

THE STATE OF WYOMING

GEOLOGIST'S OFFICE

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The Mineral Hot Springs of Wyoming



FALLS OF BIG HORN HOT SPRINGS, THERMOPOLIS, WYOMING

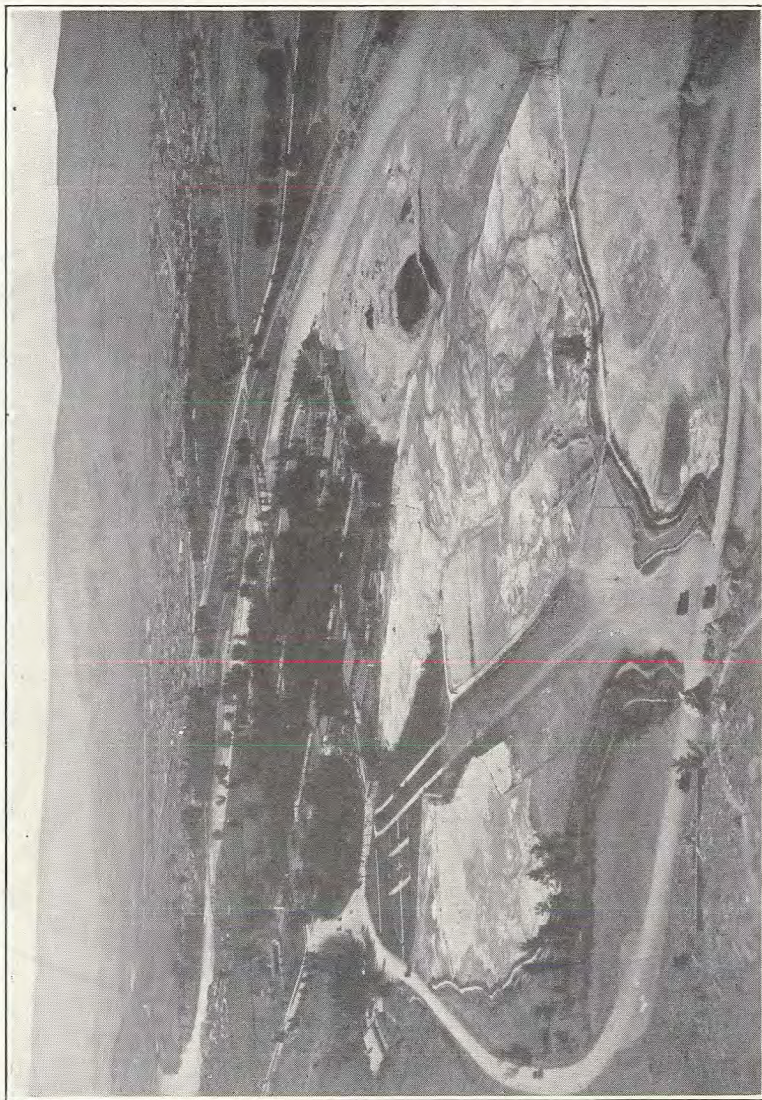
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STATE GEOLOGIST OF WYOMING
CHEYENNE, WYOMING
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MINERAL HOT SPRINGS OF WYOMING

Wyoming has been endowed by Nature in countless ways. In some locations from its secret hiding places in the earth, petroleum gushes forth in the oil fields, placing this State high in the petroleum industry; in other places, underneath its surface, abound rich minerals, non-metallic minerals and precious metals; and here and there within its borders, sometimes in the midst of a great barren waste, there is a mineral spring bubbling forth hope and promise to those who seek rest and drink of its health-giving waters. In the past, these springs have not been advertised to any extent, with the exception of one or two of the larger ones. It is the purpose of this Bulletin to give publicity to these springs. Warm mineral springs usually contain medicinal properties and many of these springs are situated where climatic conditions would attract on account of the winter mildness and summer coolness.

No attempt was made to study the geology of the various mineral springs for this Bulletin, but it has been noted that most of the springs have one point in common, the fact that the springs come to the surface through outcrops of the Chugwater formation of Triassic Age and are associated with anticlines or monoclines, faulted in some cases, this being true of the majority of the most important springs of the State. In the vicinity of the Big Horn Hot Springs at Thermopolis, four wells have been drilled and have been successful in developing important flows of hot water of practically the same temperature and mineralization as the waters of the Big Horn Hot Springs. These wells were drilled through the lower part of the Chugwater formation and into the Embar. Considerable pyrite was encountered in the bottoms of two of the wells. One of these wells flows at the rate of 121,508 gallons per day and another 2,223,330 gallons per day. The drilling of these wells has not apparently reduced the flow of the springs and it is believed that a tremendous underground reserve of hot mineralized water occurs in this immediate vicinity, and the same may be true of the regions surrounding other mineral springs where wells have not been drilled, in a number of places in Wyoming.

No theory has yet been advanced which accounts for the heat or the mineral constituents in the water of these wells and springs. Taking the present available information into consideration, it is believed that the temperature of the waters is derived from heat generated by chemical reaction among the elements



View from Mounment Hill, showing Terraces of Big Horn Hot Springs in foreground, buildings on State Reserve in middle ground, and Town of Thermopolis in back ground across the river.

present in the Chugwater and Embar formations. These formations contain gypsum, limestone, iron both in the form of pyrite and as an oxide; also, magnesium, sodium and potassium. A detailed study of the chemistry and geology of these hot mineral springs, undoubtedly, would throw more light on the origin of these hot mineral waters and will be taken up by the State Geologist in a later Bulletin.

BIG HORN MINERAL HOT SPRINGS

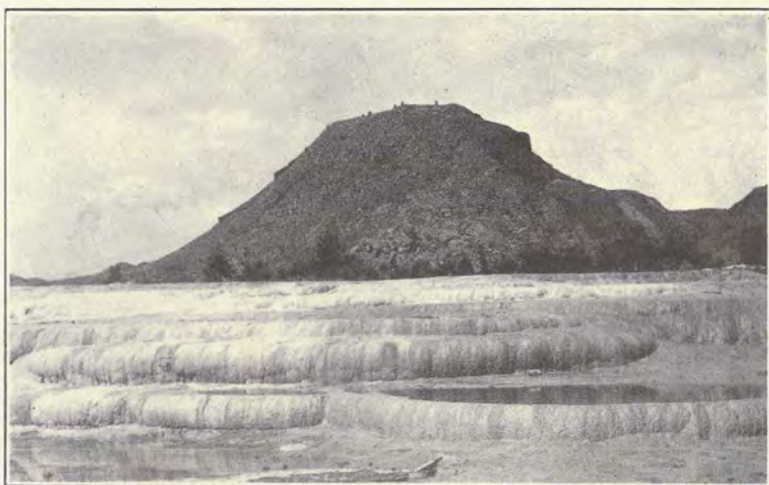
By an Act of Congress, approved June 7, 1897, these springs were made the property of the State of Wyoming. There was a treaty in connection with this Act providing that the Big Horn Mineral Hot Springs should be free to the public always. "Washakie", Chief of the Shoshone Indians, deserves credit for this wonderful gift to humanity which has brought relief from disease and suffering to many men.

The Wyoming Legislature, in 1899, enacted a law providing for bath houses to be constructed, open and free to the use of the public. Since that time the State Legislatures have appropriated about a half million dollars for parking, streets, lighting system, water systems, bridges and buildings. A bath house, at a cost of \$50,000, was built and state-appointed attendants are constantly in charge.

These baths are located at the city of Thermopolis, Wyoming, which is about five miles north of the Wind River Canyon, one of the most interesting natural formations of the world. Thermopolis is about ninety miles southeast from Yellowstone National Park and on the main line of the Burlington Route. It is on the Yellowstone, Buffalo, Park-to-Park and Atlantic Yellowstone Pacific Highways.

There are several good hotels there, open all year and having all modern conveniences. There are also a number of up-to-date apartments and boarding houses offering accommodations at reasonable rates. In addition to the hotels and rooming houses, there is a tourist camp ground, where a charge of fifty cents per day is made for the conveniences, and also a free camp ground for those who desire to use it.

Here one may spend an ideal vacation in this atmosphere of pure mountain air. There are ample opportunities for out-door amusements, golf, tennis, horseback riding, mountain climbing, and motoring down the scenic roadway of the Wind River Canyon, which was opened in July, 1924. In this canyon are three tunnels which were cut through solid rock at a cost of about a million dollars to the state and federal governments. One writer has said that "this is one of the most wonderfully picturesque spots, possibly, in the world, where the Big Horn river gathers the voices



Monument Hill and Terraces of Big Horn Hot Springs, Thermopolis, Wyoming.

of the streams of the hills into a grand chorus and roars a wonderful concert, telling in a language all its own of the joys of life in the vicinity of the Big Horn Springs."

Among the other scenic attractions in this vicinity are Monument Hill, Devil's Punch Bowl, Old Roundtop, Hot Water Lakes, Hot Water Geyser, Hot Water Falls, stock and dude ranches, game preserve and zoo of Rocky Mountain wild animals.

The Big Horn, Black Sulphur, White Sulphur and Ponce de Leon are the four largest springs, and, besides these, there are hundreds of smaller Mineral Hot Springs bubbling up in the Big Horn River and at different places on the State Reserve.

Analysis by Prof. M. P. Scheutzenburger of the College of France of the waters of the springs follows:

	Grams per Liter - Grains per Gal.	
Silica . . . . .	.0855	4.986
Iron and Alumina . . . . .	.0039	.227
Potassium Chloride . . . . .	.1756	10.240
Sodium Chloride . . . . .	.4492	26.195
Sodium Sulphate . . . . .	.2591	15.110
Magnesium Sulphate . . . . .	.3334	19.443
Calcium Sulphate . . . . .	.2256	13.156
Calcium Carbonate . . . . .	.6937	40.454
Total Solids	2.2260	129.811
Temperature, 134 Degrees Fahr.		
Flow, 4,100,235 Gals. Every 24 Hours.		

Foregoing analysis re-calculated to comply with Federal Government formula.

Parts per Million Hypothetical Combinations—	Big Horn Hot Springs
Potassium Chloride (KCl).....	175.60
Sodium Chloride (NaCl).....	449.20
Sodium Sulphate (NaSO ₄).....	259.10
Magnesium Sulphate (MgSO ₄ O).....	333.40
Calcium Sulphate (CaSO ₄).....	225.60
Calcium Carbonate (CaCO ₃).....	693.70
Ferrie Oxide and Alumina (Fe ₂ O ₃ A ½O ₃).....	3.90
Silica (Si O ₂).....	85.50
Total Solids per Million.....	2,226.00
Temperature 57.4° C. (135° F.)	

SARATOGA HOT SPRINGS

Located at Saratoga, Wyoming, are both hot and cold mineral springs and the baths are very beneficial. Saratoga is a town of about one thousand inhabitants, beautifully located on the North Platte River. The Saratoga Valley has a mild and healthful climate and is surrounded by fishing streams and beautiful scenery, all of which add to the advantages of Saratoga as a pleasant summer and health resort.

The water from the various springs comes out of the ground at a heat averaging 120° F. The waters are Radio-active and contain all of the elements that have made other similar resorts famous the world over. The climate is ideal all the year around, being not too cold in winter and with cool, refreshing nights in summer. The altitude is 6,785 feet. The wooded islands scattered along the North Platte River at this point add to the beauty of the natural picture and the pure mountain water, the tonic air from the mountains and the freedom from alkali produce unusually good conditions for recuperation from overwork, nerve and brain fog, tubercular troubles, etc. Catarrh and hay fever are relieved and cured by the water and pure air.

An analysis of the Saratoga Water by C. F. Chandler, Ph. D., New York, follows:

	Grains per U. S. Gal.	Pints per 100,000
Sodium Chloride	52.0807	89.3322
Sodium Sulphate	10.2510	17.5832
Potassium Sulphate	10.4603	17.9422
Calcium Sulphate	21.0410	36.0909
Calcium Carbonate . . . . .	.4433	.7604
Magnesium Carbonate	1.2782	2.1924
Silica	3.7195	6.3799
Iron and Aluminum (oxides).....	.1108	.1900
	99.3848	170.4712

Sanitary analysis shows the water to be absolutely free from contamination.

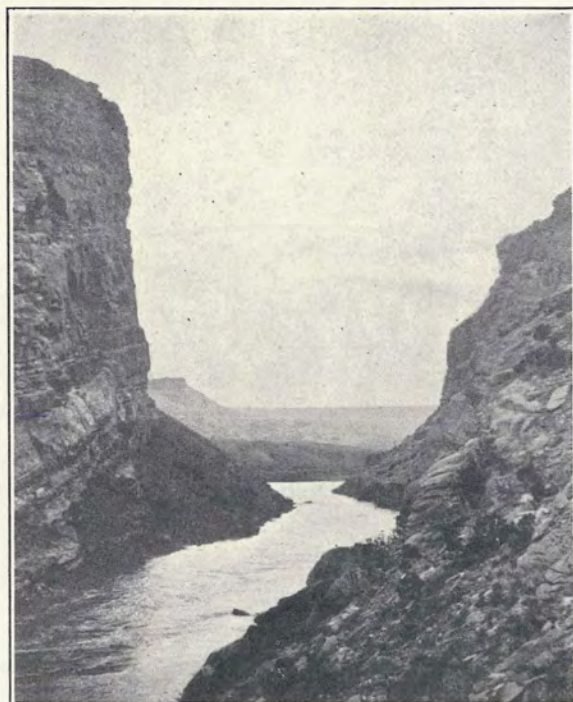
The medicinal waters bring thousands of visitors to this remote place each year for the purpose of resting, recovering lost health or for the enjoyment of the fishing and hunting in the valley or hills. Notable personages from all over the west become enamored of the beautiful surroundings and come, year after year. Physicians whose names are known throughout the west visit the springs and advise many patients to try the waters for stubborn and chronic diseases. Helpless rheumatics have been cured in from two to six weeks. Victims of the liquor and tobacco habits have been entirely cured. Sufferers from stomach and intestinal diseases have been sent away happy at the first freedom from pain, completely cured.

The Medicinal Well at Saratoga deserves mention. From this well comes a wonderful "Radio-active" Mineral Water, which is bottled and sold throughout the country, some carbonated and some "still" or just as it comes from the well.

The continued use of the water stimulates the action of, and restores to a normal condition, all the organs engaged in the process of digestion, assimilation, secretion, and excretion. It is a laxative when drunk in the morning before breakfast; used during the day and afternoon, it acts as an alterative and diuretic and cures all acid and gaseous conditions of the stomach. In June, 1911, its wonderful remedial properties were discovered, and since that time this mineral water has rapidly increased in favor. At a first glance, one asks what accounts for Nature storing up this wonderful medicinal water in such an apparently remote, out-of-the-way place as Saratoga, Wyoming. However, when one investigates, it is found that Nature has selected the ideal, on account of the fact that the mountains and brooks around Saratoga, Wyoming, abound in mineral and medicinal properties.

ALCOVA HOT SPRINGS

The Alcova Hot Springs are located in Natrona County, about thirty-five miles southwest of Casper. The water from these springs is noted for medicinal properties and the place will become famous as a health resort. The country abounds in picturesque scenery, is rich in minerals, and rock formations, and is favored with a delightful climate. The land in the valleys is fertile and suited to agriculture. The Fremont Canyon, where the springs gush out from the base of a rock 700 feet high, into the North Platte River, is the nucleus of a town. Two and one-half miles up the river is another canyon, more wonderful, being six miles long, and in some places 1,500 feet high. Gypsum, marble, graphite, saponite, agates, coal, oil and paint rock, lime stone, clay, quartz-bearing gold and silver are found in this vicinity. Extensive improvements are being made in hotels and bath houses this season. No



North Platte River near Alcova Hot Springs.

country can be found more interesting to prospectors and those seeking pleasure. One can find accommodations at the Fremont House on the bank of the river, with delightful boating and fishing. The Red Reef Chute will be an addition this summer.

The following is an analysis of the water of the Alcova Hot Springs:

Analysis of Water	Grains per Liter	Grains per Gallon
Silica SiO_2 . . . . .	.0397	2.315
Iron and Alumina, Fe_2O_3 , Al_2O_3 . . . . .	.0022	.128
Lithia, Li 20	Trace	Trace
Potash, K_2O} . . . . .	.0159	.927
Soda Na_2O} . . . . .	.2837	16.544
Lime, CaO} . . . . .	.2279	13.291
Magnesia, MgO} . . . . .	.0990	5.773
Hydrochloric Acid, Cl} . . . . .	.2970	17.320
Sulphuric Acid SO_3 . . . . .	.3848	22.441
Carbonic Acid CO_2 (calc) . . . . .	.1002	5.843
(Less O equiv. of Cl}) . . . . .	.0670	3.908
Total Solids	1.3834	80.674
Temperature, 139° Fahr.		

FORT WASHAKIE SPRINGS

The Fort Washakie Springs are located at the Shoshone Agency, Fremont County, Wyoming.

Following is the analyses of Spring No. 30:

Radicals:

Nitrate (NO_3).....	10.	Sod. Nitrate (NaNO_3).....	14.	Ammonia, Manganese
Chloride (Cl).....	43.	Sod. Chloride (NaCl).....	46.	metals of hydrogen
Sulphate (SO_4).....	363.	Sod. Sulphate (NaSO_4).....	65.	sulphide group, car-
Bicarbonate (HCO_3).....	281.	Sod. Bicarbonate (NaHCO_3).....	....	bonate, phosphate bro-
Potassium (K).....	17.	Mag. Chloride (MgCl}).....	....	mide, and iodid;
Sodium (Na).....	43.	Mag. Sulphate (MgSO_4).....	178.	none
Magnesium (Mg).....	36.	Mag. Bicarbonate ($\text{Mg}(\text{HCO}_3)_2$).....	....
Calcium (Ca).....	166.	Calcium Chloride (CaCl_2).....	251.	Strontium, arsenic,
Iron Oxide .....8		Calcium Sulphate (CaCl_2).....	251.	nitrate, boric acid;
Aluminum (Al}).....	....	Calcium Bicarbonate.....	273.	traces
Silica (SiO_2).....	46.	See note*		
		Ferrous Oxide (Fe_2O_3).....	.8	Hydrogen sulphid
		Silica (SiO_2).....	....	0.9 m. p. l.
		Potassium Chloride (KCl).....	32.	Lithium 0.2 m. p. l.
				Very slight sediment
				consisted of silica;
				the amount has been
				included in the analysis
Total	1005.8	Total	1005.8	

*Note:—($\text{Ca}(\text{HCO}_3)_2$).

CONCLUSION

This water is rather highly mineralized and contains hydrogen sulphide. It is classed as a sulphurated, alkaline, sulphate water. The constituents which give to its chief characteristics are hydrogen sulphide, calcium bicarbonate (dissolved limestone), calcium sulphate (gypsum) and magnesium sulphate (Epsom salts.).

CAPTAIN BONNEVILLE, by Washington Irving, Chapter XXV, page 269, contains the following interesting reference to Fort Washakie Springs:

"Having forded Wind River a little above its mouth, Captain Bonneville and his three companions proceeded across a gravelly plain, until they fell upon the Popo Agie, up the left bank of which they held their course, nearly in a southerly direction. * * *

"* * * and then 'turned in' for the night and slept soundly like weary and well-fed hunters.

"At daylight they were in the saddle again, and skirted along the river, passing through fresh grassy meadows, and a succession of beautiful groves of willows and cottonwood. Towards evening Captain Bonneville observed a smoke at a distance rising from among hills directly in the route he was pursuing. Apprehensive of some hostile band, he concealed the horses in a thicket, and, accompanied by one of his men, crawled cautiously up a height, from which he could overlook the scene of danger. Here, with a spy-glass, he reconnoitered the surrounding country, but not a lodge nor fire, not a man, horse, nor dog, was to be discovered; in short, the smoke which had caused such alarm proved to be the

vapor from several warm, or, rather, hot springs of considerable magnitude, pouring forth streams in every direction over a bottom of white clay. One of the springs was about twenty-five yards in diameter, and so deep that the water was of a bright green color."

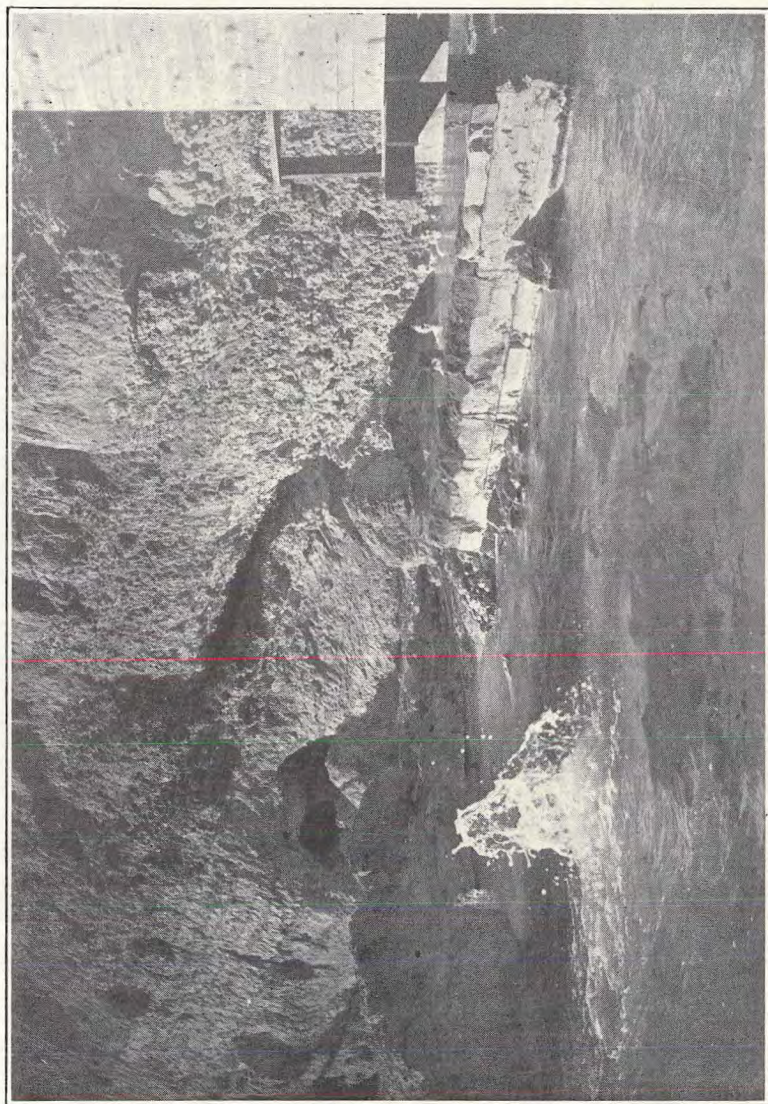
These springs are about eighteen miles distant from the Chicago & Northwestern Railroad, and although the place is open for the reception of the public, there is no resort operated here. The waters from the springs are found to be beneficial for rheumatism and skin diseases.

THE DEMARIS SPRINGS

About four miles from Cody, Wyoming, which is on the Burlington Route, the DeMaris Needle Springs are found. These are located adjacent to the Shoshone River. The upper springs has a temperature of 100° F. and the lower one has a temperature of 76° F. Around the lower spring a plunge has been built. A resort has been operated there for thirty-two years. The waters are highly mineralized. An analysis follows:

	Grains per Gallon	
	Hot Spring	Cold Spring
Aluminum and Iron Oxides.....	2.2	5.0
Calcium Oxide.....	15.5	17.8
Magnesium Oxide.....	34.6	16.6
Sodium Oxide.....	25.8	26.0
Silicic Dioxide.....	2.2	1.1
Carbon Dioxide.....	36.6	28.6
Sulphur Trioxide.....	31.2	1.9
Sulphur as Sulphide.....	6.1	12.0
Chlorine as Chloride.....	1.7	1.0
Lithium and Strontium.....	Traces	
Temperature.....	100 Fahr.	75 Fahr.

CAPTAIN BONNEVILLE, by Washington Irving, Chapter XXIII, page 251, contains the following reference to these springs of the region along the Shoshoni or Stinkingwater River: "Here the earth is hot and cracked; in many places emitting smoke and sulphurous vapors, as if covering concealed fires. A volcanic tract of similar character is found on Stinking River, one of the tributaries of the Bighorn, which takes it unhappy name from the odor derived from sulphurous springs and streams. This last mentioned place was first discovered by Colter, a hunter belonging to Lewis and Clarke's exploring party, who came upon it in the course of his lonely wanderings and gave such an account of the gloomy terrors, its hidden fires, smoking pits, noxious streams, and the all-pervading 'smell of brimstone' that it received, and has ever since retained among trappers the name of 'Colter's Hell!'"



DeMaris Hot Springs near Cody, Wyoming.

YELLOWSTONE NATIONAL PARK SPRINGS

The Mammoth Hot Springs are located near the Gardiner, Montana, or northern entrance to the Park at an altitude of 6,284 feet. Located there are the Administrative Offices of the Park, the Superintendent's Office, United States Commissioner's Office, Mammoth Hotel, postoffice, curio store, etc. Mammoth Camp is straight ahead and not far distant a herd of buffalo is run.

The large and wonderful hot springs and terraces are the chief attractions at Mammoth. These terraces and springs are numerous. The deep coloring at Mammoth Hot Springs is due to minerals in the water and to a low form of vegetable life which will grow in the water up to a temperature of 180° F., however, at Jupiter Spring and many places elsewhere in the Park the deep blue coloring of the water is not a reflection of the sky nor is it due to vegetable matter, but is natural and incomparably beautiful. Some of the most important springs besides Mammoth Hot Springs are the Jupiter, Canary, Glen, Orange, Dedolph and Diana.

An analyses of the Mammoth Hot Springs follows:

Constituents	Grams per Kilo of Water	Percent of Total Material in Solution	Grains per U. S. Gallon
KCl	0.0046	1.67	0.2685
K ₂ SO ₄	0.0015	0.54	0.0875
Na ₂ SO ₄	0.0448	16.25	2.6151
MgSO ₄	0.0076	2.76	0.4436
MgCO ₃	0.0258	9.36	1.5060
CaCO ₃	0.0790	28.65	4.6114
Al ₂ O ₃	0.0021	0.76	0.1225
SiO ₂	0.0355	12.88	2.0722
CO ₂	0.0748	27.13	4.3662
	0.2757	100.00	16.0930

A hot spring deposits clear water into Bath Spring, and the luke-warm water there is excellent for bathing.

There are many enjoyable side trips from Mammoth Springs, consisting of beautiful walks and drives. Mountain climbers find it a place of delight, for there are many mountains to climb, the principal ones being: Electric Peak (11,555 feet), Bunsen Peak (8,600 feet), Mount Everts (7,900 feet), and Sepulcher Mountain (9,500 feet).

"The general panorama at Mammoth Hot Springs is one of the most striking in the Park. The steaming tinted terraces and Fort Yellowstone near by; the long, palisaded escarpment of Mount Everts to the east; the dominating presence of Bunsen Peak to the south, with Gardiner Canyon and the distant eleva-

tions of the Mount Washburn group; the rugged slopes of Terrace Mountain to the west, and the distant peaks of the Snowy Range to the north—all together form a surrounding landscape of wonderful beauty and contrast."

OTHER WYOMING SPRINGS

In addition to the Hot Springs on which detailed information has been given, there are a number of other springs in various parts of the State which have not been investigated, mainly by reason of their being too remote from transportation.

A number of these springs undoubtedly have great possibilities and will bear further investigation. A few of them may be listed as follows:

Hot Springs near Hailey, Wyoming, a few miles off the road between Lander and Rawlins. From what information we could gather, this spring is a Sulphur Spring, having a composition similar to the Fort Washakie Hot Springs and a temperature of 100° to 120°. The flow is probably in the neighborhood of 100 to 200 gallons per minute. At the present time, it is not used for any purpose besides irrigation.

Hot Springs near Fremont Butte in Sublette County, in T. 32 N., R. 107 W. Information concerning these springs is very meagre. Small bath houses have been erected and the springs are used for bathing purposes by the residents of that locality.

Hot Springs on the Snake River. This spring is situated on the east side of the Snake River in a meadow of about fifty acres extent, about twenty miles south of Jackson and about four miles below the junction of the Hoback River and Snake River, from which point it is necessary to travel by horseback to reach the spring. It is a sulphur spring, coming through the red beds of the Chugwater formation. It has a temperature of from 100° to 120° F. A small log cabin has been erected over the spring for a bath house. The flow of the spring has not been measured, but has been estimated to be 100 gallons per minute or more. It is used by residents of that locality and is said to be good for rheumatism. Water is used to a limited extent for irrigation and is valuable for that purpose, as crops can be grown earlier in the spring and later in the fall than on lands where cold water is used.

This would make a wonderful location for a dude ranch, as it is situated in a very mountainous region on Snake River Canyon, where big game of all kinds is numerous and where trout fishing is unsurpassed. It will not be but a few years until a State or Forest Service Highway is built through the Snake River Canyon, and this location would then be upon this highway. Pure cold water for domestic purposes could be piped down from a

spring on the side of the mountain a short distance from the hot springs.

There are a number of mineral springs in Uinta County, though none of them are hot springs. The largest of these springs is located near the Union Pacific Railroad, near the Leroy station. It was formerly customary for the Union Pacific trains to stop at this point in order that the passengers could drink waters of this spring, which are said to be highly beneficial.

Along the Spring Valley, near the highway and also above the town of Spring Valley, are several mineral springs. Waters of these springs were formerly bottled and sold in large quantities by a Spring Valley druggist, now deceased. Analyses of these springs have not yet been secured.

Nine miles due south of Douglas, not far from the point where Wagonhound Creek empties into the North Platte River, is a warm spring, whose temperature, composition, and rate of discharge has not been determined. This spring has been used to a small extent for bathing purposes and for irrigation.

WYOMING OPPORTUNITIES FOR CAPITAL

The greatest undeveloped COAL resources in any state in the Union, more than 1,000,000,000,000 tons.

Sixth state in the Union in the production of PETROLEUM.

Eighth state in the production of NATURAL GAS.

Among the four leading states in the Union in OIL SHALE deposits, the Wyoming deposits are adjacent to the railroad.

Most important IRON deposits west of the Mississippi, including the largest deposit of TITANIFEROUS IRON in the United States.

Some of the largest deposits of ASBESTOS in the United States.

Unlimited quantities of PHOSPHATES.

Nearly 2,000,000,000 tons of POTASH and ALUMINA.

BENTONITE industry developing rapidly, this mineral occurs in many parts of the state, innumerable uses are being found for it in manufacturing processes.

Recent developments have shown activity in GOLD mining districts.

Non-metallic minerals found include CYANITE, FELDSPAR, GARNET, GRAPHITE, GYPSUM, KOALIN, LIMESTONE, MARBLE, MOSS-AGATE, ONYX, MICA, TALC, and TRIPOLI.

Unusual HYDRO-ELECTRIC possibilities.

Nearly 14,000,000,000 board feet of standing TIMBER 12 inches and over in diameter.

An undeveloped AGRICULTURAL empire.

YELLOWSTONE NATIONAL PARK, and the Big Horn and many other HOT SPRINGS.

Eleven NATIONAL FORESTS offering marvelous mountain scenery and camping, hunting, and fishing that will please the most exacting.