THE CODY HYDROTHERMAL SYSTEM

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INTRODUCTION

The hot springs and associated travertine and sulfur deposits near Cody, Wyoming were first discovered by John Colter in 1807 or 1808 (Mattes, 1962). Because of Colter's description of the thermal areas along the Stinkingwater River (now called the Shoshone River), fur trappers called the area "Colter's Hell" (Mattes, 1962), a name which has sometimes mistakenly been applied to Yellowstone National Park.

The hot springs of Colter's Hell are the surface manifestations of a much larger hydrothermal system. That system has been studied to define its extent, maximum temperature, and mechanism of operation. The study area covers 2,700 km² (1,040 mi²) in northwest Wyoming (see Figures 1 and 2). Research and field work included locating and sampling the hot springs, geologic mapping, thermal logging of available wells, measuring thermal conductivities, analyzing over 200 oil and gas well bottom-hole temperatures, and compiling and analyzing hydrologic data. These data were used to generate a model for the hydrothermal system.

General Geologic Setting

The Cody study area covers portions of the western Bighorn Basin and eastern Absaroka Mountains. The uplifts shown in Figure 2 are Laramide in age (Fanshawe, 1952). Uplifts which are discussed include the Rattlesnake anticline and the Horse Center anticline. The Rattlesnake anticline trends northwest, has an exposed core of Precambrian granite and granitic gneiss, and is located in T.53N., R. 103W., the southwest corner of T.53N., R.102W., and the north half of T.52N., R.102W. (see Figure 2). The Horse Center anticline trends north to north-northwest, has an exposed core of Triassic Chugwater Formation, and is located in the southeast corner of T.52N., R.101W., the southwest quarter of T.52N., R.101W., and the northwest quarter of T.51N., R.101W. (see Figure 2). Both structures exert control on the areal extent and magnitude of the hydrothermal system.

Absaroka volcaniclastic material of Eocene age (Smedes and Prostka, 1972) covers the western portion of the study area. Any heat generated by the 47-million-year-old volcanism has dissipated and no longer affects the thermal regime of the area. The volcanics are important because they cover and obscure the underlying sedimentary structure and may also influence local groundwater flow and chemistry.

Sedimentary rocks in the area represent the Cambrian through Quarternary systems, with only Silurian deposits absent. Thicknesses of the sedimentary rocks used in the thermal modeling were those of Pierce (1966, 1970, 1978), who gives a total sediment thickness of over 7 km in the eastern portion of the study area.

The thrust faults shown on Figure 2 — the Southfork thrust fault and Heart Mountain Detachment fault of Pierce (1975, 1978) — are not believed to exert significant control on the hydrothermal system.

Evidence for the Cody hydrothermal system

The most obvious evidence for the Cody hydrothermal system is the four sets of hot springs in the study area. All are located along the Shoshone River as shown in Figure 2. Chemical, temperature, and flow data for the springs are listed in Table 1.

The easternmost springs are the DeMaris Hot Springs, a group of at least seven major vents and more than ten minor vents along 220 meters of the northern shore of the Shoshone River. Measured temperatures for the vents range from 24° to 34°C, but Breckenridge and Hinckley (1978) report temperatures as high as 37°C (see Table 1). The springs occur on the southeast flank of the Rattlesnake anticline and flow from the Park City and Dinwoody Formations. A 41-meter-deep well located on a terrace 150 meters southwest of the DeMaris Hot Springs, which supplies 790 liters per minute (208gpm) of 37°C water to the Cody Health Spa, is believed to have the same source (see Table 1).

1.2 km west, along the northern shore of the Shoshone River, is a group of at least five vents called Shoshone Hot Springs (see Figure 2). Measured temperatures at three accessible vents were 28 to 34°C, with flow from the Tensleep Sandstone. Further west, the next set of hot springs is a series of 23°C seeps flowing from road fill that covers the Pilgrim Limestone. These are probably the Needle Hot Springs described but not located by Breckenridge.