with concealed subsurface faults detected by a resistivity survey (Zohdy and Bisdorf, 1993). Also, bromine-enriched rabbitbrush was located over an extensive area of presumably deep valley fill. Bromine is highly mobile under all pH/Eh conditions in the supergene environment. Two sources are likely: (i) tuff-laden lacustrine clays of the Neogene Alamosa Formation, which also consists of unconsolidated sands; and (ii) biogenic gases in the same formation or oil seeps, perhaps in the underlying Precambrian rocks. These gases may have created redox conditions that are known to produce bromine and iodine anomalies in soils.

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