Thermal springs and geothermal exploration

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There is considerable interest in thermal springs because of their potential as a geothermal exploration tool. However, the nature of the relationship between thermal springs and geothermal resources at depth has not been well documented. The case can be made that thermal springs are indicative of an environment with elevated isotherms in the near-surface environment but this does not necessarily translate into increased temperatures deeper in the subsurface, particularly those which would allow for electricity generation. In this study, we examine the relationship between temperature, volumetric discharge and heat flow for 890 thermal springs in North America obtained from various databases and government reports. These data are by no means exhaustive and contain only a subset of known thermal springs in North America. In particular, we have selected springs with both temperature and volumetric discharge measurements to facilitate heat flow calculations. There is little correlation between background heat flow and heat flow at springs. The variation in volumetric discharge suggests that the hydrogeology of an area is an important control on the development of thermal springs. Specifically, recharge rates must be sufficient to allow for noticeable springs to occur but at higher fluid fluxes, but this increase in downward groundwater flow will actually reduce temperatures in the area. In many cases, the existence of thermal springs may actually be a strong indication that an area is a poor candidate for geothermal development, particularly for electricity generation. Thermal springs with high temperatures and low volumetric discharges are more likely to indicate conditions necessary for electricity generation because such springs can occur with a negligible effect on a region's heat flow budget.

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