

Subject: magma chamber at TF

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This is the response I prepared for the EIR/EIS on magma chambers.

Issue: EPA is worried that geothermal development will remove water that is currently cooling the magma chamber and thus cause a volcanic eruption.

There are two issues involved. First is the lack of evidence for any sizable magma body under Medicine Lake Volcano. Second is the separation and difference between the hot water geothermal system and a magmatic-water system. The United States Geological Survey has been studying Medicine Lake Volcano since the early 1980's using surface mapping and geophysical studies (Stanley, W., 1982; Fuis, G., Zucca, J., Mooney, W., and Milkereit, B., 1987; Evans and Zucca, 1988). All these studies came to the same conclusion that there was no large magma body under Medicine Lake Volcano. Donnelly-Nolan (1988), using geophysics and surface geologic studies also concludes that there is no magma body greater than 1 cubic KM in size above 5 KM depth (16,000 feet) in the area. In fact she states that there is little evidence that a large magma body ever existed under Medicine Lake Volcano.

Secondly, there is a difference between geothermal water and magmatic water. The geothermal water reservoir is a pool of deep circulating hot water that exists generally between 2500 and about 15,000 feet. Magma bodies generally exist much deeper and found in hotter more water-poor rocks. However, if there was a connection between magma and the geothermal system, then there would be a characteristic magmatic signature to the geothermal fluids. Such components would be elevated levels of SO₂, H₂, HCl, and HF, as well as having generally a pH of less than 3 pH units and having a unique water isotopic signature of +6 to +10 del 180 and -10 to -20 del D (Ellis and Mahon, 1977; Giggenbach, 1997).

The geothermal reservoir at Medicine Lake is a neutral pH, low salinity, low gas system with a typical geothermal water isotope signature of -8 to -9 del 180 and -94 to -96 del D. If a magma body existed within the Telephone Flat geothermal reservoir, then the water would have to reflect that magmatic contribution. No such contribution is found in any of the produced fluids, or in the surface springs.

It should be added that no development of geothermal fluids has ever been known to cause a volcanic eruption. This is the case even in fields, such as The Geysers, where the mass withdrawals of fluid has been considerable.

References:

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