

REPORT OF EXAMINATION OF HOT WATER WELLS AND THE
BIG HORN MINERAL HOT SPRING LOCATED NEAR
THERMOPOLIS, WYOMING

By

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According to request of Governor Frank C. Emerson, under date of January 5, 1929, examination of the hot water wells and the Big Horn Hot Spring at Thermopolis was made on January 8th and 9th, 1929.

Information desired on this examination was whether or not the capping of the water wells which were drilled in this vicinity would result in preventing or at least materially lessening the chances of further depletion of the discharge of the Big Horn Hot Spring, provided a diminution of the discharge of this spring has occurred in recent years and especially since the artesian wells north of the State Reserve were developed.

From a careful study of all information available relative to the source of water of the Big Horn Hot Spring and the hot water wells in this locality, I have come to the conclusion that it is the same in all instances and is none other than the Tensleep sand, a well known formation which underlies the entire Big Horn Basin. The Tensleep sandstone, as all very well know, is a porous rock slightly more than 200 feet in thickness and which is able to absorb a very large amount of surface water and carry it underground. In most portions of the basin area the formation lies at a depth too great to be reached by ordinary well boring, as is the case immediately north of Thermopolis in the syncline which exists there and where the water receives its heat from the great depth. As the water enters the formation on the high mountain slopes, it has a head so great that it causes flows in all the valleys and lower slopes and especially in the vicinity of Thermopolis.

The present springs and their predecessors - for the region has been one of thermal activity for a long time - have built up extensive terraces of travertine or hot springs deposits similar to those in the Yellowstone Park. These deposits are easily visible and identified and lay on the top of the several monumental hills and terraces that occur in this vicinity. The ancient springs

Hand Water

which formed these deposits have gradually become extinct for the reason that the Tensleep formation originally elevated on the flanks of the mountains while undergoing uplift have gradually, during long ages past, eroded down to lower elevations and thus reduced the hydrostatic head on these sands to such an extent that it caused those springs to become extinct whose vents were located at the highest levels. Cave-ins and earth movements resulting from these cave-ins, produced by the gradual elimination of the mineral taken into solution by the water of these springs, possibly also caused some of these ancient higher flowing springs to become extinct. The later day spring, which we now know as the Big Horn Hot Spring, without a doubt derives its water from the Tensleep sand as its source of supply. The vent and crevice through which the waters of the spring flow from the Tensleep sand was without doubt produced when the Thermopolis anticlinal fold was formed, the axis of which crosses the Big Horn River approximately at the location of the spring in an easterly, westerly direction.

From the well logs of the flowing wells located on the north and gentler sloping limb of the anticline, it is quite evident that the Embar formation which immediately lies above the Tensleep formation became very greatly broken and shattered on the apex of the anticline and this is likewise true of the Red Beds lying above the Embar. It was noted that all of the water wells drilled in this vicinity which are producing artesian water barely entered the Embar formation. The Embar usually in other parts of the Big Horn Basin is found to be dry. On the Thermopolis anticline, where the Embar was shattered during the formation of the anticline, this shattered part became an auxiliary reservoir which is being supplied and replenished from the Tensleep sand through a crack or cracks in the top foot or two of this sand, which small layer is impervious to water and which is the principal factor and physical characteristic of the Tensleep sand and which makes it such a wonderful water reservoir.

The Tensleep sand has a great porosity, containing approximately 20% voids. From this, it can readily be seen that the Tensleep sand is virtually an immense reservoir of water 40 feet in depth, covering the entire basin area in extent. Obviously, this immense reservoir then is the source of the water flowing from the artesian wells and also of the Big Horn Hot Spring in the vicinity of

Thermopolis. The breach of the foot or two thick impervious capping of the Tensleep sand is the orifice through which escaping waters from the reservoir must come to supply the waters of the Big Horn Hot Spring, as well as the artesian wells which are drilled only into the auxiliary small Embar reservoir created when the formations arched into the Thermopolis anticline.

The escaping water from the Tensleep sand on the arch of the Thermopolis anticline would require more than thousands of years to even appreciably diminish the immense body of water contained in the Tensleep sands, even though this escape of water were not replenished annually by run-off from the mountains which continually replaces the amount drawn off at lower levels through visible natural springs, producing wells and hidden flows of all kinds.

I am thoroughly convinced that the artesian wells which are now flowing water north of Thermopolis will contribute in no manner toward depleting the flow of the Big Horn Hot Spring, whether they have direct connection with the crevice supplying water from the Tensleep sand or not and if it were possible to cap the wells and this feat accomplished, it is quite doubtful and in my opinion quite improbable that the discharge of the Big Horn Hot Spring would be affected in the least.

On account of the shattered and broken condition of the Embar formation on the arch of the anticline, there are innumerable springs flowing water in this region. Many of them discharge directly in the river itself and may be seen bubbling on its surface. The effect produced by the capping of the drilled artesian wells, in my opinion, would be simply to produce numerous other small springs not now in existence.

From personal observation, deduction and interviews with several persons who have been intimately acquainted with the condition of the Big Horn Hot Spring for the past twenty to thirty years, I conclude that in reality there has been no apparent or appreciable diminution in the amount of the flow therefrom, either at the present time or immediately after the bringing in of any and all of the drilled artesian wells.

An infinitesimal decrease in the flow of the Big Horn Hot Spring, not apparent or appreciable, may have been accomplished by natural agencies in the gradual reduction of hydrostatic head, as has been going on for centuries and a like infinitesimal, gradual diminution of the spring may continue for the same reason during the coming centuries. Natural catastrophies due to earthquake or earth movement on account of cave-ins may also at some future date alter conditions and may change the flow or even the location of the spring at any time.

State Geologist

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