

**MISLEADING SODIUM-POTASSIUM-CALCIUM TEMPERATURES IN  
LOW-TEMPERATURE CARBON DIOXIDE-RICH ENVIRONMENTS;  
AN EXAMPLE FROM SOUTHEASTERN IDAHO**

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The Blackfoot Reservoir region in southeastern Idaho is recognized as a potential geothermal area because of the presence of several young rhyolite domes (50,000 years old), Quaternary basalt flows, and warm springs. NNW-trending normal faults near the edges of the Blackfoot Lava Field appear to be the dominant structural control of spring activity in the region. Surface spring-water temperatures average 14°C except for a group of springs west of the Reservoir Mountains along Corral Creek, which average 33°C. Chemical geothermometers, which indicate temperatures of last water-rock equilibrium, applied to fifty water samples give temperatures of less than 75°C except for the eight springs along Corral Creek. The Corral Creek springs have Na-K-Ca temperatures of 324°C to 370°C that are a direct result of large concentrations of potassium in the water (greater than 200 ppm). A correction for CO<sub>2</sub> applied to the Na-K-Ca geothermometer lowers the estimated temperatures of the anomalous springs to near the measured surface temperatures. Mixing model calculations suggest that hot water with a maximum temperature of approximately 67°C may be mixing with cooler, more dilute water in the springs from Corral Creek. Stability relations of low-temperature phases in the systems K<sub>2</sub>O-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>-H<sub>2</sub>O-CO<sub>2</sub> and Na<sub>2</sub>O-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>-H<sub>2</sub>O-CO<sub>2</sub> indicate that the large concentrations of potassium in the eight anomalous springs are derived from equilibrium reactions with feldspars. CO<sub>2</sub> and H<sub>2</sub>S gasses may be derived by the oxidation of organic matter and the reduction of sulfate. The observed elemental concentrations in the spring water and gasses are due to water-rock reactions at temperatures less than 100°C that can be reached at depths of 1 to 2 kilometers below the surface.