Springs of Colorado

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Colorado College

Dedicated To

Frank and Doris Foster
of Boulder

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SPRINGS OF COLORADO

Springs have for thousands of years been a source of wonderment and speculation, of valuable water supplies, of recreation and health, of business and commerce, of energy, of scientific interest.

The springs of Colorado do not meet all these requirements to the same degree that they may in other parts of the globe. They are smaller than several in Montana, less thoroughly developed than a number in Florida, much less historic than many in Europe. Perhaps the only worldwide superlative is that the swimming pool that utilizes the water at Glenwood Springs is said to be the largest of all outdoor warm-water pools. The water at Steamboat Springs has the next most conspicuous recreational use in Colorado.

Nevertheless, the springs of Colorado are interesting and important, as we hope to bring out here. If the therapeutic uses of thermal springs has declined somewhat with a growing sophistication, the drug culture, and an impatience with slow recovery (though we live longer), the bottling and distribution of spring water is an expanding industry, even where public water supplies are safe; but Colorado lags in developing it. The public spa has given way almost entirely to the swimming pool, for which the temperature of the water is a matter of comfort rather than health, and the chemical composition is quite irrelevant. The inability of chambers of commerce and commercial interests to furnish photographs for this book indicates somewhat a general lack of interest in the local springs of Colorado. The drawings were made to order by Sarah Andrews.

The possible use of hot water and steam — whose source is related to that of springs, specifically thermal springs — has been investigated recently more seriously than ever before to generate heat and power and to serve agriculture and recreation in Colorado. Springs, in Colorado as elsewhere, are essential to farmers and ranchers as a water supply for stock. They serve the hunter and fisherman similarly.

Springs have played their part in history. Their curative effects were one of the reasons for the building in Greece of the temples of Aesculapius and other temples. The noted pass of Thermopylae was named from the hot sulfur springs nearby. Roman as well as Greek literature is replete with descriptions of famed springs, which, according to Pliny, "add to the number of divinities, and establish villages." Many of the springs are still in use, together with those developed by the expanding Roman Empire in the rest of Europe, many doubtless on the sites of barbarian springs, and to the East. The baths of imperial Rome are now legendary, but they were once real: the baths of Caracalla were both fabulous and authentic. Bathing as a group activity was renewed by the year 1420, in Switzerland, and spread to other countries.

Springs in the United States and Canada were extensively used by the Indians, this also being true in Colorado. The earliest studies were made by physicians, the first of whom was Dr. John Bell in 1831. The original geologic observations were published in 1843 by William B. Rogers; a later interest by geologists lay mainly in the relationship of springs to the deposition of minerals and then expanded to a consideration of the sources of the water and the heat of thermal springs.

No sharp boundary exists between hot or warm (thermal) springs and cool or cold springs, except perhaps their comparison with body temperature and the outside air. In Colorado, most of those of particular interest are the warmer ones, including most of the ones that have been developed. The term *mineral waters* embraces them all, for there is no such thing as natural pure water, although some springs are obviously more highly mineralized than others. Mineral waters were once defined simply as those proposed for drinking for medicinal reasons; according to Gerald A. Waring, some are so called because they are actually free from mineral ingredients! Except for their internal use, a comparison of the chemical composition of a given water with that of any famous European spa is now regarded as old fashioned or foolish. The dissolved gases in spring water are mainly carbon dioxide and hydrogen sulfide but may be nitrogen, oxygen, argon and other rare inert elements, and methane. The soluble mineral substances are numerous, serving to classify spring water according to various arrangements that have been proposed. Organic matter occurs in many springs.

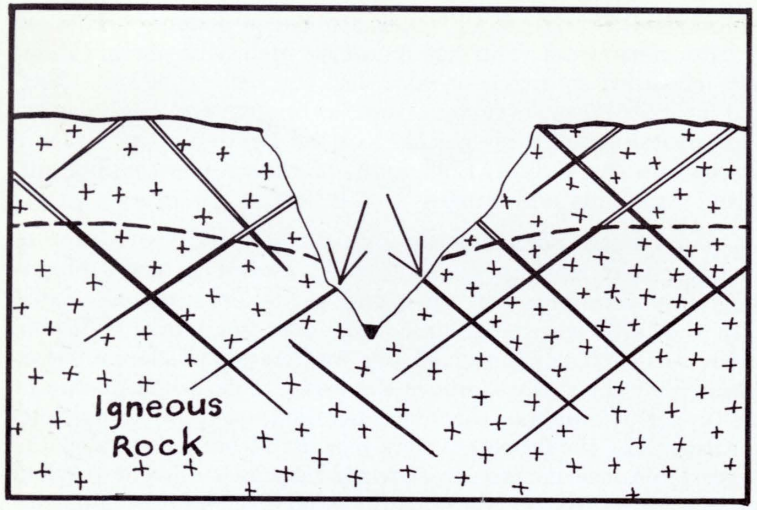
Springs discharge ground water, also called underground water or subsurface water. This has its source mainly as precipitation: rain, classified as drizzle or rain, sleet (ice pellets) or hail, snow, and moisture. Some may come from the cooling (and solidification and crystallization) of molten rock at depth or (in volcanic regions) on the surface. Both kinds of water — descending and ascending — mix and mingle.

Ground water percolates through the soil and the variety of openings that exist in all solid rock. Except in areas of underground solution — the cave and cavern features associated with the term *karst* — ground water does not move in flowing streams as popularly conceived, nor, for that matter, does it rest as lakes below the surface. Above the water table, which separates the (upper) vadose zone (or zone of aeration) from the (lower) zone of saturation, the ground is merely moist at best. But below the water table, the movement of water may be sufficient to yield ground-water discharge (or phreatic-water discharge) — both constituting the hydraulic discharge, of which springs are the natural outlet upon the land or into a body of surface water. An aquifer is the medium that carries the water.

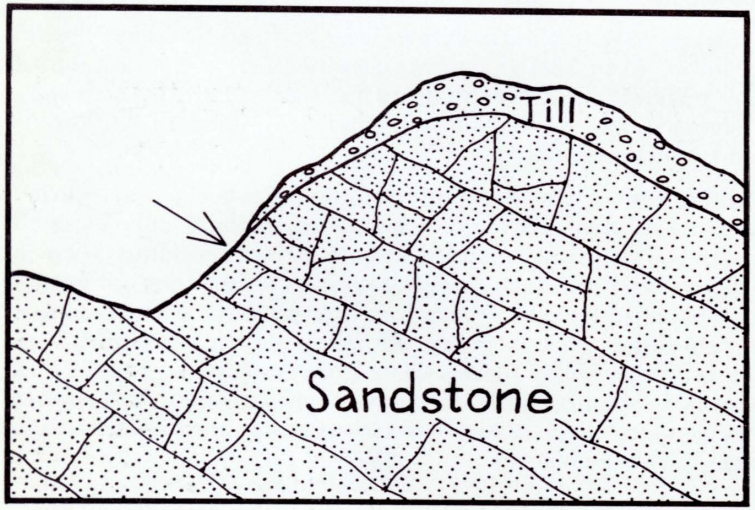
Eleven ways to classify springs were outlined by Oscar Edward Meinzer. Even though spring classification is not attempted here,* knowing the ideas that are involved will greatly help one's understanding of the subject, and so Meinzer's outline is presented briefly below:

1. Nature of the opeinings through which the water exits. *Seepage springs* emit percolating water, perhaps only in small amounts, from many small openings in permeable material (which is porous and transmits fluids). *Filtration springs* are similar but may be more copious. *Fracture springs* yield water from more or less sheetlike breaks of good size; *fissure springs* come from large cracks in rock; *joint springs* come from systems of joints in rock (caused by solidifying or drying or earth movements); *fault springs* emerge along displacements of rock; *tubular springs* come from large, pipelike openings.

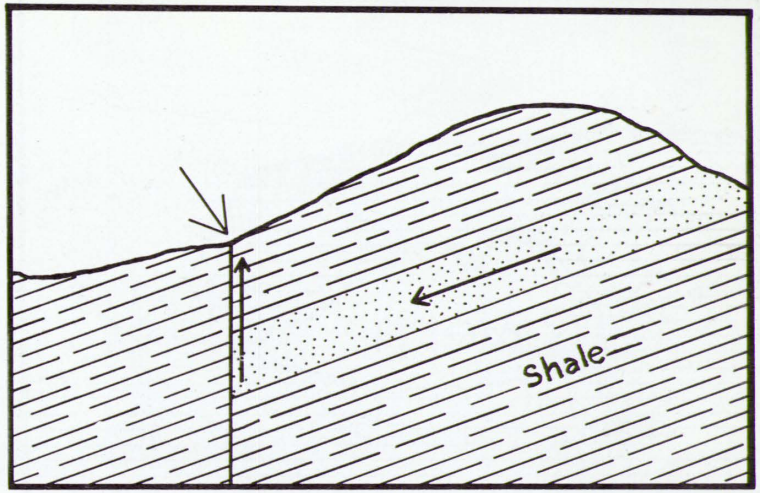
* The best classifications of springs seem to be those of K. Keilhack, Kirk Bryan (a former teacher of the author), and C.F. Tolman, who said: "As a result of the complex interaction of the many factors in spring formation, not only is there no satisfactory general classification of springs, but also it is not likely that such a classification will ever be developed."



Fracture Spring

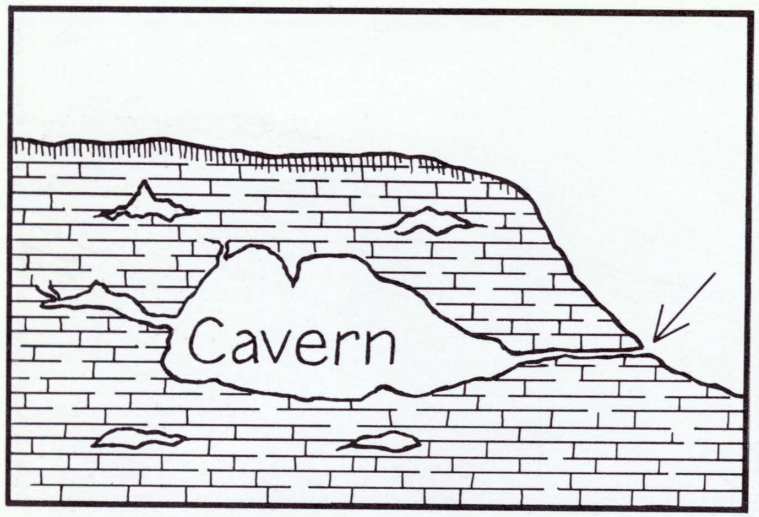


Fracture Spring

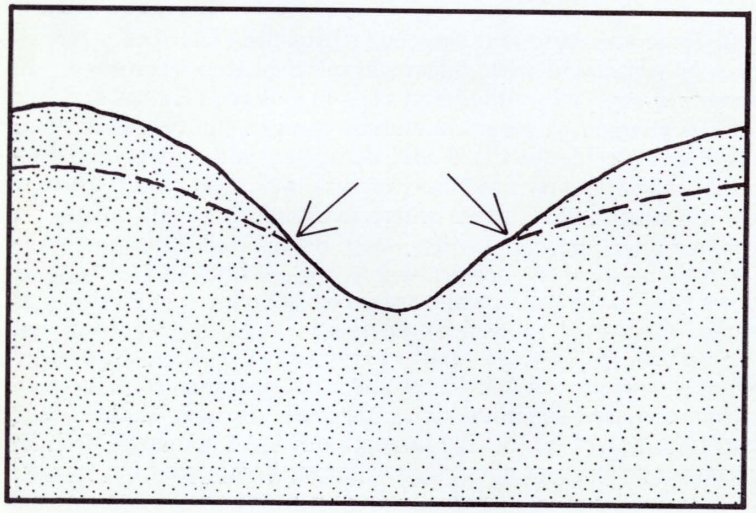


Fault Spring

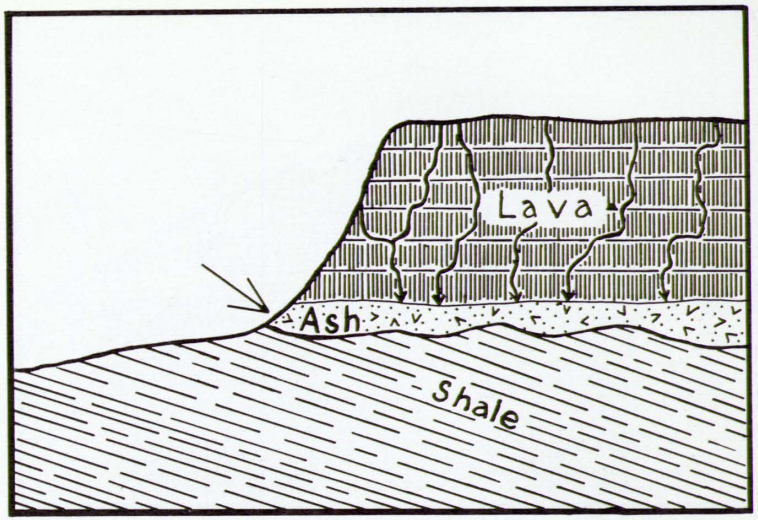
2. Rock structure and associated pressure. The rock structure may be associated with volcanism or with deep fractures in the earth. An especially prominent zone in Colorado for hot and cold springs charged with carbonic and hydrogen sulfide gas is where the rocks are highly tilted and disturbed and where sandstone meets shale. Gravity produces pressure, which, in *gravity springs,* forces water to the surface where it intersects (cuts, meets) the water table. Gravity springs may be divided into *depression springs,* or *dimple springs,* where the ground surface extends downward to the water table, as in a pit or hollow; *contact springs,* where the water table is interrupted — *hardpan springs* and *glacial-drift springs* are varieties of contact springs; *fracture springs,* having large, sheetlike openings that intersect pervious materials, impervious materials, or deep-seated rocks; and *tubular springs,* having large pipe-shaped openings. *Artesian springs,* on the other hand, feed water to the surface from within a confined space resembling in effect a water main. Deep-seated agencies produce pressure in springs that are associated with volcanism and with through-going fractures.



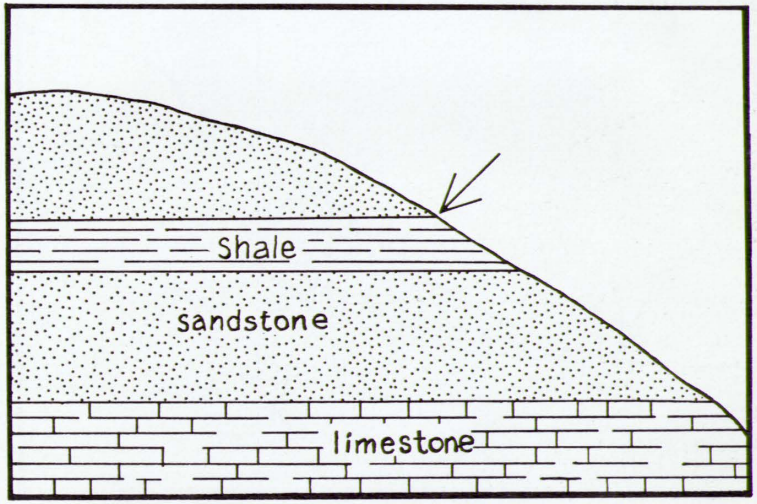
Tubular Spring in Limestone



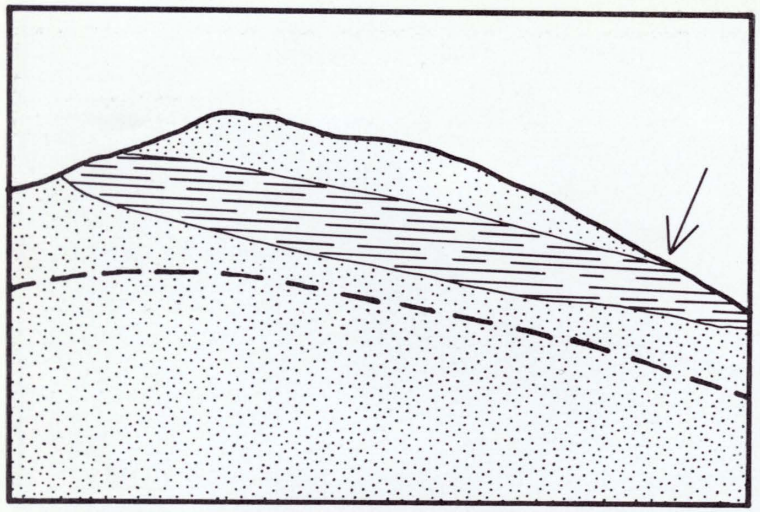
Depression Spring, Dimple Spring, or Valley Spring



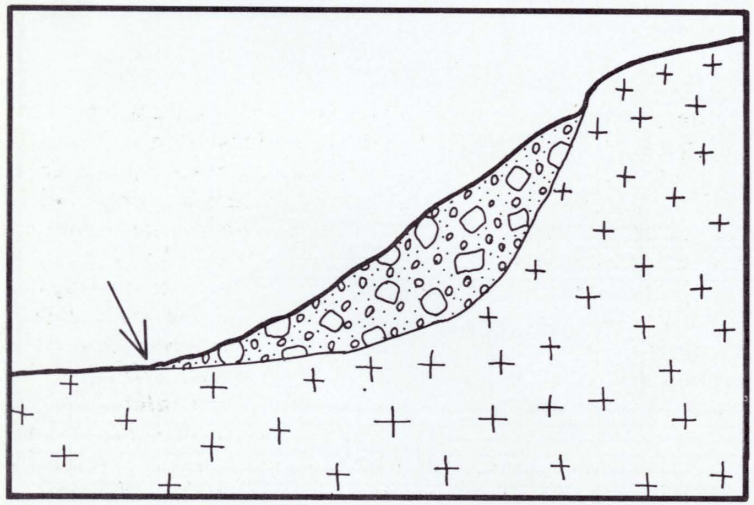
Contact Spring



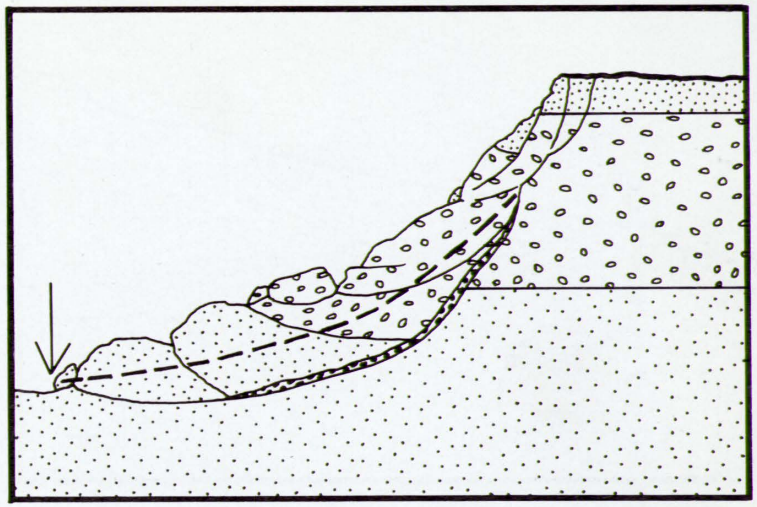
Contact Spring



Perched Spring

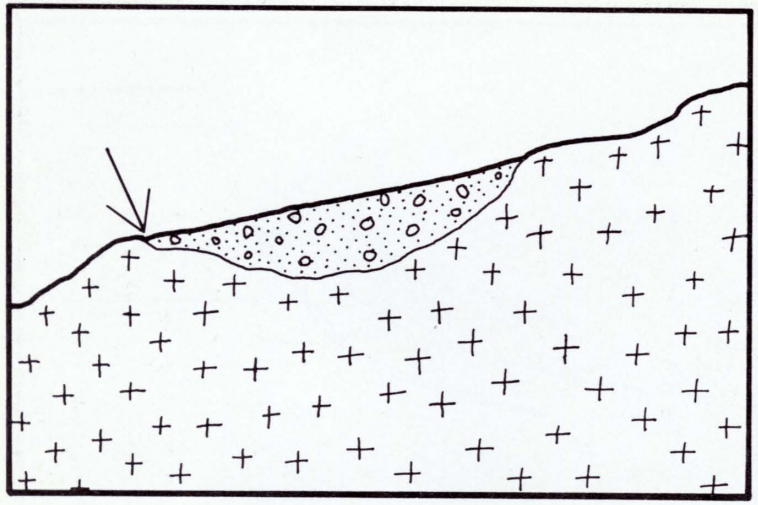


Talus Spring

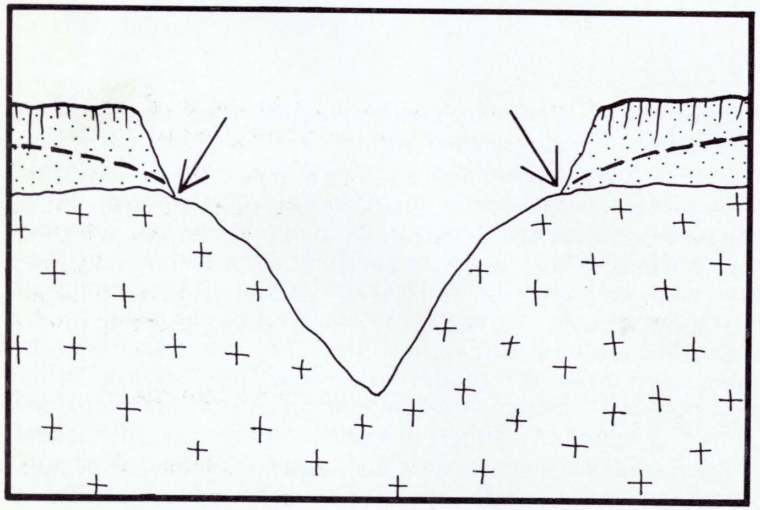


Landslide Spring

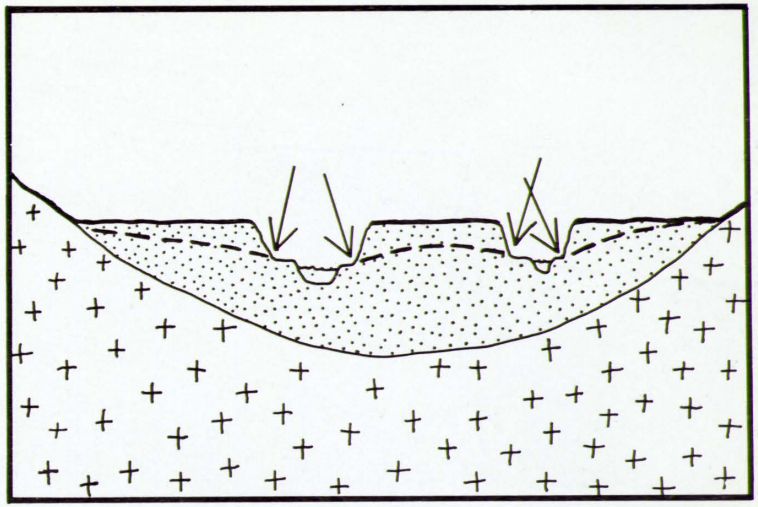
Other varieties of these springs, based on structure or topography, include *perched springs,* springs from old soil on mountain uplands, *talus springs, landslide springs,* springs from old alluvium, *pocket springs, mesa springs, cuesta springs,* desert waterholes, and *barrier springs* — all from thin (veneer) coverings of pervious rock that is flat or gently dipping and that overlies impervious rock that is usually irregular and either outcrops or comes close to the surface above the level of the main valley. Among the varieties issuing from thick pervious rock where the water table meets the ground level are *channel springs, valley springs, cliff springs, dimple springs,* and *alluvial-slope springs,* or *boundary springs,* and *fault-dam springs. Monoclinal springs, synclinal springs, anticlinal springs,* and *unconformity springs* have been named according to well-known structural or stratigraphic features combining pervious and impervious beds. Some of these kinds of springs are illustrated here.



Pocket Spring



Mesa Spring or Unconformity Spring



Channel Spring

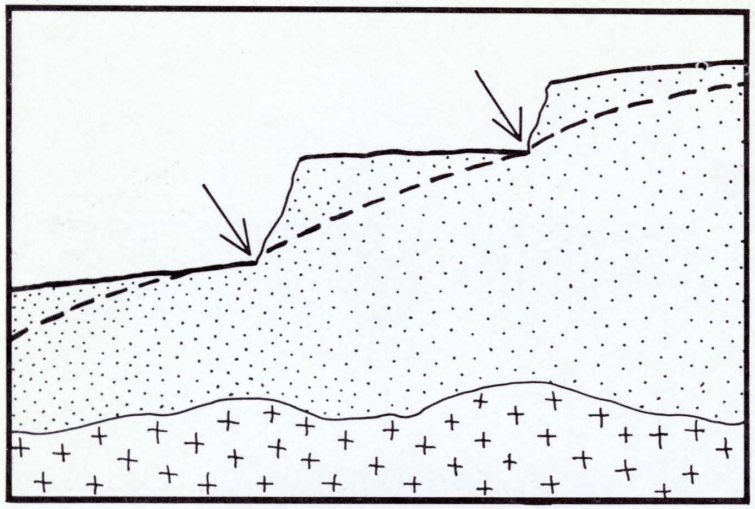
3. Nature of the rock. This pertains to the kind of rock — basalt, lava, sandstone, limestone, quartzite, and so on.

4. Formations. Individual or groups of layers of rock are, in the New World at least, almost all given geographic names according to where they were first described. In Colorado, the names include the Alamosa Formation, Hermosa Formation, Manitou Limestone, and others. The Dakota and Benton Formations are "the special mineral and hot and gaseous geological spring zone of Colorado," said Arthur Lakes.

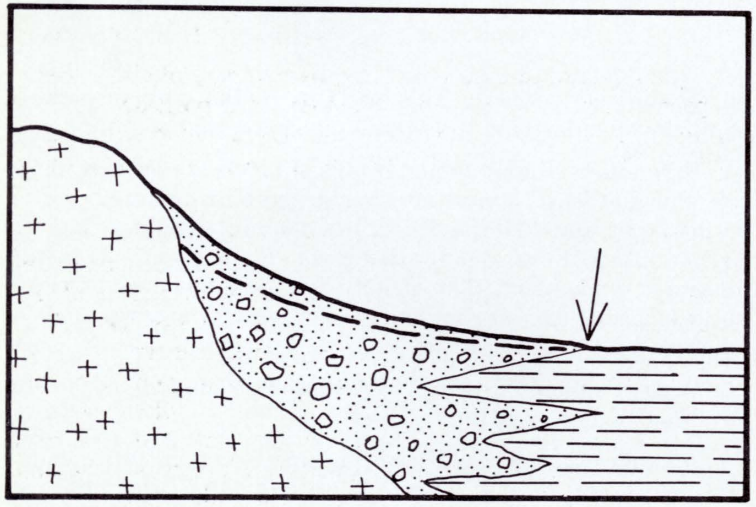
5. Water "sphere". Springs may discharge into the air or else into other bodies of water.

6. Amount of water. This has been expressed in meters or cubic centimeters per second, liters per second, and other units of measurement, as well as in magnitude, numbered first to eighth.

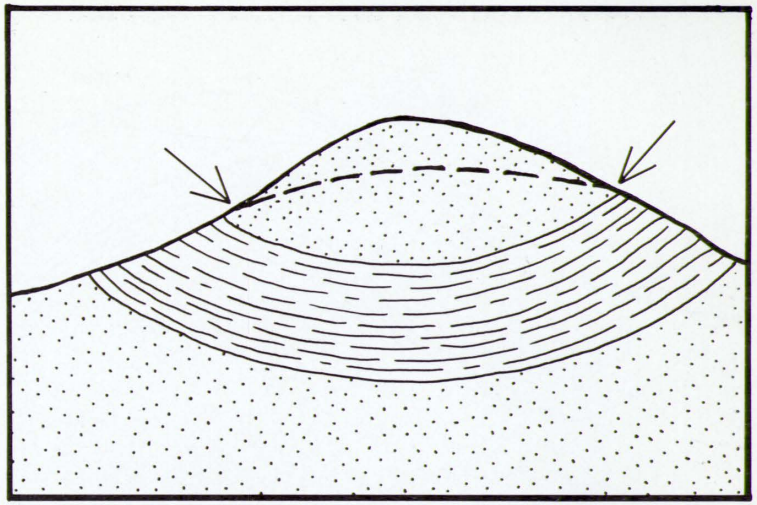
7. Uniformity of flow. There may be *constant springs, sub-variable springs,* or *variable springs.*



Cliff Spring



Alluvial-slope Spring

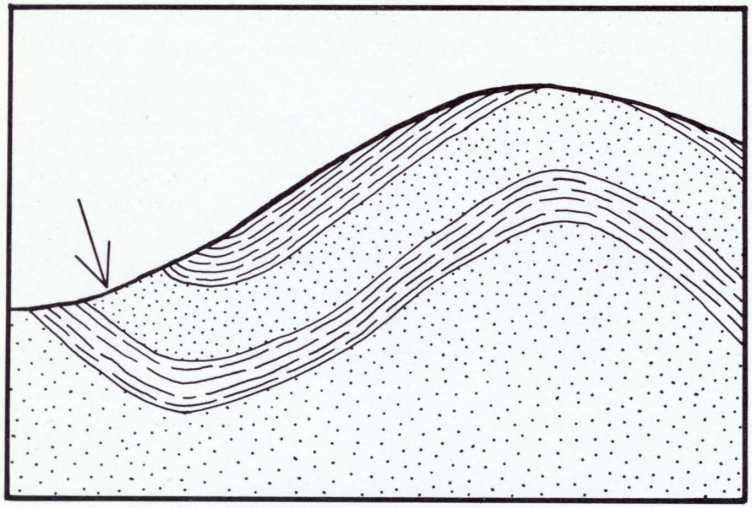


Synclinal Spring

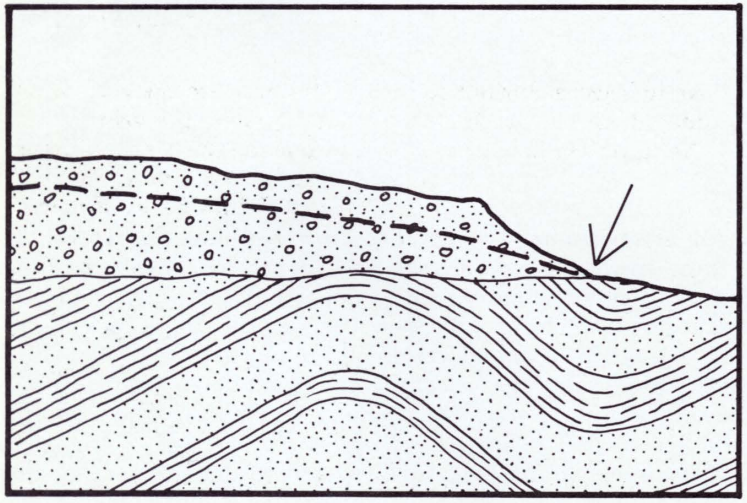
8. Permanence of flow. There may be perennial springs, flowing continuously, or intermittent (or temporary) springs. Periodic springs ebb and flow and, like geysers, discharge at intervals.

9. Quality of water. Here belongs the diversity of classification of springs according to their chemical composition, such as alkaline, saline, sulfur, and numerous others, alone and in combination. These terms are not much used nowadays except at large spas.

10. Temperature of water. The sources of heat are several, including increased temperature with depth, chemical reactions, radioactivity, earth movements (folding and fracturing), and local conditions. The chief source, however, seems to be geologically recent volcanism — actual volcanoes are not necessary — and associated rock faulting (dislocation) of recent date, permitting also the escape of the water. The steam given off by molten rock as it solidifies seems to be the actual source of most of the heat. Volcanoes, hot springs, and mud geysers are all phases of the same kind of geologic activity. The decrease in the boiling point of water with increased altitude should be kept in mind, considering the generally high elevations in Colorado. The mineral content increases the boiling point but slightly.



Anticlinal Spring



Unconformity Spring

11. Special features. *Pool springs, mound springs,* and other terms describe individual aspects of springs or those related to springs.

The most extraordinary springs in all Colorado are the almost countless artesian springs and wells in the San Luis Valley. So steeply do the aquifers descend from the surrounding mountains — the Sangre de Cristos on the east and the San Juans on the west — that the water is under great pressure. Wherever natural openings (fissures and faults) permit, this water rises toward the surface. Manmade wells serve the same purpose, and the water may reach the top of the ground. In many places, the springs and wells flow like fountains, often freezing into fantastic mounds of ice in winter.

Doubtless, the most dramatic historical event associated with the springs of Colorado was the dispute between the Utes and the Navahos over the ownership of the Great Pagosa Spring and associated mineral waters in southwestern Colorado. To settle the matter, a duel was arranged between representatives of the two tribes. The Ute champion was an adopted scout and aide to Kit Carson, Lieutenant-Colonel Albert Henry Pfeiffer. Having chosen bowie knives as weapons, he threw his at his opponent, killing him and winning the springs for the Utes.

Next to Pagosa Springs in historic interest are the cool-water, carbonated springs at Manitou Springs. Among the visitors here have been Indians of various tribes, who made this a neutral sanctuary; French traders, who named the adjacent stream the Fontaine qui Bouille ("fountain that boils"); John Charles Frémont, who analyzed the waters and after whom the name Fremont Soda Springs persisted for a while; and later travelers of some repute.

Of greater historic significance than either of the above, however, are the springs that furnished water to the cliff dwellers of Mesa Verde and similar plateau areas in southwestern Colorado. These springs made possible the habitation, prior to the 13th Century, in what is now Mesa Verde National Park, of America's first and most spectacular apartment dwellings. Colorado National Monument has a like arrangement of cliffs and springs.

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Idaho Springs

Avalanche Springs

In 1876, Ferdinand Vandiveer Hayden, geologist and explorer, described five springs along the banks of the Crystal River. These are near the old Crystal River Railway station of Avalanche, in Pitkin County. At times, they have been used for bathing. The names Bath House Spring, Cold Iron Spring, Hot Iron Spring, River Spring, and Hot Sulphur Spring clearly indicate the nature and use of the water. The name Penny Hot Springs has also been applied here, 12 miles south of Carbondale, where the water comes out of Tertiary diorite, the red beds of Permo-Pennsylvanian age that the diorite later intruded, and the stream alluvium of the lovely Crystal River. The temperatures, produced by the diorite, have been recorded up to 134°F (57°C).

Canon City Hot Springs

Now much cooler than previously and greatly declined in discharge, this spring — described by Charles Dennison in 1880 — is on the south side of the Arkansas River a few miles from the lower (eastern) end of the Royal Gorge. It once supported "a typical western resort hostelry" but now can barely support itself. Its temperature is 68°F (20°C).

Other springs near Canon City have likewise seen better days. The Fremont Natatorium Spring, in conjunction with a 1,655-foot well, supplied a swimming pool now out of business; the author remembers this place almost as one recalls a youthful dream.

Adjacent to the Colorado State Penitentiary is the Soda Spring, familiar to Zebulon Pike when he camped here on his noteworthy expedition in 1806. The Iron Spring or Iron Duke Springs is close by, and the Canon City Hot Springs and Grape Creek Spring are hereabouts.

Cebolla Hot Springs

Known to the Utes for their healing effects, and also called Powderhorn Hot Springs and Ojo de los Caballos, two groups of springs totaling about 20 in number are situated southwest of Gunnison on Cebolla Creek, in Gunnison County. As early as 1877, Albert Charles Peale referred to these springs. Mounds of sinter are evident around the orifices of many of these as they issue from

both sides of a hill. The rock is granite and metamorphic rock (gneiss and schist) cut by younger dikes. The temperature range is 48°-114°F (9°-46°C), the heat source being the San Juan volcanic area. The New Bath House Spring is at 100°F (38°C). Resorts have been attempted here on several occasions, and other uses have been made of the water.

Clarke's Magnetic Mineral Springs

The Pueblo hospital of Clark's Sanitarium evidently stood at B and Clark (formerly Spring) Streets, where its operations — no pun intended — were made possible by this spring (or well) and others in the area: (Sisters') Hospital Artesian Well, Pueblo Lithia Spring (Pueblo Lithia Water Well, at the Congress Hotel), and Ferris Artesian Well. The water was bottled and sold widely for its radium content and "magnetic" properties. When steel was placed in Clarke's well, for example, it became magnetized in a few hours.

Colorado Springs

The largest city in the country having the word *springs* as part of its name used to have flowing springs along Monument Creek, but these and others have been capped or neglected. Nearby Manitou Springs has not forgotten its heritage.

Conundrum Hot Springs

Hikers and backpackers into the Maroon Bells — Snowmass Wilderness Area about 10 miles south of Aspen use these Pitkin County springs for washing and informal bathing. Lying along its banks near the head of Conundrum Creek, they number six, four small and two larger. The water reaches a temperature of 100°F (38°C). The water emerges from limestone of Carboniferous age.

Cottonwood Hot Springs

Also known as Buena Vista Hot Springs — they are 6 miles west of the town — these waters of five springs are situated along Cottonwood Creek, in Chaffee County, where a new resort has been built for swimming. The old resort consisted of two pools in a bathhouse, both fed through short tunnels. The temperature of 120°-144°F (49°-62°C) is provided by an intrusive body of monzonite of

Tertiary age at its contact with Precambrian granite of the Collegiate Range.

Crested Butte Springs

Five springs on Cement Creek, in Gunnison County — Ranger's, Park or Cement Creek, Jarvis Spring No. 1 and No. 2, and Iron Spring — were associated with the name Crested Butte in its sanatorium days. This was some decades before the town became a ski resort, catering to an entirely different clientele. Travertine and iron deposits were formed by the various waters as they emerged from limestone and perhaps other Cretaceous sedimentary rock. The recorded temperatures were 44°-83°F (7°-28°C), but an unnamed spring in the vicinity is 100°F (38°C).

Dotsero Hot Springs

On the north bank of the Colorado River 4 miles west (downstream) from Dotsero, in Garfield County, is a spring used locally for bathing, although the old bathhouse is gone. The water comes from limestone of Pennsylvanian age where a fault zone separates it from Precambrian rocks. A tunnel was driven to control the spring but without much success. Big Dotsero Springs has a temperature of 90°F (32°C). The Old Bath House Spring was a separate one a little distance away and had its own building.

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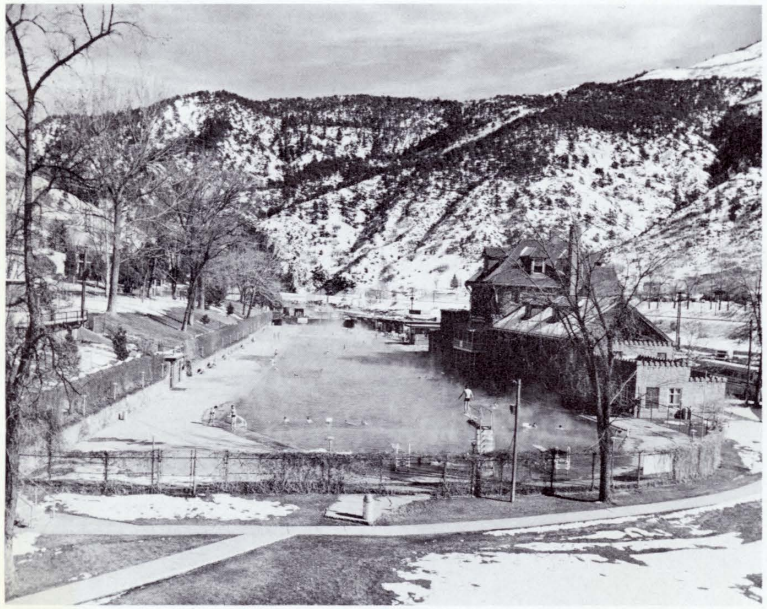
Eldorado Springs

Eldorado Springs

Long known as a Boulder County resort, the four Eldorado Springs — Curie, Cave, Bath, and Arapahoe — supply water for an outdoor pool of considerable size. Spectacular feats of wire balancing used to excite visitors at what was referred to as Boulder Radium Springs. The name Moffat Pool Spring was also used. The temperature of 82°F (28°C) is furnished by buried igneous rocks of Tertiary age, lying between Boulder and Golden. Here, Precambrian metamorphic rocks come in contact with Paleozoic and younger sedimentary rocks, the water issuing from marl of the Niobrara Formation, of Cretaceous age, which is much faulted.



Glenwood Hot Springs

Glenwood Springs

Holes scooped in the ground and shaded by pine boughs were the bathtubs of the early settlers, who copied the Indian method of treatment. In 1891, more substantial facilities were built by an

English syndicate. What are reputed to be "the only natural rock caverns exhaling hot mineral vapor to be found in the entire world" are here and were much prized by the Indians.

The hot springs along the Colorado River, in Garfield County, at Glenwood Springs and several miles downstream have been turned into an outstanding modern resort. The Yampah (formerly Azure-Yampah) Spring, at 126°F (52°C) is the largest, and the outdoor swimming pool fed by it is said to be longest in the world. Unfortunately, in the view of many, the deemphasis of the hot soak in favor of the warm plunge has been a disservice to the older folk. The vapor caves offer baths inside.

The powerful flow of the Glenwood Hot Springs is guided by faulting. The sedimentary rock — shale of the Belden Formation of Pennsylvanian age — was pushed and tilted upward along the south flank of the White River Uplift, where it broke off and was displaced. It furnished the means of exit for the 50 or so hot springs at temperatures of 106°-125°F (4°-52°C), highly mineralized and well charged with gas. The large springs at the mouth of the canyon come from the Leadville Formation of Mississippian age; the downstream springs issue from alluvium or red beds of Pennsylvanian age.

Ref: *Glenwood's Early Glamor,* by Caroline Bancroft, Johnson Publishing Company, Boulder, 1958.

Ref: *Glenwood Springs: Spa in the Mountains,* by Lena M. Urquhart, Pruett Publishing Company, Boulder, 1970.

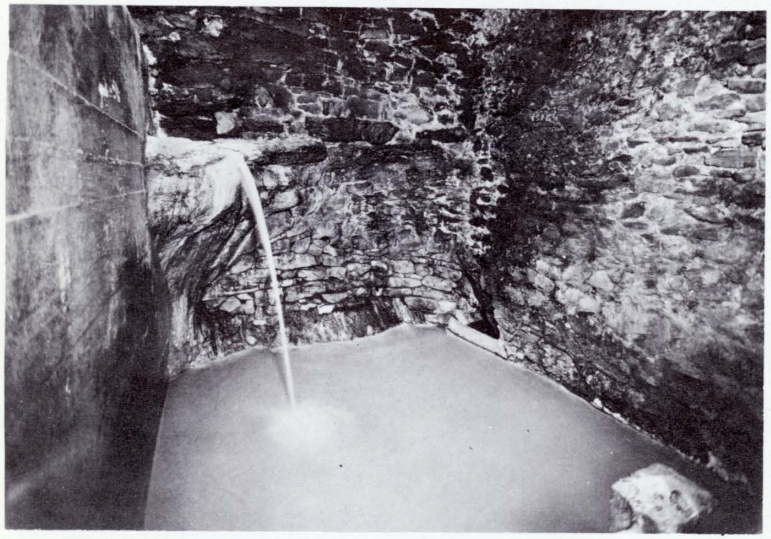
Hartsel Hot Springs

One of the most strongly radioactive of Colorado's many springs is at Hartsel, in Park County in South Park, but the bathhouse is no longer open for use. (Perhaps the mosquitoes ate up the masseurs and masseuses.) Other springs — hot, cold, and salt — occur here also; the salt springs, at the Salt Works, are historically famous from territorial days. At a temperature of 88°-135°F (31°-57°C), the water at Hartsel issues along a fault that is probably related to the nearby Hartsel fault and the chain of faulting through the center of South Park. The radioactivity is probably

related to the cause of the blue color in the well-known barite deposit a few miles to the west. Tertiary lava flows were common in the southern part of South Park, perhaps owing to the contact between Precambrian granite and sedimentary rock of Mesozoic age.

Other names used in this area include Old Salt Spring (or Salt Works Spring), Ranch Spring (or 63 Ranch Spring), Stinking Springs, Cold Soda Spring, and Iron Spring.

Ref: The detailed geology of South Park is Memoir 33 of the Geological Society of America, by J. T. Stark and others (1949).



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Hot Sulphur Springs

Hot Sulphur Springs

At the opening of Byers Canyon, a number of mineral springs, 20 to 25, having a similar origin and composition flow here along the banks of the Colorado River, in Grand County in Middle Park. They supply rather strongly mineralized (sulfur) water at

temperatures of 90°-118°F (32°-48°C) — typically 113°F (45°C) — for indoor swimming. The springs were combined for use from the Big Spring, Bath House Spring, Combined Spring, Little Sulphur Spring, Big Sulphur Spring, and Pool Spring. An earlier bath consisted of a natural rock basin enclosed in a building.

Thrust faulting between Precambrian igneous and metamorphic rock (granite, gneiss) and Cretaceous sedimentary rock (Dakota Sandstone) offers an outlet for the water, which is heated by the nearness of fairly young igneous rock. Lava flows of Tertiary age occur on both sides of the town. Tufa deposits are conspicuous.

Idaho Springs

Long known for its three groups of mineral waters, Idaho Springs stands where the higher foothills merge with the mountain zone. The radioactive hot water at 102°-122° (39°-50°C) along Fork Creek is attractively used in tunnels and indoor pools, and some springs are cold. Bottling of the Hot Soda Spring and Blue Ribbon Spring (cold) was done in earlier decades, when there were "two large bathing establishments." Cold Soda Springs is another spring.

Deposits of travertine show the former extent of hot-spring action. Faults are undoubtedly the conduits through which the water, heated by the proximity of Tertiary igneous rock (alkali syenite porphyry) that has not yet cooled off after having intruded Precambrian gneiss, a metamorphic rock.

Juniper Hot Springs

In the northwest corner of Colorado, in the flood plain of the Yampa River, in Moffat County, are several springs both cold and hot (up to 100°F, 38°C). A western resort was developed here in past years. The water flows from shale and sandstone of Cretaceous age. The springs bear such names as Lower Bath house, Upper Bath House, Hot Spring (or Hot House), Hill, Meadow, and River Springs. Each did different things for and to you.

Lemon Hot Spring

Also called Geyser Warm Spring, this was discovered during placer mining. It is on the south side of the San Miguel River at Placerville, in San Miguel County. Recent development was designed to utilize further the water, formerly let into bathtubs by tunnels driven for the purpose. The spring comes out along a large fault in red beds of Triassic age. The temperature is 93°F (34°C), produced by Tertiary volcanic action, so widespread in southwestern Colorado.

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Manitou Springs

Manitou Springs

Generally referred to as the Springs of Manitou, this famous group of cool, radioactive springs is historically important, both for its use (on neutral ground) by the Indians and by early explorers, leading to the development of a popular resort and a large bottling industry. Numerous persons have profited from these natural resources.

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Ute Chief Spring

The main springs were formerly well known by such names (among others) as Cheyenne, Shoshone, Seven Minute, Ute Iron, Ouray Iron, Hiawatha, Ute Chief, Ute Chief Magnetic, Mansion

Hotel No. 1 and No. 2, Navajo, Navajo Geyser, Manitou, and Iron Geyser Springs.

The geology is interesting and distinctive, even if not exactly unique. Acid water, after flowing through the Pikes Peak granite, moves into the Manitou Limestone (of Paleozoic age) along the Ute Pass fault, which marks the front of the Foothills. As it descends, it comes under higher pressure and so dissolves the limestone more readily. Where the water emerges at the surface, it loses pressure and the dissolved carbon-dioxide escapes as fizz (effervescence), exactly as it does from soda pop when you remove the cap. In a sense, the water at Manitou Springs has drained through the Cave of the Winds, but it is fit to drink nevertheless — my wife likes it, many people don't.

The town of Manitou Springs is revitalizing this, one of its major attractions, for the centennial of Colorado statehood.

Ref: *The Springs of Manitou,* by Virginia McConnell and Bettie Marie Daniels, Sage Books (The Swallow Press, Inc., Chicago), Denver 1964.

Ref: *Forgotten Springs of Manitou,* by Richard Lee Luna, Juel Arneson Printing Company, Colorado Springs, 1971.

Mineral Hot Springs

A station of the same name in Saguache County was the center of a development that offered a spa and swimming some years ago. The place was also called Chamberlain Hot Springs. Two groups of springs use about 30 separate sources. Water at 136°-144°F (58°-62°C) comes from stream alluvium in the San Luis Valley, being heated by Tertiary lava near its contact with Precambrian granite.

Mount Princeton Hot Springs

Once well known in Colorado history as an elaborate resort, and known also as Chalk Creek Hot Springs, these waters, at temperatures of 118°-135°F (48°-57°C), have greatly declined in use. They lie along Chalk Creek, in Chaffee County, where they flow from alluvium and are heated by the presence of a Tertiary-age body of monzonite intruded into Precambrian granite. This forms the Collegiate Range.

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Mount Princeton Hot Springs

The Hortense Hot Spring, usually considered part of the Mount Princeton group, is the hottest in Colorado, ranging between 165° and 183°F (74° and 84°C). Hortense is about 1 mile west of Princeton. Swimming pools and heating devices utilize the water at two youth camps. Heywood Hot Springs (a composite flow), Big Spring, Hotel Spring, and (Hayes') Iron Spring are others in the area.

Orient Springs

No longer the somewhat impressive resort of long ago, when the iron mine was working, the Orient, or Valley View, Hot Springs, in Saguache County, are used only for local bathing. Five springs come from quartzite near its contact with granite and flow at 72°-99°F (22°-37°C).

Ouray Hot Springs

The three groups of springs at Ouray, which are situated in an alpine setting of remarkable beauty — the Switzerland of America — supply water for a commercial spa of the cave type and for an outdoor municipal swimming pool in Radium Park. This has long been a favored spot for its pleasant surroundings and warm,

radioactive water from Pavilion Spring, where the highway enters the town at its northern approach. Fish Pond Spring, Hot Spring, Bath House Spring, Big Spring, and Cogar Spring are other names individually used, and the whole group used to be referred to as the Radio-active Mineral Springs.

Faults guide the water to the surface at Ouray, where colorful sedimentary rock of the Hermosa Formation of Pennsylvanian age is associated with Precambrian rock and lava rock of Tertiary age, which provides the heat. The temperature of the water ranges from 140°-180°F (60°-82°C).

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Pagosa Springs

Pagosa Hot Springs

Big Pagosa Spring is the largest spring here and one of the biggest in America, but there are others of various temperatures, up to 140°F (60°C). They lie along the San Juan River, in Archuleta County. Some of the other names are Artesian Well, Cold Spring No. 1 and No. 2, and Saw Mill Spring. The radioactive springs at Pagosa are nearly unique in Colorado, being used, like those in Iceland, to heat a number of public and private buildings in town,

including a pool, as well as sidewalks and driveways to melt snow. The water flows through openings in sedimentary rock (black Mancos Shale) of Cretaceous age and has deposited a large amount of colorful sinter. The heat comes from nearby volcanic rock of Tertiary age.

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Poncha Springs

Poncha Springs

A copious flow of hot water from about 40 mineral springs (some say 100) on Poncha Mountain, in Chaffee County, serves the baths — once part of a fairly elaborate development — at Poncha Springs and also the indoor swimming pool at Salida, 6 miles away. This pool is well patronized; the Salida Museum is in the same building.

A clearly mapped fault between Precambrian and Tertiary rocks is responsible for the emergence of the water, which has deposited considerable sinter. The heat comes from the younger lava, which gives temperatures of 131°-156°F (55°-69°C). Cold Spring was much favored for its flavor.

Red Creek Springs

Now only a memory, the springs gone dry, trampled by cattle, overwhelmed by floods, otherwise of little value, this was once a popular resort maintained by 25-30 springs. Siloam Springs and Parnassus Springs are other names for this place in Pueblo County, 12 miles southwest of Pueblo. Deposits of tufa mark the spot.

The names included Bubbling Spring, Resort Spring, Clear Spring, Iron Spring, Mound Spring, and farther away, Watson Artesian Well, used for irrigation.

Routt Hot Springs

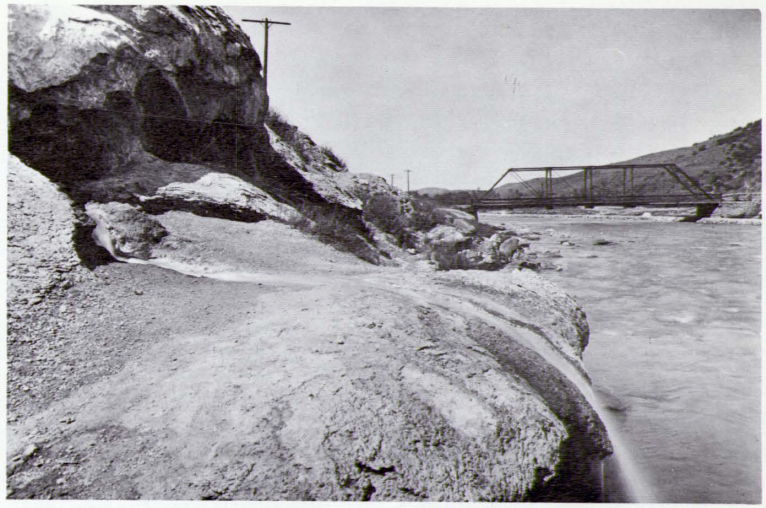
Seven miles north of Steamboat Springs, in Routt County, are three springs used for bathing along Hot Springs Creek. The water comes from basalt of Tertiary age. The temperature is fairly uniform at 147°F (64°C).

Shaw's Spring

Del Norte is another name for this spring, which supplies a swimming pool 6 miles north of Del Norte, in the San Luis Valley, Rio Grande County. The original resort at Shaw's Warm Spring has disappeared. Near an exposure of igneous rock is the Santa Fe Sandstone of Tertiary age, from which comes the water at a temperature of 86°F (30°C). A town well of ancient vintage is still used in the heart of Del Norte.

Steamboat Springs

The original Steamboat Spring that huffed and puffed like a steamboat near a sharp bend in the Yampa River, in Routt County, is still here but has changed its voice. About 150 other springs furnish water for various uses. Some are cool, and there are about 15 large and 120 small thermal ones, averaging 75°F (24°C). The Bath House Spring, at 102°F (39°C), feeds a public pool. The other names include Bubbling Spring, Soda Spring, Macalso Lithia and Magnesia Spring, Rumbling Spring, and Magnesium Spring — clues to their characteristics and chemistry.



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Sulphur Spring at Steamboat Springs

Faulting controls the movement of water here. Precambrian rock of the Park Range is in contact with sedimentary rock of Mesozoic age, which is steeply tilted at the foot of the mountains, on top of which are lava rocks of Tertiary age. When it rains, several of the springs flow more abundantly, indicating surface access to the underground channels. Substantial deposits of tufa have been formed.

Ref: *Ski Town USA*, by John Burroughs Rolfe, Pilot Press, Steamboat Springs, 1962.

Trimble Spring

Exiting from several closely grouped channels in a large mound of tufa, the five springs here, 9 miles north of Durango, in La Plata County, were provided with a "commodious" bathhouse and other facilities. The temperature, heated by Tertiary lava, was measured at a maximum of 124°F (51°C). The rocks are folded and fractured red beds of Permo-Pennsylvania age. Tripp Springs, somewhat cooler, is not far away.

Wagon Wheel Gap Hot Springs

Boiling Spring, at 136°F (58°C) the hottest here, is also the largest of a group of four hot and two cold springs that formerly supported an attractive resort on Goose Creek near both Wagon Wheel Gap and Creede, in Mineral County. Many dikes cut across granite, which is capped by lava flows of Tertiary age. Hot Saline Spring, Hot Soda Spring, Cold Lithia Spring, and Hot Sulphur Spring suggest the chemical composition here.

Waunita Hot Springs

Each of two groups of springs, 1/2 mile apart on Hot Springs Creek, in Gunnison County, consists of about 150 springs. Tomichi Hot Springs is a different name; Waunita Hot Radium Springs was another. Those springs of the upper group supply water to a swimming pool, the temperature ranging up to about 158°F (70°C). Former facilities, including bottling works, have disappeared at the lower group. Precambrian granite is overlaid by sandstone of Cretaceous age, from which the water flows. Tertiary lava is present 2 miles south and evidently supplies the heat. Waunita is an attractive place but not well known. The rocky "grave of Waunita" was once something to see.

Wellsville Warm Spring

These springs in Fremont County issue at 91°-93°F (33°-34°C) from a tunnel that had been drilled into sedimentary rock of Mississippian age. The location is on the north bank of the Arkansas River 5 miles southeast of Salida. No longer of much importance, though once popularly developed, the springs are of interest in supplying water to grow fish and tropical plants for markets in Pueblo and Colorado Springs.

Bibliography

An extensive bibliography on the thermal springs of Colorado is given in U. S. Geological Survey Professional Paper 492 (1965), *Thermal Springs of the United States and other Countries of the World — A Summary,* by G. A. Waring, revised by R. R. Blankenship and Ray Bentall. This incorporates everything of importance to that date. The major separate reference is Colorado Geological Survey Bulletin 11 (1920), *Mineral Waters of Colorado,* by R. D. George and others, to which may be added items on geothermal resources that are listed in Colorado Geological Survey Special Publication 2 (1972), itself an important reference.

Books by Richard M. Pearl

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Handbook for Prospectors
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