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*Believing the Report of the State Geologist, Prof. F. Alden Smith, to be a document of great public interest at this time, because full of valuable information concerning the mines, minerals and general resources of Colorado; we have, by the permission of the Author, republished the Report and issued a large extra edition at our own expense, thus affording an opportunity for a more extended circulation than that provided for by the State. Price, 25 cts.*

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# BIENNIAL REPORT

OF THE

# STATE GEOLOGIST

OF THE

STATE OF COLORADO,

PUBLIC LIBRARY.  
OF THE  
CITY OF DENVER.

FOR THE TERM ENDING DECEMBER 31, 1880.



DENVER, COLO.:  
TRIBUNE PUBLISHING COMPANY, STATE PRINTERS.

1881.

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BIENNIAL REPORT

STATE OF TEXAS

DOCUMENTS DEPARTMENT

## LETTER OF TRANSMITTAL.

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STATE OF COLORADO,  
OFFICE OF STATE GEOLOGIST,  
DENVER, JANUARY 1, 1881.

*To His Excellency, HON. F. W. PITKIN, Governor of Colorado:*

SIR:—I have the honor to submit herewith my biennial report, as State Geologist, for the term ending December 31, 1880, together with a general economic report of the principal resources of the State.

Very respectfully,

J. ALDEN SMITH,  
*State Geologist.*



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## REPORT.

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The office of *Territorial Geologist* for Colorado was created by the Legislative Assembly in February, 1872, the object being to have a preliminary examination made of the different sections of the Territory, with a view to ascertaining and presenting to the public a resumé of the resources of each, and their adaptation to the different branches of industry, as mining, farming, fruit growing, manufacturing, etc. The office was created and the present incumbent appointed during the last days of the session, but no appropriation made for the salary of the Geologist, or for the expenses of any work that might be done. Hence no work could be undertaken, except at my own expense. Much has been accomplished, however, in connection with my private practice as mining engineer, in the different districts of the State, during the past sixteen years. I have also drawn to some extent from the works of Hayden, King, Wheeler, Powell, and their assistants. Inasmuch as these gentlemen have performed all the preliminary geological and topographical work necessary for the State, up to the present time, and the results of their observations having already been published in elaborate form by the general government, and those publications being accessible to all, it is not deemed advisable to make this a strictly geological or technical report, but rather, after giving a brief resumé of the principal geological features of the State at large, to make a general economic report of its principal resources, mineral, agricultural, etc. We now have a better set of geological, topographical, drainage, economic, and panoramic maps (furnished by the Hayden



survey) than any other State in the Union, and it will be many years before a more detailed scientific survey will be required. My investigations have necessarily been largely confined to the mining districts, many of which have been but superficially examined; some of the newer districts have not been visited at all, and none have been as thoroughly investigated as their merits deserve. With this brief explanation and apology, I will proceed, first giving a brief statement of the general

#### GEOLOGY OF THE STATE.

The greater portion of the rocks of the mountain regions are granitic, intermixed, especially near the higher ranges, with much of the eruptive and true volcanic rocks, among which are the eruptive granites, porphyries, obsidians, etc. The relation of these rocks to the metalliferous veins will be more particularly described further on, under the head of "Gold and Silver Mines." From my own observation, and the best authority at hand from the observations of others, it seems probable that the upheaval of the mountains in this region commenced during, or immediately succeeding, the deposition of the carboniferous formation, and continued gradually, with short intervals of quietude, through the cretaceous and tertiary periods. Along the base of the mountains, on the east side, at many points, may be seen upturned strata of rocks representing all the various periods from the carboniferous up through the triassic, jurassic, cretaceous and tertiary, and in some places the silurian and devonian rocks are to be seen. The same formations are also found in many places in the parks, and rocks as late as the devonian appear on some of the highest mountains. While the more recent formations are quite constant all along the eastern base of the mountains and in the parks, from the north to the south line of the State, the older rocks, silurian, devonian and carboniferous, are wholly wanting over much of the distance. I do not think the carboniferous rocks have been observed at any point on the east side of the mountains, from Colorado Springs

north to Cheyenne, and it is doubtful if they occur at any point in that region. For full particulars of the technical geology of the State at large, as well as for particular districts, I refer inquirers to the very able and elaborate writings of Professor Hayden, Captain Wheeler, Clarence King, Major Powell, and their assistants, with most of whom I have worked in the field, with much pleasure and profit.

#### GOLD AND SILVER MINES.

Gold exists in greater or less quantities, in veins, associated with iron and copper pyrites, zinc blende, galena and tellurium, and in alluvial deposits in the mountain streams and ravines, all the way from the northern to southern limits of the State, extending also into Wyoming and Dakota on the north, and into New Mexico, Arizona, etc., on the south, and from the Platte river and its tributaries on the east, across the Sierra Madres to Utah, Nevada and California on the west. Upon these mines, together with the very rich and inexhaustible mines of silver, lead and copper rests, at the present time, the main basis of Colorado's prosperity. I do not mean to be understood that there are *paying* mines of all or any of these metals over the whole of this vast range of territory, but that traces of them are to be found all along, and that some or all of them are found in paying quantities at short intervals.

Thus far the most extensive and profitable developments of gold and copper have been made in the Central portion of Gilpin County. Within a radius of three miles diameter, taking the post office in Central City as a central starting point, more *proved* valuable gold mines have been discovered than in any other district in the State. And it is doubtful if any section of country of equal extent in the known world contains as many developed mines of proved value as are known within that little circle.

The general strike of the veins there is approximately northeast and southwest, though there are isolated instances of their having a strike nearly north and south, and



others nearly east and west. These veins, so far as observed, are of three distinct geological ages, though by far the greater number, including nearly all that have been, and are now successfully worked, are of one and the same age, intermediate between the other two series. The oldest series have a general north and south strike, are usually very wide and strong, nearly vertical in dip, filled principally with a brownish quartz, containing a little iron pyrites, and a very small percentage of the precious metals, but not sufficient, as a rule, to render their operation profitable. They are of comparatively rare occurrence, not more than four or five being known in Gilpin County. The second series in geological age are those on which most of the paying mines of this county are located, and will be described further on. The third and youngest series are generally narrower than either of the others, and resemble in general characteristics, other than width, the second series, carrying a like or similar character of ore and gangue material, with an approximate proportion of the precious metals.

Within this district some thousands of lodes have been located and recorded, and among them about one hundred and fifty, approximately parallel lodes have been developed and proved to be valuable mines—or one for every 106.56 feet, in a cross section of the three mile circle. And it is more than probable that, among the other locations, there are at least fifty more important lodes, which would give one for every eighty feet. I think, therefore, we may safely challenge the world to produce its equal in numbers of true fissure veins of proved value as mines of gold, silver, copper and lead.

The width of the veins varies from two to fifteen feet, probably averaging about three and a half feet. The contained ore is of two distinct classes, or grades, the stamp ore, or "mill dirt," as it is generally termed, and smelting ore. The former is the gangue rock of the veins, a quartzose and feldspathic rock, of a blueish gray color,

slaty structure, usually very soft, from the decomposition of the feldspar, thickly impregnated with iron pyrites and zinc blende, and generally carrying a small per cent. of copper pyrites, with occasionally a little galena scattered through it in specks, streaks and bunches. The average assay value of this class of ore as indicated by the results of some thousands of assays made by the writer and others during the past sixteen years, is about one ounce, or \$20.00 per ton in gold, and not far from six ounces silver. The average amount extracted by the stamp mills proper, from the best information obtainable, is about sixty per cent. of the gold, and seven per cent. of the silver, or about \$12.50 per ton, coin. The silver saved is only that which is in alloy with the gold, and the per cent. varies quite perceptibly in the ores of different mines. There is a further saving by concentrating the tailings from the stamp mills, equal to about one dollar per ton, average, for the crude material, at the prices generally paid for the concentrates, during the past five years. This gives a total average yield of \$13.50, coin, per ton, or about 73 per cent. of the assay value of the ore. From a few of the mines a much higher per cent. is saved, and from others less, but I am convinced that the above is very near the general average. From the nature of the ore, it being very heavy in sulphurets, it is scarcely possible to obtain much better results from the present stamping process. This grade of material usually fills from four-fifths to nine-tenths of the whole width of the vein, the balance being filled with a band of nearly solid and pure iron and copper pyrites, or of zinc blende and galena, and not unfrequently with all of these sulphurets contained in variable proportions. These proportions of the different grades of ore do not, however, remain constant in all parts of the veins. At some points the stamp rock fills the entire crevice, to the total exclusion of the band of sulphuret ore; and at others, the sulphuret ore crowds out the stamp rock, though this latter circumstance is of far less frequent occurrence than the former.



This sulphuret ore—iron, copper, etc., is usually separated from the stamp rock by hand picking at the mine, and sold to the smelters. The usual price for this class of ores (except such as are very rich in lead) is as follows: first, ten per cent. of the assay value is deducted for losses, and twenty dollars per ton for smelting charges; the balance goes to the miner. The average assay value of this class of ore, in Gilpin County, as indicated by numerous assays, and the working results of the past twelve years, is about \$100 per ton, coin. For this grade delivered at the smelting works, the miner receives \$70 per ton, net. At the present cost of labor, fuel, freights, etc., this is considered to be a very fair and liberal scale of prices.

With an average population of six thousand souls, this county has produced during the past nine years, \$18,126,640, equal to an average yearly income of \$335 for each inhabitant. The bullion product for 1880 was about \$2,700,000, with less than twenty per cent. of the developed mines in operation, the remainder having been idle for various reasons, principally because many of them are in the hands of eastern owners who declined to work them, or to lease to those who are anxious to operate them. With eighty per cent. of the mines in operation, instead of twenty, this district should yield about eleven millions annually. The introduction of effective and economical concentration works, and a constant and sufficient supply of water to serve as a motor for stamp mills, would add materially to the bullion output, as it would then be possible to utilize, profitably, many thousands of tons of low grades, now thrown upon the waste dumps.

Outside of this large cluster of gold-bearing veins, and virtually surrounding it on all sides, is a belt of highly productive silver veins, quite similar in character of gangue matter and ore, with the exception that the precious metal is almost exclusively silver instead of gold. These veins first attracted the attention of the writer in 1864, and several of them were located during the summer of that year,

but there being no market for silver ores at that time nearer than Newark, N. J., and the ores not being rich enough to bear transportation seven hundred miles by ox teams, with an additional two thousand miles of railroad carriage, they were abandoned until some three years ago, when many were relocated, and have since been worked steadily, contributing an important proportion of the bullion output of the county.

As an indication of the permanent character of the veins of Gilpin County, it is proper to state that many of them have been opened to depths varying from 700 to 1,200 feet, without diminution of the quantity or quality of the ore. On the contrary, there has been some increase, as a whole, in both—probably enough to considerably exceed the increased expense of mining at great depths. And at present there are no indications that they will deteriorate in any manner within the limits of the greatest depths at which it will be practicable to operate them.

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### LAKE COUNTY

and its famous camp, Leadville, is advanced beyond all other mining districts in the State, at the present time. Few greater marvels are recorded in the annals of mining. In 1877, the total bullion product of the county, including gold from the placers, did not exceed two hundred and fifty thousand dollars. In 1878, the year of the "carbonate discoveries," the output rose to about three millions. In 1879, it reached a little more than ten millions, and in 1880, about sixteen millions, with a good prospect of a largely increased product for the current year. The source of the bullion is principally an argentiferous carbonate of lead, intermixed with a considerable per cent. of galena. In many of the mines, however, the silver occurs as chloride and sulphide, associated with the siliceous oxyds and carbonates of iron. The ores usually occur in contact veins between porphyry above, and limestone below; but



there are many instances of their occurrence in irregular masses in the porphyry, with no continuous, well defined vein. The underlying limestone is generally considered as belonging to the silurian age. Many theories have been advanced as to the cause and source of these ore deposits, none of which are satisfactory in all particulars, and I do not wish to add another without a more critical and exhaustive examination, than I have thus far been able to make. The fact that the ore is there in enormous masses, of a grade which renders its extraction and reduction a highly lucrative business, is unquestionable, and we can well afford to wait until further development shall bring more light to the subject of source and cause.

Many persons believe that the ore deposits are confined to the porphyry, and to the contact veins between that rock and the underlying limestone, but I cannot fully endorse that assumption. It is a fact that the same formation of limestone occurs on the east side of the range, six to twelve miles from the Leadville mines, where it has been broken and cut through to the underlying archæan rocks, exposing long sections which may be examined through their entire depth, and studied like an open book; and that in this limestone, valuable veins of mineral exist, running parallel with the strata of the lime, both in the lime and at the contact between it and the granite, which are being worked at a profit. There are, also, vertical veins, having their origin in the underlying granitic rocks, and breaking up through the overlying limestone, carrying valuable ore, both in the lime and in the granite. I see no good reason why the same conditions may not exist at Leadville. I fully believe they do, and that sinking into the lime will reveal the horizontal veins, and that drifting on them will, in turn, show the position of the vertical fissures. The fact that fissure veins do occur in the immediate vicinity of the carbonate contacts is proven by the extensive workings on the "Printer Boy," and other mines in California Gulch. This position is further supported by the

fact that numerous fissure veins are known to exist in the granitic rocks across the Arkansas River, three to five miles west from Leadville. It will cost but a trifle, comparatively, to sink a trial shaft at some point on the Carbonate or Iron Hills, and if the other horizontal and fissure veins are found there, of which I have little doubt, the future of Leadville as a continuously prosperous mining camp, is assured. It is an indisputable fact that horizontal deposits of ores containing precious metals, as well as those of coal, iron or placer washings, can be measured with a high degree of accuracy, and the time required for their exhaustion approximately estimated. And it is only a question of limited time, a few decades at farthest, at the present rapid rate of extraction, when all the ground in the region of Leadville, now known to contain these deposits, will be exhausted. But with these lower deposits and fissure veins developed, as they undoubtedly will be in the near future, the work will go on, and the product continue in increasing quantity for an indefinite period of time.

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#### CLEAR CREEK COUNTY,

Lake alone excepted, is the most extensive silver producing county in the State at the present time, its product for 1880 being, in round numbers, \$3,000,000. The character of the veins and their general filling is almost identical with those of Gilpin County, except that the precious metal is almost exclusively silver, and that many of them carry a greater or less per cent. of the true silver ores, as ruby, glance, brittle, etc., and generally contain a smaller per cent. of iron pyrites. The greater proportion of the silver is contained in the gray, yellow and purple sulphurets of copper, lead, zinc and bismuth sulphides, a comparatively small proportion being derived from native silver, and the true silver ores. Valuable mines are being worked at short intervals, over the whole width of the county, from north to south, and from Idaho on the east to the



snowy range on the west. Most of the true silver mines are located in Georgetown, Argentine, Chicago Creek and Daly Districts, the gold Mines in Empire District and those carrying both metals, in variable proportions, are to be found in Idaho, Trail Creek, Mill City, Fall River and Downieville Districts. The ores about Empire are almost wholly auriferous, and have been worked at good profits, (though in a small way) for twenty years. The veins are true fissures, similar to those at Central City, and are practically inexhaustible. The chief reason why these mines have not been more extensively operated is the fact that no smelting works are near at hand, and the solid sulphuret ores are not rich enough to warrant transportation to distant markets. The results of working the ores under stamps, are about the same as the average in Gilpin County, but the per cent. of smelting ore is less, and as a rule, not quite as high grade, though sufficiently valuable to yield good profits at a home market for the solid ore and tailings. Time will inevitably furnish a remedy, when Empire will again become one of our prominent gold producing districts. In the lower, or eastern portion of the county, the mines are more like those of Gilpin County, with the exception that the per cent. of gold is lower, and that of silver higher. In that section are located some of the most valuable mines we have for permanent working, a fact now recognized by capitalists, and proven by the increased activity and production of the past two years. In this quarter are also, extensive *placer mines*, which have been worked with variable success, but generally with profit, for the past twenty years, and there is ground enough yet unprospected to give profitable employment to a large number of men for many years to come, if the work is judiciously directed.

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#### BOULDER COUNTY,

✓ during the past six years, has been producing silver and gold in large quantities, and in about equal proportions.

In 1879, the total output was about \$800,000, but last year it fell somewhat below this aggregate. The principal silver product has been taken from a dozen or more mines in the Caribou District, and the gold from Gold Hill, Ward, Jamestown, Magnolia and Sugar Loaf Districts. The placer mines of this county, though generally considered valuable, have not been extensively operated for some years, and consequently, have but a small share in the annual bullion yields. A little work is being done upon a few claims on Four Mile Creek and on Left Hand, but with those exceptions, the placer grounds are wholly idle. The veins, as a rule, are identical with those of Gilpin and Clear Creek Counties, though there are numerous gash veins and a few contacts between porphyry and granitic rocks.

#### THE TELLURIDE MINES,

of Gold Hill, Sunshine, Central, Sugar Loaf and Magnolia Districts deserve special mention here, because differing widely in the character of their ores from any others in the State. A description of a few of the more prominent may prove interesting, and will suffice for the whole, as their general characteristics are similar. The *Red Cloud* and *Cold Spring* were the first of this character discovered and opened in Colorado, and attracted the attention of the mining and scientific circles of the world, on account of the rarity of telluride ores, and the large quantities produced. As the two veins under present consideration are identical in geological characteristics, the *Cold Spring* is selected for description, because it has been worked to greater depths. The veins are nearly parallel, forty feet apart at the surface, and separated by a dike of gray porphyry. The south wall of the *Red Cloud* is gneissic granite. The north wall of the *Cold Spring* is the same, making both "contact" veins. The *Red Cloud* was penetrated to the depth of about 400 feet, and at that depth the porphyry dike had narrowed down to three feet, so that the two veins were, at that point, only this distance apart,



The veins, so far as explored, are very regular and well defined. The rich ore is confined within the walls of the veins, and does not, apparently, traverse the porphyry in small veins, nor extend into it in any manner, differing in this respect from the celebrated telluride mines at Nagyag and Offenbanya, in Transylvania. The *Cold Spring* Mine has been sunk to a depth of about 500 feet, and has a thousand feet or more of levels, showing a vein remarkably regular and well defined throughout, varying in width from two to twelve feet. It has produced a large quantity of remarkably rich ore, the first-class yielding from \$3,000 to \$5,000 per ton, carefully selected lots giving much higher returns. A lot of fifty pounds has just been shipped through the express office at Boulder for which the agent receipted at the rate of over \$60 per pound, or \$120,000 per ton. The relative proportion of gold and silver in the bullion from this mine usually ranges between twenty-five and thirty-five ounces silver to five ounces gold. Five different telluride mineral species have been observed in its ores, viz, petzite, sylvanite, auriferous hessite, altaite and calaverite, and it is quite probable that others exist there. The gangue rock in this, as well as in most of the other telluride mines, is generally a hard, bluish hornstone, mixed with a soft, feldspathic matter, very similar to the stamp rock of the deep mines in Gilpin County. Intimately associated with the rich ore is a considerable per cent. of iron pyrites, with more or less of sphalerite, galena and chalcopyrite.

The *American* Mine, at Sunshine, is the most extensively developed, and may be taken as the best representative mine for that district. It is a fissure vein in granitic gneiss (both walls alike) and has been traced and opened on the surface a distance of about one thousand feet, showing more or less rich telluride ore, the entire distance, though the *main* body, or principal ore chute, was confined to about one hundred and fifty feet in length. The strike is north 45° east, true, and its dip south at an angle

of  $84^{\circ}$  from the horizon. Its width varies from twelve inches to fifteen feet, averaging about thirty inches. The ore streak varied from two inches to two feet, probably averaging about eight inches. The assay value of the first-class ore, *by the ton*, varied from \$2,000 to \$12,000, the average being about \$4,500 per ton. The second class yielded about \$800, and the third class about \$200 per ton. In addition the mine has produced several thousands of tons worth \$30 to \$40. The whole dump from the assorting house will yield about \$12 per ton—valuable only for concentration. Among the mineral species found in the mine are petzite, sylvanite, auriferous hessite, altaite, calaverite, nagyagite, native tellurium, coloradoite (sp. nov.), tellur-pyrite (sp. nov.), tellurite (sp. nov.), ferro-tellurite (sp. nov.),\* and free gold, principally in the form of wires. Petzite and sylvanite are the predominating minerals, the others being of comparatively rare occurrence. The proportion of gold to silver in the bullion produced from this mine is about one ounce of the former to three of the latter. It has been worked to a depth of 500 feet, carrying an ore chute, or "chimney" from 150 to 200 feet in length to the 300-foot level. Below that point the shaft has been in lean ground, or in common phrase, "in cap," though small quantities of rich ore have been encountered at short intervals all the way down.

The *Slide Mine*, at Gold Hill; the *Melvina*, at Salina; the *Keystone* and *Mountain Lion*, at Magnolia, and the *John Jay* and *Last Chance*, at Providence, all of which are, or have been, largely productive, are in general geological features, and mineral characteristics, very similar to the *American*.

The *Smuggler Mine*, at Ballarat, merits a short description, since it is somewhat different in geological features from either of the others described. It is a fissure vein in mica schist, or gneissic schist, running nearly parallel

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\* See Catalogue of Minerals hereto attached, for other new species found in other telluride mines.



with the strata of the enclosing rock. Its strike is approximately northeast and southwest, and dips to the south at a very high angle. It is one of the largest telluride lodes that has been opened in the country, but owing to the slaty structure of its country rock, and its position relative to the strata of that rock, it is not as clearly defined and regular as those in the granite, and the contacts. The character of its ore and gangue is not materially different from those already described, except that its gangue matter is not so hard.

From the foregoing it will be seen that the telluride ores are not confined to the contact veins between porphyry and granite, as believed by many, in the earlier stages of development. This belief arose partly from the fact that the first lodes discovered here were of that character, but principally because the telluride ores of the famous Transylvania mines are largely confined to the igneous rocks or their immediate vicinity. The largest number of the productive lodes here are in granitic gneiss, at long distances from any porphyry. Several are in mica schist, and but two, thus far opened, are between porphyry and granite.

The telluride district, so far as known, extends from Magnolia District on the south, to Ballarat on the north, a distance of about thirteen miles (air line), and the belt is not over three miles in width. Within that district are some twenty mines which have produced large quantities of exceedingly rich ore; and probably thirty others, a few tons each, besides hundreds of prospects, some of them quite promising, from a few pounds up to tons. None of them have been exploited to a greater depth than 500 feet, and but three have reached that depth. Probably twenty others have reached the depths of 100 to 300 feet. The balance are from ten to fifty feet, most of them under thirty.

I have given considerable space to a description of these telluride mines, because of their rarity, and for the reason that no general description of them has been published.

Auriferous and argentiferous telluride ores were found here *in quantity* for the *third* time in the world's history, and in greater abundance than ever previously known. And I think I may safely assert that a single mine in Boulder County can be named which has produced more tellurium, had it been reduced and saved, than any ten of the other mines of the world combined. Hundreds of tons of ore have been shipped to smelting works that would have yielded from five to ten per cent. tellurium, and thousands of tons containing one to three per cent. Pieces of several pounds weight may be selected that contain as high as seventy-five per cent., and it is no uncommon thing to find masses containing from fifteen to twenty-five per cent.

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#### PARK COUNTY.

It is only a few years since the great mining resources of this county came to be fully understood, yet the bullion output is now quite large and steadily increasing. The immense silver mines located on Mounts Bross and Lincoln, Loveland Hill, Sacramento Gulch (which are a continuation easterly, of the formations that prevail at Leadville), and in fact all along the western border of the county, are being steadily and rapidly developed, and at an early day, if properly managed, cannot fail to place this district among the first bullion producers of the State. Efforts are being made to resume work on the extensive and valuable gold mines of Montgomery, Buckskin and Mosquito Districts. The surface ores of these mines paid large profits in the primitive arastras and stamp mills of early days, and there is no apparent reason why, with the improved methods of mining and reduction, they should fail to pay equally well in the future. The placer mines, which yielded abundantly in the past, have of late received but a small share of the attention their value merits. They have been largely worked in an irregular way for many years, but with very few exceptions, no regular, systematic



operations have been carried on. When more extensively and methodically conducted, as they will be in the near future, gratifying returns will be realized.

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### SUMMIT COUNTY,

Like Park, was for many years almost exclusively supported by her placer mines, which are extensive, have been and still are, worked with large profits. The first discoveries of silver mines in this county which attracted much attention, were made on Snake River some twelve years since, and some of the mines have been worked with varying success from that time to this. The former isolated situation of the district, and the absence of a home market for the ores, are cited as the only reasons why it has not become populous and prosperous long ere this. The veins generally are fissures in granitic rocks, extra large, strong and well defined, capable of yielding very large quantities of ore, the main mass of which is what is termed low grade, say from forty to sixty ounces silver per ton. It is associated with galena, zinc blende, gray copper and iron pyrites in a quartzose gangue, generally mixed with more or less sulphate of baryta, or "heavy spar." But all the ore is by no means of this low grade. Much is hand-picked-out and shipped to Georgetown that yields 200 to 800 ounces silver per ton. The greatest obstruction to the prosperity of this district is the heavy snow falls on the high range of mountains which separates it from ore markets. But this objection is largely obviated by the completion of the railroad to Kokomo, and the district will undoubtedly advance rapidly in development and prosperity after this season.

The developments of "carbonate" ores in the vicinity of Breckenridge have created some excitement during the past year, and while I have not been able to visit the district, to make a personal examination, I am convinced, by the reports of reliable parties, that some valuable discov-

eries have been made there, and quite a large town has grown up in consequence.

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### GUNNISON COUNTY.

During the past two years much attention has been directed to this county. A great deal of prospecting has been done, many valuable discoveries made, and a dozen or more flourishing towns erected, each having a population of 500 to 2,000, besides probably fifty others, with a dozen to one hundred persons in each. I have had no opportunity to examine more than a very few of these mines, personally, but judging by what I have seen, and the most reliable information obtainable, I am fully convinced that within the next two years the mines of this county will attain high rank among the best in the State. Good evidence supporting this opinion lies in the fact that, while it is less than two years since general attention was called to these mines, considerable quantities of ore have been shipped to market during the past summer, some of which was of marvellous richness. The principal points from which this ore was taken are the towns of Gothic, Crested Buttes, Irwin, Independence, Pitkin, Aspen, Tomichi, etc. Heretofore a large portion of this county has been practically inaccessible in winter, but the completion of the Denver & South Park Railroad next summer will measurably remove that difficulty.

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### CHAFFEE COUNTY,

the past two years has developed an extent of mineral resources that were hardly suspected two years since. Many gold-bearing lodes were discovered in the vicinity of Granite, some twelve years since, and a few of them quite profitably worked for a time, but until within the past two years, little, if any, attention was paid to the silver mines of the region. Since the completion of the South Park rail-



road, the towns of Buena Vista, South Arkansas, Poncho Springs, Maysville, Garfield, Chaffee, Alpine, Cleora, Hortense, etc., have been built up, each having its group of mines of greater or lesser extent, many of which are already developed to a stage of extensive and profitable production, and doubtless many others will be developed to a paying condition within the next year. The old gold mines about Granite have been revived to some extent the past year, and a new mill erected there. A group of gold mines of much promise has also been opened on the north side of the Arkansas, near Buena Vista. Altogether the county is in a flourishing condition, and the mining interests present a very encouraging outlook for immediate and continued prosperity.

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#### THE SAN JUAN REGION,

embracing San Juan, Hinsdale, La Plata, Ouray, Conejos and Rio Grande Counties, is comparatively in its infancy in point of development. The almost unlimited mineral resources of the region are undeniable, and its former isolated situation, lack of transportation facilities and extensive reduction works are the sole reasons why it has not long since become one of the great bullion producers of the country. It has many very large veins of low grade ore, which can only be made profitably productive by the aid of railway transportation, and extensive concentrating works. Enterprising capitalists, who understand and appreciate the situation, and the profits to be made in the near future, are rapidly obviating this difficulty by erecting extensive reduction establishments, and developing the mines for large production when the railroad shall have been completed to the mining districts. I have not been able to visit the mines of this region, but many experts of unquestioned ability and integrity, have visited and carefully examined them, and their reports are so unanimously favorable to their value, there is no longer room to doubt.

Rico, San Miguel, Silverton, Lake City, Mineral City, heads of the La Plata River and Junction Creeks, and a few others, are the principal mining centers, though by no means *all* of them. At nearly all these points are very large quantities of low grade ores intermixed with greater or less quantities of high grade, that will bear the expense of shipping out to smelting works.

The veins of the San Juan region are principally true fissures in the archæan rocks, with many contact veins between that and the volcanic rocks, with which much of the region is covered. The devonian, silurian, carboniferous and cretaceous are also quite extensively represented at different points.

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#### CUSTER COUNTY.

Within the limits of this county are located Rosita and Silver Cliff Districts, with their well known valuable mines. There are, at the present time, about half a dozen regular and continuously paying mines at Rosita, and about an equal number at Silver Cliff. In addition to these are a dozen or more in each district but slightly developed, which are producing considerable quantities of ore of good grades. The veins and ore deposits of these districts are, in some respects, phenomenal. So far as observed, they appear to be of four distinct classes or characters. First, fissures traversing both the archæan and eruptive rocks, and having the silver and gold associated with iron, copper, zinc and lead sulphides, not unlike the general ores of Gilpin and Clear Creek Counties. Second, contact veins between the eruptive and stratified rocks, with ores of a similar character to those of the fissures, but as a rule somewhat higher in grade, owing to a greater or less admixture of the chloride of silver. They have also a different gangue matter, in that it contains much heavy spar, or sulphate of baryta. Third, the extinct geyser deposits, consisting of great "well holes," filled with boulders,



coated with a shell of rich ore, varying in thickness from a mere scale to an inch or more. The ore consists of the sulphides of zinc, iron, lead, copper, and it is said some tellurides, though I have never seen any of the latter species. These ores are generally quite rich in the precious metals, and some of them extraordinarily so, running up to many thousands per ton, principally gold. Fourth, eruptive deposits, or overflows of highly siliceous matter, containing the silver principally as a chloride associated with iron and manganese oxyds permeating the whole mass, but richer in some spots than others. These latter ores are generally rather low grade, but their "free milling" qualities, together with their great quantities, and the very low cost at which it is possible to mine and mill them, makes this character of mines very profitable.

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### GRAND COUNTY

has attracted considerable attention during the past two years, chiefly on account of the discoveries of silver mines and gold placers in the North Park and in the Rabbit Ear range of mountains, northwesterly from the Hot Springs, in Middle Park. Some samples of very rich silver ores have been brought from this region, but the ore, though reported as occurring in great quantities, is, as a rule, of rather low grade. Some of the placers "prospect" quite encouragingly, but owing to the want of capital by the owners for the construction of ditches, flumes, etc., to bring a supply of water to the gravel deposits, and other causes, they have not been very productive. Some placer mines in *Routt County* are also quite promising, but for various reasons, chiefly the lack of water and a good dump for tailings, have not, thus far, proved very lucrative.

It was my wish to visit and examine all the mining districts of the State during the past year, to enter and examine the chief mines in each, and give a brief general

description of them, but want of time and means have rendered it impossible to do so. The same reasons have prevented my visiting and examining the principal coal, iron and agricultural regions, and will account for the brevity of my reports concerning them, as well as for any minor errors that may appear. With this explanation, I close my report on the gold and silver interests, and proceed to the consideration of the coal, iron, agricultural and other resources of the State.

#### COAL MINES.

The coal fields of Colorado embrace a very large area on both sides of the continental divide, as well as a considerable area in the South and Middle Parks. It has been estimated that these fields cover about 50,000 square miles, but, after deducting the barren ground in the coal regions proper, caused by faults of various kinds, I consider this estimate much too high. But that we have immense quantities, enough to supply the needs of the State for ages, is a fact proved beyond question.

The coals are lignitic, very dense, generally of a jet black color, high lustre, and wholly destitute of any fibrous or woody structure, far superior to most lignites, and pronounced by good judges quite equal, for most purposes, to the best Pennsylvania coals. Their specific gravity varies from 1.28 to 1.40, averaging about 1.33. They are also remarkably free from sulphur, the quantity rarely reaching one per cent., and generally falling below 0.4 per cent. The quantity of ash, too, is very low, generally ranging between two and seven per cent., and averaging about five and a half. Their heating powers are very high; they ignite readily, burn freely, and are very generally used for domestic purposes, and for making steam, both in stationary boilers and in locomotives throughout the State. They are used also for making gas, roasting pyritous ores, blacksmithing, and to a limited extent in smelting.



While, *as a rule*, it has not been found practicable to make a good article of coke from these coals, exceptions to the rule are not wanting. The South Park, Canon City and Trinidad coals all afford *good* coke, though not quite so firm and strong as the Connellsville article. It is very extensively used in blast furnaces for smelting the silver-lead ores at Leadville and other places.

The age of these coals is still a matter of dispute among geologists, many claiming it to be tertiary, and others with perhaps equally good reason, holding it to be cretaceous. I think, however, that it may now be generally conceded that the northern fields are tertiary, while those at Cañon City, Trinidad, and probably those of the Middle Park, are upper cretaceous.

The most extensive beds of lignites yet developed are in the northern part of the State, in Boulder and Jefferson counties, on the plains near the base of the mountains. For detailed descriptions of several of these mines, as well as for some in the southern and western portions of the State, the reader is referred to the elaborate reports of Prof. Hayden and his able assistants. Some thirty or more mines have been opened in this region, showing veins of merchantable coal, varying in thickness from five to sixteen feet. I copy the following geological section from Prof. Hayden's reports, showing the formation of the Marshall bank, where the largest exposures of the coal strata are to be seen:

48. Drab clay, with iron ore along the top of the ridge.
47. Sandstone.
46. Drab clay and iron ore.
45. Coal (No. 11), no development.
44. Drab clay.
43. Sandstone, fifteen to twenty feet.
42. Drab clay and iron ore.
41. Coal (No. 10), no development.
40. Yellowish drab clay, four feet.
39. Sandstone, twenty feet.
38. Drab clay, full of the finest quality of iron ore, fifteen feet.

37. Thin layer of sandstone.
36. Coal (No. 9), nearly vertical where it has been worked, 12 feet.
35. Arenaceous clay, two feet.
34. Drab clay, three feet.
33. Sandstone, five feet ; then a heavy seam of iron ore; then three feet of drab clay ; then five feet of sandstone.
32. Coal (No. 8), five feet.
31. Drab Clay.
30. Sandstone, twenty-five to forty feet.
29. Drab clay, six feet.
28. Coal (No. 7), six feet.
27. Drab clay, five feet.
26. } { Sandstone, with a seam of clay twelve to  
eighteen inches, intercalated, twenty-five  
feet.
25. } { Drab clay, four feet.
24. } { Coal No. (6), in two seams four and one-half  
feet. .
23. } { Drab clay three to four feet.
22. Yellowish, fine grained sandstone, in thin, loose  
layers, with plants, five to ten feet.
21. } { Drab clay, excellent iron ore. } 15 feet.
20. } { Coal (No. 5), seven feet. }
19. } { Drab clay. }
18. Sandstone, dip  $11^{\circ}$ . This sandstone has a reddish  
tinge, and is less massive than 14.
17. Drab clay. }
16. Coal (No. 5). } twenty feet, obscure.
15. Drab clay. }
14. Sandstone, massive, sixty feet.
13. Drab clay.
12. Sandstone.
11. Drab clay.
10. Coal (No. 3).
9. Drab clay.
8. Sandstone, twenty-five feet.
7. Drab clay.
6. Coal (No. 2), eight feet.
5. Drab clay.
4. Sandstone, about twenty-five feet.
3. Drab fire clay, four feet.
2. Coal (No. 1), eleven to fourteen feet.
1. Sandstone.



From the foregoing section it will be seen that there are at this point eleven distinct veins of coal, varying in thickness from three to fourteen feet each, giving a total thickness of sixty-five feet six inches, allowing that Nos. 3, 4, 10 and 11, (undeveloped) are each three feet thick.

The No. 1 vein is the one now being worked in all the mines of that region, except the Boulder Valley mine, at Erie, where they have just commenced developing No. 2, and are taking out six feet of coal of a little better quality than that taken from No. 1. No. 1 vein will produce coal enough to supply the demands of the State for many years to come, and after that is exhausted, the others can and will be taken up in course, and the production continue for ages to come.

In the southern portion of the State coal also occurs in great abundance. The mines near Cañon City, Trinidad, and in Gunnison and La Plata counties are the most prominent. I have no information concerning them, further than that they are being extensively worked, and that some of them produce a character of coal quite different in some respects from that of the northern and western mines, and which, for certain purposes, is considered superior in quality. Large quantities of it are being used on the railroads, as well as in Denver, Pueblo, etc., for gas and for domestic purposes. The veins at Cañon and Trinidad are from five to eleven feet thick, and it is reported that a vein has recently been opened in La Plata County which is *fifty* feet thick, and carries about forty feet of good coal.

In the South Park are large deposits of lignite, said to be the best coking coal yet found in the State. Going west from this point, across the main Range, indications of the same kind of coal are met with on the Blue river, and again on the Snake, a short distance above its junction with the Blue, where some attempts at opening have been made; and thence on towards, and across the Grand river. But I am not aware that any good coal has been found on that side of the Range until the vicinity of Bear river is reached,

where there are beds of lignite of good quality from four to fifteen feet in thickness.

Besides these valuable lignites, a superior article of Albertite, or Cannel coal, is reported on good authority as occurring in large veins in the western portion of the Middle Park. It was first noticed by General Fremont, in the report of his first expedition across the continent, and has since been noticed by different parties.

Anthracite coal has also been found in abundance in Gunnison County, west of the main range, on Rock Creek, Anthracite Creek, Ohio Creek and Slate River. The veins range from two feet to six feet in thickness, and the coal is of a most excellent quality.

The present daily output of coal in the State is about 3,000 tons, about 500 of which is converted into coke for smelters' use.

#### IRON.

Accompanying and contiguous to the coal mines in all parts of the State are found vast quantities of iron ore of good quality and of nearly all the varieties known, but as yet has only been worked to a very limited extent. At some day in the near future, however, iron smelting is destined to become one of our most important and lucrative industries. But one attempt to utilize this vast quantity of iron ore has ever been made. Several years since a blast furnace was erected at the Marshall coal and iron mines, in Boulder County, and was operated about two months, producing in that time about 250 tons of pig iron of good quality. The result of that experiment was, that two and a half tons of crude ore produced one ton of metallic iron, equal to forty per cent. from all the ore reduced. The fuel used was charcoal, at the rate of about 140 bushels to the ton of metal produced. The furnace has since been idle, for the reason that the supply of old iron from the breaking up of useless machinery shipped out here from the eastern States in the early days, was so



great as to supply the demand until quite recently, at a less price than the cost of production from the ore.

The ore used in the experiment above mentioned was wholly gathered up from the surface of the ground, where many thousands of tons of equally good quality still lie scattered about. It also occurs in this manner, and in beds and veins contiguous to all the coal mines in northern Colorado. It is principally of the brown hæmatite variety.

Near Cañon City, besides almost inexhaustible beds of red and brown hæmatite, very large deposits of magnetic ore, unusually rich and pure, are said to exist, samples of which yield by assay as high as seventy per cent. metallic iron. Argillaceous carbonate of iron of unusual richness is also reported as occurring in abundance near the Cañon City coal mines. Spathic iron, magnetite and micaceous specular iron exist in bunches and in large veins at many places high up in the mountains.

Accompanying the coal and iron mines are large deposits of

#### FIRE AND POTTERY CLAY

of excellent quality, and at Golden City large establishments have been erected for the manufacture of fire bricks and brown pottery ware, supplying not only the local demand, but shipping quite extensively to neighboring States and Territories. Crucibles, scorifiers, muffles, etc., for assayers' use, are also manufactured from the same clays.

#### COMMON CLAY,

of good quality for building bricks, is abundant at short intervals throughout the State.

#### LIMESTONE,

of superior quality for the manufacture of quick lime, as well as for building stone, exists in inexhaustible quantities all along the base of the mountains, as well as at

many points at all elevations up to the Range and in the Parks. Numerous kilns have been erected and are in operation at different points, supplying the local demands.

## GYPSUM

occurs in heavy beds in the South and Middle Parks, and in greater or less quantities all along the eastern base of the mountains in all the formations above the carboniferous. Thus far it has not been utilized to any considerable extent, the home demand having been quite limited. But when it is needed, as it necessarily must be in the near future, there is an inexhaustible supply at hand.

## MARBLE

of several varieties and very good quality is found in abundance in several different localities. A beautiful variety of *breccia marble* occurs in abundance a few miles north of Boulder City, and fine, *white marble* is reported near Fort Collins, Larimer County. I have not visited the locality, but am reliably informed that there is plenty of it there and of fine quality. Beautiful specimens of dark colored *clouded marble*, and others of an *apple green* color were shown to me some time since, but the locality was not given. The colors were beautiful, the texture fine and compact, such as would readily take a high polish, and be very desirable for mantels and other household ornamentation wherein marbles are used. A considerable deposit of the beautiful banded variety, known as *Gibraltar marble*, was discovered by the writer some years since, near Idaho Springs, from which blocks of considerable size have been obtained.

## BARYTA.

Considerable quantities of sulphate of baryta, or heavy spar, exist in several localities, both in veins and in deposits. Large quantities of this mineral are now used in the adulteration of, and as a substitute for, white lead, for painting purposes, and is extensively mined for that pur-



pose in Nova Scotia, where the crude mineral sells for eight dollars per ton.

#### FLUOR SPAR

occurs in extensive beds at Jamestown, and in large metaliferous veins near Bear Creek, Jefferson County. It is used for the manufacture of various ornamental articles, as paper-weights, candlesticks, inkstands, etc., and is also extensively employed as a flux in the reduction of copper ores.

#### SALT.

Several large salt springs exist in the South Park, some fifteen miles southeast from Fairplay, and some years since works were erected there capable of turning out 10,000 pounds of salt per day. Saline springs of various degrees of strength also exist at several other points in the State, some of which could be made profitable, but none of them have been improved, and many are not even claimed. Among the best of these are the springs near the head of Salt Creek, a tributary of the Rio Dolores, which are so strongly saline as to render the waters of the creek quite briny.

#### MINERAL SPRINGS

containing salt, soda, iron, sulphur, magnesia, lime, bitumen, oil, etc., are abundant throughout the whole State, especially in the mountainous portions, some of which are taken up and improved, and many more ought to be. In the different localities are both hot and cold springs. The waters of most of the cold springs are very pleasant to the taste, generally resembling in a greater or lesser degree, the famous Seltzer waters of Germany, are slightly alterative, diuretic, and, as a rule, contain enough iron to give them great value as tonics. The hot springs are generally very efficacious in scrofula, and all diseases of the skin, and many of them have almost marvellous curative effect in cases of rheumatism, secondary syphilis, etc. Among the most noted of these springs are those at Idaho (hot and

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cold), Springdale (cold), Manitou (hot and cold), Cañon City (hot and cold), Middle Park (hot and cold), Poncho (hot and cold), Hortense, Cottonwood, and Haywood (hot and cold) Tomichi (hot and cold), Pagosa (hot), besides others of less note, though probably of equal value medicinally, located in Boulder Cañon, Four-mile Creek, in Boulder County, Boulder City, Leadville, Wagon-Wheel Gap, White Earth river, and numerous other places. The temperature of the water in the hot springs ranges between  $80^{\circ}$  and  $115^{\circ}$ , and that in the cold springs from  $50^{\circ}$  to  $70^{\circ}$ . Among the most noted of the oil and bitumen springs are those at Oil Creek, near Cañon City, Green River near Bitter Water Fork, and on Grand river, below the White River Agency. On Oil Creek are four springs, from which considerable oil has been taken, by skimming it from the surface of the salt water, which comes up with it. In the crude condition it is heavy and impure, containing about fifty per cent. of heavy oil, twelve per cent. of benzine, with much paraffine and paraffine oil, and about fifteen per cent. of coke and useless matter. A well was bored near these springs, several years since, to a depth of some three hundred feet, but no large, regular oil reservoir was opened.

#### SULPHATE OF SODA.

This valuable product occurs more or less abundantly at several points on the plains, and in the South and Middle Parks. Twelve miles south of Denver are located Burdsall's Soda Lakes, four in number. The waters of these lakes are very highly charged with soda, three and a half barrels yielding one barrel of crystalized sulphate of soda, as I am informed by Dr. Burdsall. The soil near the shores of these lakes, for twenty feet in depth is heavily impregnated. Three pounds, when well leached, affords one pound of soda. In dry seasons the soda frequently lies four to six inches deep around the shores of the lakes, over an area of forty acres or more and can be shoveled up in almost any quantity, sufficiently pure for metal-



lurgical purposes, glass-making, etc., without redissolving and crystalizing. The salt, by analysis, contains sixty-three per cent. of soda—carbonate of soda, sulphate of soda, chloride of sodium, sulphide of calcium, and traces of manganese. By roasting, this salt can be converted into carbonate of soda, for which there is an almost unlimited demand. These deposits will, at no very distant day, form an important part of the industrial operations of Colorado.

#### BUILDING STONE

of various kinds, as granite, lava, trachytic rocks, limestone, sandstone, etc., occurs in inexhaustible quantities in nearly all portions of the State. Several years ago mills were erected at Denver and Golden City, and machinery put in place for sawing the softer varieties of sandstone and limestone for the home market. Some very hard sandstone, extracted in sheets from three to twelve inches thick, with very true and even surfaces, making splendid patterns for flagging stone, is quarried in abundance near Fort Collins.

#### TIMBER

of the softer varieties, such as pine, spruce, fir, aspen, etc., of the best quality, is abundant in the mountain regions all over the State, and cottonwood occurs in more or less abundance along most of the streams on the plains as well as in the mountains. Oak, maple, cherry, etc., occur in many places, but rarely, if ever, of sufficient size to be of much use for timber. Of pines we have three or four varieties; of spruce, at least three varieties; of fir, two varieties, one of which is the beautiful *silver fir*, highly prized here, as well as throughout the eastern States, as an ornamental shade tree, and of cottonwood three varieties, all of more or less value for timber. Of native

#### ORNAMENTAL TREES AND SHRUBS

we have a considerable variety, among which may be mentioned the *ash-leaved maple*, or *box elder* (*acer negunda*),

*flowering maple* (*acer circinatum*), *American aspen*, three varieties of *cottonwood*, *balm of gilead* (*populus candicans*), *American mountain ash* (*pyrus Americana*), a beautiful tree, growing from twenty to thirty feet high, flowering in June, and bearing beautiful flame red berries in clusters, some of them six inches across, which remain on the trees through the winter, making them highly ornamental throughout the year. *Silver and balsam fir*, *black and white spruce*, *hawthorn*, or *white thorn*, *snowberry* (*symphoricarpus racemosus*) *white flowering raspberry*, *common and staghorn sumach*, *red-berried and common elder*, *red cedar*, *red rose*, three varieties of *clematis* or *virgin's bower* (*c. virginiana*, *c. verticalaris*, and *c. pitcheri*), and several others, all of which are found growing wild in abundance, and in a high state of perfection.

## WILD PLUMS AND BERRIES

of many kinds are abundant, both in the mountains and on the plains, near the foothills. The *wild yellow*, or *red plum* (*prunus Americana*), *chickasa plum*, *sugar berry* (*celtis occidentalis*), and two or three other varieties of large plums, grow wild in great abundance in many places along the streams near the base of the mountains, both in the low cañons, and on the plains, fully equal in size and flavor to the same varieties grown under cultivation in the Middle and Eastern States. In the mountains, wild red, black and choke *cherries*, fox and Oregon *grapes*, red *raspberries*, *strawberries*, *mulberries*, *huckleberries*, red, yellow and black *currants*, smooth and prickly *gooseberries*, *service berries*, etc., grow in profusion, of good size and extra fine flavor. The raspberries, strawberries and huckleberries are especially noted for their high, delicious flavor, and the yellow and black currants (*ribes floridum*), for their extra large size, being from one-third to half an inch in diameter. They are highly prized and extensively used for jellies and preserves. Experience has proven that many of these native plums and berries, though growing in such perfection



in the wild state, can be greatly improved by cultivation, if intelligently managed. I hope to see more attention paid to this matter in the future, for although grave doubts are entertained by some of our most experienced and intelligent farmers about our being able to successfully grow apples, pears, peaches, and many other varieties of eastern and western *large* fruits, there is certainly no doubt of our ability to raise all kinds which now grow spontaneously, and there is little doubt that judicious cultivation will greatly improve most, if not all, of them. Judging from the results of experiments already made there is no doubt of our being able to raise, in some localities at least, most, if not all the kinds of *small* fruits and berries that grow in the Eastern and Middle States. At nearly all points near the base of the mountains, domestic currants, gooseberries, raspberries, blackberries, grapes, strawberries, etc., grow quite as luxuriantly, and of equally good quality, as at any place in those States, or in California.

#### AGRICULTURAL.

For general farming operations, Colorado has but few equals among all the States and Territories of the Union. The reports of the Territorial Agricultural Society, Board of Immigration, etc., furnish voluminous masses of conclusive testimony on this point. I append the following brief extract from the Agricultural Society's biennial report for 1873:

"In 1869 one of our farmers on the South Platte, a few miles above Denver, raised ninety bushels of wheat on one acre of land, sixty-five and a half bushels on another acre, and five hundred and fifty bushels of wheat on ten acres of another farm. Another farmer raised on a single acre of land, ninety bushels of oats; and still another raised on eight acres, six hundred and forty bushels of oats. In one instance two hundred and fifty bushels of onions were raised on a half acre of land. One thousand bushels of potatoes were the product of three acres. From one

pound of seed barley one hundred and ten pounds were produced. Garden vegetables of all kinds attain an enormous size. Potatoes, cabbages, onions, squashes, melons, tomatoes, etc., yield astonishing crops. Experiments in the culture of the grape have demonstrated that vine-growing can be most successfully and most profitably undertaken," and that they can be grown as cheaply and in nearly the same abundance as in California and Ohio, and of superior quality, for wine especially.

The following have been determined as about the average crops throughout the territory :

Wheat . . . . .	28 bushels per acre.
Oats . . . . .	45 " " "
Barley . . . . .	40 " " "
Corn . . . . .	35 " " "
Potatoes . . . . .	200 " " "
Onions . . . . .	250 " " "

But these figures are far below what may be produced with extra care and labor. For three successive years the premium crops of wheat, exhibited at the Territorial fair, ranged from sixty-seven to seventy-three bushels per acre. In one year two fields of corn were sworn to as having yielded over two hundred bushels per acre.

Potatoes have given from four to six hundred bushels per acre. Onions have reached one thousand bushels per acre. A cabbage of eighty-two pounds weight has been sold in the Denver market. Those of forty to sixty pounds each are plentiful at every annual fair. Car loads have been shipped away in which the closely trimmed heads averaged throughout twenty-three pounds apiece."

#### HOPS

grow wild in abundance, and in a high state of perfection in many of the cañons near the base of the mountains, and I have the authority of one of the best and most intelligent brewers in the country for saying that in the manufacture of ale and beer, after repeated trials, he has found



them to be worth fully ten per cent. more than the best "New York extras." No attempt at cultivating them has yet been made, within my knowledge, in the State, but there can be no doubt of the success of the enterprise, when undertaken by persons of intelligence, having a good practical knowledge of the business. There is now a very promising opening for enterprising, practical men to start business in this line, and one that promises as good returns for the capital and labor as any branch of industry established here.

## FLAX,

of two varieties (*Linum Bootii* and *L. perenne*), also grows wild in abundance and great luxuriance in many places, especially in the Parks, and its cultivation and manufacture will, at some time in the future, become an important branch of industry.

I append a Catalogue of all the Minerals of Colorado that have thus far been noticed, together with remarks on the local peculiarities of several species. A very large collection of minerals and fossils has been made, and deposited in the State University at Boulder. A portion of it has already been classified and arranged, and the balance will be as soon as trays and cases can be procured.

Very respectfully,

J. ALDEN SMITH,

*State Geologist.*

## CATALOGUE

OF THE

PRINCIPAL

## MINERALS OF COLORADO,

WITH ANNOTATIONS

ON THE

LOCAL PECULIARITIES OF SEVERAL SPECIES.

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By J. ALDEN SMITH.

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DENVER,  
1880.

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CATALOGUE

EXHIBIT

MINERALS OF COLORADO

WITH EXPLANATIONS

BY THE UNITED STATES GEOLOGICAL SURVEY

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THE following is believed to be a full (or nearly complete) list of all the minerals noticed in the State of Colorado, up to this time. The author first published a catalogue of the minerals which had up to that time come under his observation, in the *Black Hawk Journal*, in 1865, and in 1870 he published a revised and amended catalogue, in pamphlet form. In making up the following he has availed himself of the observations of Dr. Frederick M. Endlich, of the Hayden Survey, of Mr. Persifor Frazer, Mr. Arch. Marvin, A. von Schulz, E. E. Burlingame, Mr. Peters, Drs. Genth, Loew, Peale and others. The single initial after the notice of the mineral indicates the name of the gentlemen who first observed it.



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# CATALOGUE

OF THE

## MINERALS OF COLORADO.

*Agates* of the different varieties are common in many localities. Beautiful *moss agates* are found in the Middle Park, and many fine gems have been and are to be found there. Quite an important trade has been carried on during past years in obtaining these agates and shipping them to the Eastern States, where, as well as here, they are highly esteemed and much worn as settings for brooches, ear-drops, rings, sleeve buttons, etc. After being cut they sell for prices varying from 50 cts. to \$5 each, and occasionally one of extraordinary beauty, and showing some rare peculiarities, will sell for \$10 to \$20. The dendritic delineations ("moss") are usually of a brownish black color, but green, red, yellow and white are not uncommon colors. They are found in many localities in Colorado, but so far as our knowledge extends, no fine gems have been found outside of the Middle Park localities.

*Fortification and Ribbon Agates* are abundant near the mouth of Willow Creek, Middle Park, and at different points on the Arkansas river, but are of inferior quality as compared with the Oberstein and Lake Superior agates.

Fine geodic specimens, lined with amethyst, have been found on the summit of the Range, east of the Animas. S.

*Actinolite*.—Abundant in many localities. Radiated form, in fine specimens near Bergen's ranche. Asbestiform va-



riety in metalliferous veins, associated with lead, zinc, copper and iron, near the head of North Boulder Creek. In radiated form, of light green and bluish green colors, on Mount Ouray. S.

*Alabandite*.—At Quartzville, Park county. P.

*Alabaster*.—Near Mount Vernon, in considerable quantity and of fair quality. S.

*Albite*.—Common in several localities. Fine xls. near Central City; Gold Hill, Boulder County; and Fairplay, Park County. S.

*Allophane*.—Has been noticed in the Franklin mine, Gilson Gulch, and in the Cincinnati mine, Central City, associated with native silver. S.

*Altaite*.—Slide, Cold Spring, Prussian and Red Cloud mines, Gold Hill. Some fine xld. specimens have been found in the Slide mine. Analyses, published by Dr. Genth, show the following result. The specimens were from the Red Cloud mine. G.

	PER CENT.	PER CENT.
Quartz . . . . .	0.19	0.32
Gold . . . . .	0.19	0.16
Silver . . . . .	0.62	0.76
Copper . . . . .	0.06	0.06
Lead . . . . .	60.22	60.53
Zinc . . . . .	9.15	0.04
Iron . . . . .	0.48	0.33
Tellurium . . . . .	37.99	37.51
Total . . . . .	99.90	99.74

Specimens from the Slide mine, both massive and xld., yield a *very much* higher per cent. of gold and silver than the above analyses show. S.

*Alum*.—Is to be found, native, near Mount Vernon—also *aluminite*, or alum stone, at the same place. S.

*Amalgam*.—Has been found in connection with Coloradoite, in the American, and several other mines, at Sunshine, Boulder County; Keystone, Magnolia; and Smuggler, Balarat. S.

*Amber*.—One specimen, said to have been found near the head of Cherry Creek. Doubtful. E.

*Amazon Stone*.—Fine, large crystalized specimens on Elk Creek, five miles above the crossing of the Tarryall road, associated with orthoclase, smoky quartz, aventurine, micaceous iron and anhydrite, the latter rare. Also at Crystal Peaks, Park County. One xl. in the author's collection, from the latter locality, is fourteen inches long, four inches square, of a very fine, even, dark green color, and has one good termination. S.

*Amethyst*.—Has been found in many different localities in Colorado, and in some places quite abundant. Small crystals of rare brilliance and good color have been found at Nevada. The author obtained some exceedingly fine ones there in 1864, one of which was cut, making a jewel which measures  $7 \times 10$  lines, and is pronounced by lapidaries and jewelers to be the finest amethyst ever found in America. Quantities of very large xls., from one to three inches in diameter, have been found in a vein of ferruginous clay, in Missouri gulch. C. W. Havens, of Black Hawk, has some beautiful clusters, with white quartz xls., from the Circassian silver mine. S.

*Amianthus*.—Head of North Boulder Creek, in galena veins. S.

*Amphibole*.—Common in dikes traversing granite, in many localities. P.

*Analcite*.—In minute xls. in basalt, near Uncompahgre Peak. E.

*Andesite*.—Minute xls. in trachytes, near Black Mountain. E.

*Anglesite*.—Freeland mine, Trail Creek, and in many of the carbonate mines about Leadville. S.

*Anhydrite*.—A single specimen in the author's collection, of a wine-red color and quite transparent, from near the head of Elk Creek. S.



*Anthrophyllite*.—Near Post's Ranch, and head of North Boulder Creek. S.

*Anthracite*.—In the Elk Mountains, Anthracite Creek, Uncompahgre Cañon, etc. Dr. Endlich says: "This anthracite coal is of lower and upper cretaceous age. Partly its greater age, and partly other causes, have given to it the anthracitic character. Nearly all of it was originally simply bituminous coal." Dr. Peale says: "The eruption of the trachyte found near the coal first mentioned, probably so heated it as to deprive it of the bituminous matter." An analysis made by Dr. Peale, of coal from Anthracite Creek furnished the following result:

	PER CENT.
Water . . . . .	1.60
Fixed carbon . . . . .	88.20
Volatile combustible matter . . . . .	3.40
Ash . . . . .	6.80
Total . . . . .	100.00

An average of seven analyses of Elk Mountain anthracite furnishes:

	PER CENT.
Water . . . . .	2.757
Fixed carbon . . . . .	77.360
Volatile combustible matter . . . . .	13.620
Ash . . . . .	6.291
Total . . . . .	100.028

Specific gravity, 1.740. S.

*Antimony*.—Occurs as a sulphuret, and probably in other forms, associated with silver, copper, lead, etc., in many of our gold and silver mines. S.

*Antrimolite*.—Occurs sparingly in amygdaloid at Table Mountain, near Golden city. S.

*Apatite*.—In beautiful nodular clusters of crystals, occurring in clay, near Fort Collins. S.

*Apophyllite*.—Hunt's Peak. Also from the basalts near Golden, and San Luis valley. E.

*Arfvedsonite*.—In quartz, El Paso County. E.

*Aragonite*.—Near Golden city, and at Georgetown, in fine specimens. S.

*Arsenic*.—Occurs occasionally in our mines, the same as antimony, but neither of them has ever been found in the native state, within the knowledge of the author. Fine specimens of arsenical iron, yielding as high as 400 ounces silver per ton, have been taken from the Whale mine, Spanish Bar. S.

*Asbestos*.—Is occasionally found with Actinolite, on the head of North Boulder Creek. S.

*Argentite*.—Occurs sparingly, rarely xld., in many of the silver mines at Georgetown, Caribou, Mount Lincoln, Rosita, Tomichi, etc. S.

*Arsenopyrite*.—Crystallized and massive in Burroughs, Kansas, Illinois, California, Kent County, and many other mines in Gilpin County. It is associated with iron and copper pyrites, usually carries a small per cent. of gold, and a much higher per cent. of silver. S.

*Asphalt*.—Occurs in veins, and in springs in the White River region, and near Cañon City. E.

*Astrophyllite*.—Occurs in quartz on Cheyenne Mountain. E.

*Atacamite*.—In some of the silver mines, on Kendall Mountain, near Howardsville. E.

*Augite*.—Table Mountains, near Golden City. S.

*Aventurine Quartz* (?).—From Elk Creek. The specimens in the author's collection show *white* scales or blisters, instead of yellow, the usual color. S.

*Aventurine Feldspar*.—With Amazon stone, from Elk Creek. S.

*Aurichalcite*.—In Jones' Mine, Nevada, coating zinc blende. G.

*Azurite*.—In the surface ores of many of the silver mines of Boulder, Gilpin, Clear Creek and Park Counties. No



large xls have been found, but some very brilliant small ones have been observed. S.

*Baryta*.—Occurs as a sulphate (heavy spar), in many of our mines and in extensive beds on Vasquez River. Some splendid *transparent* xls are found, with calc spar, on Apishapa Creek. S.

*Basanite*.—South Park, east of salt works, with flint, in trachyte. P.

*Beryl*.—From Bear Creek, below Harrington's saw mill, and on Tiffany's Rancho. A few very good specimens of aqua marine have been obtained in the latter locality. S.

*Biotite*.—Small xls are found in porphyritic trachytes, Buffalo Peak, South Park. P.

*Bismuth*.—Occurs native, as a sulphide and carbonate in the Las Animas Mine, Sugar Loaf District, Boulder County, and in some of the Snake River silver mines. S.

*Bornite*.—Occurs on the Rio Dolores; San Juan, and near Cañon City. Beautiful specimens in Hukill Mine, Spanish Bar. E.

*Bournonite*.—Terrible Mine, near Georgetown, xld. E.

*Bloodstone, or Heliotrope*.—Found sparingly in Middle Park. No very fine specimens have as yet been found in the State. S.

*Brucite*.—A single specimen, from Jamestown, noticed by the author in 1866. S.

*Bronzite*.—La Ganita Creek, Rio Grande County. H.

*Cairngorm Stone*.—Head of Elk Creek. Some fine gems, equal if not superior to the best Scottish stones, have been obtained in this locality. Also some very large and fine transparent xls have been found at Crystal Peaks, west of Pike's Peak. One xl in the writer's collection is twenty-six inches in length, four inches in diameter, and clear. S.

*Calamine*.—Gilpin and Clear Creek Counties.

*Calaverite*.—Associated with other tellurides in the Slide, Cold Spring, American, Keystone, and other mines in Boulder county. Dr. Genth publishes the following analysis :

	PER CENT.
Au . . . . .	38.75
Ag . . . . .	3.05
Te . . . . .	57.32
U <sub>2</sub> O <sub>3</sub> . . . . .	0.05
FeO . . . . .	0.30
Al <sub>2</sub> O <sub>2</sub> Mg, O, etc . . . . .	0.55
	100.02

There were doubtless some impurities in the sample analyzed by Dr. G., as several crystals of this mineral, from the Slide Mine, tested by cupellation by the author gave 42 to 44 per cent. gold. S.

*Calcareous Spar*.—Near Mount Vernon, and at Bergen's Ranche, in brownish white xls. Also in octahedral xls on Apishapa Creek; scalenohedra in Elk Mountains; fibrous in Trout Creek Park; beautiful rose color, in San Juan. S.

*Caledonite*.—Freeland Mine, Trail Creek. S.

*Carnallite*.—Salt Works, South Park. P.

*Carnelian*.—White from the South Park, and flesh-red, rare, from the Middle Park. S.

*Cerargyrite*.—Gilpin County Mine, Black Hawk; in masses sometimes an inch or more in thickness, in some of the mines about Leadville; at Rosita, Silver Cliff, etc. S.

*Cerussite*.—Pleasant View and Gunnell Mines, Central City; Rosita and Leadville mines, etc. S.

*Chabasite*.—Table Mts., Golden City, and in basaltic geodes, Uncompahgre Peak. E.

*Celestite*.—Apishapa Creek, in beautiful azure blue xls. S.

*Chalcanthite*.—On Clear Creek, below Black Hawk, in a deposit. Also on many old mine dumps near Central. E.

*Chalcedony*.—Beautiful specimens of the hydrous varieties are obtained from a large vein of siliceous sinter, below



the Salt Works, South Park, in botryoidal, mammillary and stalactitic forms. Like carnelian, it is common in many localities, but few specimens of rare beauty have ever been found in the State. It is frequently met with lining cavities in the mines. One specimen in the author's collection, of the mammillary form, shows green, brown, red, yellow and white colors. Nodules and geodes occur in abundance in the Middle Park, from the size of a pea to four inches in diameter. S.

*Chalk*.—On the Smoky Hill route, eastern part of the State, in huge bluffs, 100 to 300 feet high. First noticed and described by D. C. Collier, Esq., of the Central City Register. S.

*Chalcocite*.—Bergen district; Liberty lode, Bear Creek, and Sugar Loaf, Boulder County. S.

*Chalcopyrite*.—Common in many of the gold and silver mines throughout the State. In the gold mines of Gilpin County it is always both auriferous and argentiferous, but in different mines it varies very much in the per cent. of precious metals. In the Bobtail, Gregory, Bates, Fisk, and others, it is the richest portion of the ore, yielding from four to fifteen ozs. gold per ton, and twenty to forty ozs. silver, while the iron pyrites is comparatively barren. In the Burroughs mine the chalcopyrite does not yield one ounce gold per ton, while the iron pyrites yields from four to ten ozs. The same is true to a greater or less extent in several others of the mines in that region. At times, beautifully xld. specimens of this mineral can be found in nearly all the paying gold mines of Gilpin County. S.

*Chlorite*.—Trail Creek and Mt. Princeton. In some localities chlorite replaces the mica in both granite and schists. S.

*Chlorophane*.—In many copper and lead lodes, in Bergen district. S.

*Chromite*.—Mt. Silver Heels, near Fairplay. P.

*Chrysocolla*.—Trail Creek and head of San Luis Valley. S.

*Chrysolite*.—Occurs in the drift in the extreme southern portion of the State, and in the trachytes in several places. E.

*Chrysoprase*.—Occurs very rarely; but some very fine gems of this mineral have been found in the San Juan region, S.

*Coal*.—Brown coal or ligneous coal, in banks twelve to sixteen feet thick, near Denver, Boulder, Golden, Cañon City, Trinidad, El Moro, etc. S.

Albertine coal, in veins three feet wide, in the Middle Park, noticed by Professor Denton, in 1865. S.

A total average of thirty-four analyses of Colorado bituminous coals gives the following result:

	PER CENT.
Water . . . . .	6.436
Fixed carbons . . . . .	52.617
Volatile Combustible Matter . . . . .	34.096
Ash . . . . .	6.835
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Specific gravity, 1.325.	99.984

*Coloradoite* (*sp nov.*)—Occurs in several of the Telluride mines in Sunshine, Magnolia and Balarat Districts, Boulder County. Dr. Genth furnishes the following analyses of the mineral:

	No. 1. PER CENT.	No. 2. PER CENT.	No. 3. PER CENT.
Au . . . . .		3.46	7.67
Ag . . . . .		2.42	7.18
Hg . . . . .	52.28	55.80	48.74
Cu . . . . .		trace	0.16
Zn . . . . .		trace	0.50
Fe . . . . .		1.35	0.92
Te . . . . .	42.95	36.24	34.49
Quartz . . . . .		2.90	3.07
Al <sub>2</sub> O <sub>3</sub> Fe <sub>2</sub> O <sub>3</sub> . . . . .	2.44	<hr/>	<hr/>
V <sub>2</sub> O <sub>3</sub> . . . . .	0.70	102.17	102.71
Mg O . . . . .	0.11		
Ca O . . . . .	0.84		
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	99.32		



Sample No. 1 was from Keystone mine; 2 and 3, Smuggler. S.

*Columbite*.—Occurs in prismatic needles, penetrating the zircons of Pike's Peak. E.

*Copper*.—Native copper is occasionally found in the form of dendritic coatings, filling seams in the gangue rock of several of our mines, but it is rare. A few very fine cabinet specimens of dendritic, or moss copper, in masses of several pounds weight have been taken from the Narragansett Mine, Gregory lode. Beautiful microscopic xls. are found in seams of the gangue rock, in the Ni Wot Mine, Ward district. S.

*Covellite*.—Gunnell and Sap Mines near Central City. Loew.

*Copper Pyrites*.—Sulphuret of copper and iron. This mineral is quite common in most of our mines, below the permanent water level, and usually contains a good per cent. of gold, selected specimens sometimes yielding as much as fifty ounces per ton. Good cabinet specimens may be obtained from any of our deep mines. S.

*Cuprite*.—Fine specimens from the Malachite lode, Bear creek. In crystals, from Sacramento gulch, and from Sweet Home Mine, Buckskin. S.

*Dolomite*.—Occurs as a rock at Leadville, and other places in the State. S.

*Derbyshire Spar*.—Argentine and Wisconsin lodes, Bear Creek. S.

*Dyscrasite*.—Reported from Poughkeepsie gulch, head of the Uncompahgre. E. and Hills.

*Embolite*.—Peru district, Snake River. S.

*Enargite*.—Beautifully crystallized and massive specimens have been found in the Powers Mine, Russell District. S.

*Egeran*.—Fine specimens south of Genesee Ranch, on Bear Creek. S.

*Enstatite*.—La Garita Creek, Rio Grande County. Hill

*Epidote*.—Fine crystalline specimens are found on Trail Creek, Virginia Cañon, Russell district, Nevada, and other localities. S.

*Fahlers*.—Common in many of the silver mines at Georgetown, Caribou, San Juan, etc. Some beautiful xls. have been obtained from the Freeland Mine, Trail Creek.

*Feldspar*.—Fine, large xls., detached and in clusters, abundant on Elk Creek, and at Crystal Peaks, west of Pike's Peak. Also xls. of the sanidin variety in great abundance on Gregory Hill, Black Hawk. Some rare pseudomorphs after micaceous specular iron occur at the Elk Creek locality. Also a few very perfect *hopper shaped* xls. were found by the author, near Idaho, in 1867. In crystalline form they are square prisms one-fourth to three-fourths of an inch in diameter, and one inch in length, with the tops indented in the same form as salt xls. S.

*Fire Clay*.—In great abundance at the coal banks of Golden City, Ralston, Boulder, and in the Middle and South Parks. S.

*Float-stone*.—Very large, fine specimens, snow-white, and in some cases showing thin scales of gold, have been taken from the Mammoth lode, Central City. S.

*Flos Ferri*.—Specimens of rare beauty have been found in a vein near Golden Gate. S.

*Fluor Spar*.—Massive, in wide metalliferous veins, near Bear Creek. The white, green, pink and purple colors are common, and often all these colors occur in irregular bands in a single specimen. It also occurs quite frequently in the silver mines at Argentine and Georgetown; also in extensive beds at James Creek, sometimes containing visible *free gold*. Large crystals, sometimes ten inches across, are found at Crystal Peaks. S.

*Franklinite*.—In Mispickel, on Rio Dolores. E.

*Freieslebenite*.—At head of Cement Creek, near Baker Park. E.



*Galenite*.—Occurs in many of our gold and silver mines. Beautifully crystallized specimens have been found in the Glennan and Running lodes, Black Hawk, the Delaware and Calhoun lodes, Russell district, Mt. Desert, Forks, Jones and others, Nevada. Some fine crystals two inches across, from the Glennan lode. Fine specimens of the granular varieties, rich in silver, come from the Whale lode, Spanish Bar.

The Galena of this State is frequently remarkably rich in silver, sometimes yielding two to three hundred ounces per ton; and one specimen in the collection of Prof. C. A. Martiné, of Georgetown, from the McClellan lode is 11 per cent. silver. S.

*Garnets*.—Precious garnets are found in quantities in the bar diggings of the South Park, and also across the Range, about Breckenridge and other places. They are usually quite small, however, and of no value as gems. A few specimens in the collection of the author, presented by Mrs. Hall, of South Park, are of a beautiful, deep, wine red color. Ferruginous garnets occur in great abundance at Central City, Trail Creek, Bergen's Ranche and other localities, in large veins, associated with epidote, quartz, calc spar, and sometimes copper pyrites. Some beautiful specimens in the author's collection are from the Trail Creek locality. Dodecahedrons six inches in diameter have been found at Bergen's Ranche.

Manganésian garnets occur in gneiss, at Spanish Bar, Sugar Loaf and other localities, in great abundance. Beautiful specimens of *topazolite* are found near the Malachite lode, on Bear Creek. S.

*Glockerite*.—Central City, on many old dumps. E.

*Gothite*.—With hæmatite, on Topaz Buttes. E.

*Gold*.—Crystallized gold is quite a rare thing in this State, though a few very good specimens have been found. Beautiful microscopic crystals have been found in considerable abundance, in the Gunnell, Gregory, Bates, and other

mines near Central City. Some beautiful arborescent masses were shown us in 1866, by Chas. Lowe, of Fairplay, which were washed out of his claims that season. Some beautiful and rare specimens were taken from the Leavitt lode, Mountain City, the same season. The gold was in coarse wires, attached to the gangue by the ends only, and bowing out from it half an inch to an inch, forming a network of angles and circles. Many of the wires of gold were covered with a drusy silicious coating, and some were covered with minute crystals of GALENA. "Wire gold," strings of minute octahedral crystals, united and forming serrated, fluted, or chain like wires, an inch or more in length, are sometimes found in many of our mines. One specimen from the Briggs Mine, consisting of small striated wires of gold, interwoven among quartz xls. and cubes of iron pyrites, is the most beautiful and interesting specimen of the kind that we have ever seen. Some beautiful octahedral xls. about the size of pin heads attached to xls. of iron pyrites, zinc blende and galena, were taken from the Pleasant View Mine in 1869. Some flattened and distorted octahedrons, one-fourth of an inch across, together with some arborescent masses, were taken from Georgia Gulch some years since. A large quantity of crystalline gold of peculiar forms was taken from a vein in California Gulch, in 1869. There was about 100 ozs. in the lot shown to us, in xls., arborescent masses and thin plates, from less than a troy grain up to fourteen ozs. in weight. The whole was in crystalline forms, more or less perfect—some in small but distinct cubes and octahedrons, some in chain-like wires, flattened and striated wires, arborescent masses resembling bunches of moss, and some in smooth plates, showing the crystalline form around the edges only, which were finely serrated. Some of the plates were half an inch broad, by an inch long, and of the thickness of heavy letter paper. Much wire gold has been taken from the American and Slide mines, in Boulder County, associated with telluride ores. Some of the wires from the Ameri-



can are four inches in length, and not larger in diameter than a fine cambric needle; and many of them have microscopic xls. of Petzite attached to them. Most of the wires from these mines, however, are short and thick, being one-fourth to half an inch in length, by one-eighth to three-sixteenths of an inch in diameter, and beautifully striated. Many of these wires are Petzite, simply coated with a thin plate of gold. Much material has been taken from the American and Slide Mines that is of great interest for microscopic investigation, as well as for careful analysis. S.

Gold in Fluor Spar, and Sul. Baryta xls., Jamestown, Summit District. S. Hills.

*Electrum*.—Has been found in the Champion Mine, Trail Creek and in some of the Gunnison County Mines.

*Goslarite*.—On the dump of the Wood Mine, Leavenworth Gulch, Gilpin County. E.

*Graphic Granite*.—Near Colver's Mill, Bear Creek, and on Gold Hill, Boulder County. Very fine specimens in the latter locality. S.

*Graphite*.—Trinidad Mines, Las Animas County, in large xls. S.

*Greenockite*.—On Sphalerite, in the Dallas Mine, Black Hawk, and Jones Mine, near Central. S.

*Gypsum*.—In beds ten feet thick, in the South Park; also in fine arrow-head xls. and fibrous masses near Mount Vernon, Cache-la-Poudre, and other places. S.

*Halite*.—Occurs at Salt Works, South Park, and at salt-licks in various parts of the State. P.

*Hæmatite, Red and Brown*.—Bellemonte Furnace, Golden City and other localities. S.

*Henryite*.—First found in the Red Cloud and Cold Spring Mines at Gold Hill. An analysis by Dr. Endlich gave the following result: E.

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	PER CENT.
Pb . . . . .	53.19
Fe . . . . .	5.03
Ag . . . . .	0.31
Au . . . . .	trace
Te . . . . .	41.45
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	100.00

Specific gravity, 8.5255.

It will be seen that the analysis corresponds very nearly with that of Altaite, with the exception of the quantity of iron, which might be accounted for by the presence of a little pyrite in the altaite, with which it is always intimately associated in those mines. S.

*Hessite*.—Occurs abundantly in the Slide and Prussian Mines, and sparingly in the Cold Spring, American, and other mines at Gold Hill and Sunshine, and in the Hotchkiss Mine, near Lake City. A specimen from the Red Cloud Mine, Gold Hill, analyzed by Dr. Genth, gave :

	PER CENT.
Gold . . . . .	0.22
Silver . . . . .	59.91
Copper . . . . .	0.17
Lead . . . . .	0.45
Zinc . . . . .	trace
Iron . . . . .	1.35
Tellurium . . . . .	37.86
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	99.86

*Hessite, Auriferous*.—Dr. Genth has published three analyses of this mineral, one of which gives :

	PER CENT.
Quartz . . . . .	0.70
Gold . . . . .	13.09
Silver . . . . .	50.36
Copper . . . . .	0.07
Lead . . . . .	0.17
Zinc . . . . .	0.15
Iron . . . . .	0.36
Tellurium . . . . .	34.91
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	100.01

*Heulandite*.—Near Uncompahgre Peak, in basalt. E.



*Hyalite*.—Near the Hot Sulphur Springs, Middle Park—rare. S.

*Hypersthene*.—In some of the dikes of the Front Range. E.

*Idocrase*.—Near Malachite lode, Bear Creek, and on North Saint Vrain Creek—fine specimens. S.

*Iodyrite*.—A small fragment found in some surface ore from the Red Cloud Mine, Gold Hill. E.

*Iron*.—Native in the Colorado meteorite, found in 1866, a description of which is here inserted :

*Meteoric Iron*.—A large mass, weighing 460 lbs., was discovered in a cañon near Bear Creek, in 1866, by Mr. Jas. L. Willson, and the author, while on a prospecting tour. The following is Mr. Willson's description of the mass :

"It is singular in form, 22 inches long, 16 inches wide, and 12 inches thick. Four of its sides are flat, and two rounded. This form indicates it to be a fragment of a much larger mass. It is magnetic—weight about 460 lbs. The force with which it struck the rocks at the time of its fall, had battered one end and so shattered it that we were enabled to break off a piece that weighed eleven pounds. Its composition appears to be the native metals of iron, nickel, cobalt, and a trace of copper, unequally distributed in the mass. In one part nickel and cobalt are largely in excess of the other metals, while in other parts iron is the chief ingredient. These metals are aggregated and highly crystallized. A coating of the oxyd of iron, half an inch thick, has taken the place of the shining black crust observed on aërolites when they first reach the earth. The less oxydizable metals of nickel and cobalt still remain in their metallic state in this coating of iron rust."

The mass also contains phosphuret of nickel (*schreibersite*), and sulphurets of iron and nickel, in addition to the above. It is now in the collection of Prof. C. U. Shepard, of Amherst College, Massachusetts. S.

*Iron.*—*Bi-Sulphuret, or Iron Pyrites.*—This very common mineral is found in abundance in all our gold and silver mines, crystallized and massive, and always carries more or less gold and silver in chemical or mechanical combination, and is sometimes very rich in the precious metals. Beautiful cabinet specimens, in cubes from one to three inches across, have been taken from the Kingston, Hill House, S. P. Chase and other lodes, Russell district, and from a mine owned by Capt. Hall, at Jamestown. Specimens from the latter mine, in finely polished cubes an inch across, with truncated corners, were presented to the author by J. Virden, Esq. One specimen from the Kingston lode is intermixed with brittle silver. Fine octahedral xls. are found in the San Juan region. Also some fine clusters of *rhombic* xls. are found in the Elk Mountains. Pentagonal dodecahedra in several mines in Gilpin County. *Radiated* and *Botryoidal* masses are found in Gilpin and Boulder Counties. S.

*Jamesonite.*—Sweet Home Mine, San Juan and Summit district, near Del Norte. P.

*Jarosite.*—On the dump of the Wood Mine, Leavenworth gulch, Gilpin County. E.

*Jasper.*—Is found abundantly in the South and Middle Parks, of various colors, red, brown, yellow, green and black being most common. S.

*Jet.*—A single specimen in the author's collection, found near Golden City. S.

*Kaolinite.*—The white, chalk-like bluffs on Chalk Creek. Product of decomposed oligoclase. E.

*Kobellite.*—Has been found sparingly in Moscow Mine, Sugar Loaf District, Boulder County. S.

*Labradorite.*—In the dolorites of the State, generally, and in large xls. on Parmelee's Ranch, Deer Creek, Park County. S.

*Lanarkite.*—Carbonate mines, at Leadville. E. And in Tin Cup Mines.



*Lead*.—Native lead. A single specimen only has been noticed here, which was found in a lot of ore sent to the author to be assayed, from a lode near Breckenridge, the name of which is unknown. The metal occurs in small grains and wires, attached to partially decomposed galena. S.

*Lepidolite*.—Rito Alto Peak, in a form resembling the Saxon Zinnwaldite. E.

*Leucite*.—In amygdaloids, Table Mountain, near Golden City. S.

*Leucopyrites*.—Fine specimens of this mineral, rich in silver, have been taken from the Whale mine, Spanish Bar. S.

*Lignite*.—Greenland, on Denver & Rio Grande railway, where it retains its woody structure in an eminent degree. S.

*Limonite*.—Common in several localities, especially near the coal mines. S.

*Lieovrite*.—North Clear Creek, below Black Hawk. A single specimen in the author's collection, presented by T. J. Oyler. S.

*Lime*.—Mt. Vernon, Golden City, Boulder, South and Middle Parks, etc. A large deposit of limestone, of the variety known as Gibraltar Marble, was discovered by the author near Idaho, in 1867, where fine specimens can be obtained in abundance. Also fine Brecciated marble, in Boulder County. S.

*Lithographic Stone*.—Specimens of this stone of very good quality occur in quantity near Boulder City, but it is doubtful if large specimens could be obtained. S.

*Lionite*.—From Mountain Lion Mine, Magnolia District, Boulder County. Dr. Genth has published two analyses of the mineral:

	PER CENT.	PER CENT.
Gold . . . . .	1.38	1.53
Silver . . . . .	0.25	0.25
Tellurium . . . . .	55.86	55.54
Quartz . . . . .	34.72	35.91
Alumina and iron oxyd . . . . .	6.15	6.14
Manganese " . . . . .	0.17	0.19
Calcium " . . . . .	0.48	0.26
Total . . . . .	99.01	99.82

*Magnesite*.—Occurs in the Bobtail, Running, Lake and Pewabic Mines, Gilpin County. S.

*Magnetite*.—In fine octahedrons, is found on Gunnell Hill, Central City; Vasquez River, below Idaho, and other localities. Also massive in a large vein, at Caribou City. S.

*Magnetic Pyrites*.—Near Running lode, Bobtail Hill, and in Sharkskin lode, Sugar Loaf District. S.

*Magnolite*.—From American, Keystone and other telluride mines, in Boulder County. It is the result of decomposition of Coloradoite, according to Dr. Genth, and occurs in capilloid and acicular crystals. It has the formula  $Hg_2TeO_4$ .

*Malachite*—*Green Carbonate of Copper*.—The earthy variety has been found quite abundantly near the surface, in the Malachite lode, Bear Creek; also some small crystalline specimens, of fine color and high lustre, from the Champion and Coyote lodes, Trail Creek. S.

*Manganese*.—The per-oxyd and bin-oxyd occurs in many places throughout the State, but in no place yet discovered in sufficient quantity to make mining for it remunerative. It occurs in arborescent delineations between layers of sandstone, and in seams in the other rocks, (by the miners called "forest rock,") frequently forming dendrite specimens of rare beauty. S.

*Marcasite*.—In several gold mines in Boulder and Gilpin Counties. S.

*Melaconite*.—Occurs in the Gunnell, Sap, Briggs, and other gold mines in Gilpin County. P.



*Melanterite*.—On the old dumps of many of the gold mines in Gilpin County. E.

*Melonite*.—Occurs rarely in some of the telluride mines in Sunshine District, Boulder County. S.

*Mercury*.—Occurs native, as the result of decomposition of Coloradoite, in the surface ores of many of the telluride mines of Boulder County. S.

*Mesitine Spar*.—Fine specimens of this mineral are found in the Black Prince lode, near Capt. Austin's, Lump Gulch. S.

*Mesolite*.—South Table Mountain, near Golden. E.

*Minium—Oxyd of Lead*.—Occurs sparingly in the Freedom Mine, Trail Creek. S.

*Mineral Resin*.—Marshall's Coal Mine, Boulder; also in the Golden City and Ralston Creek Coal Mines. S.

*Mica*.—Abundantly distributed throughout the mountains, but rarely in fine xls., or in plates of sufficient size or purity to be commercially valuable. One very fine xl. in the author's collection, found near the Genesee Rancho, is three and a half inches long by two wide and one thick. Very good xls. have also been observed near Georgetown. In some cases these latter have dendritic delineations between the folia, resembling the moss in moss agates. S.

*Molybdenite*.—Leavitt Lode, Central City, and in Sweet Home Mine, Boulder County. S.

*Molybdite*.—Alice Carey Mine, San Juan District. E.

*Mordenite*.—Table Mountains, near Golden.

*Nagyagite*.—In American and Phil. Sheridan Mines, Sunshine, and probably in other telluride mines, in Boulder County. One specimen from the Phil. Sheridan Mine was analyzed at the Ecol des Mines, Paris, but the result is not at hand at this writing. S.

*Natrolite*.—Table Mountains, near Golden City. E.

*Obsidian*.—Silver Cliff, Buffalo Peaks, etc. A heavy vein of porphyritic obsidian occurs near the Rio Grande Pyramid, and nodules occur in the lower trachytic series. P.

*Oligoclase*.—Occurs in many of the granites, and in the volcanic rocks of the State. Good xls. are quite rare. E.

*Olivene*.—Transparent, green, in the basalts of the San Luis valley. E.

*Onyx*.—Middle Park, west side of Grand River, near Willow Creek, associated with chalcedony, jasper and fortification agate. S.

*Opal*.—A variety of opal of a milky bluish-white color, and very transparent, is found near Idaho, Clear Creek County, in a vein of auriferous quartz. It is found in seams and lumps, distributed through the whole width of the vein. Some pieces show a decided opalescence when cut, but do not reflect much play of colors. A yellowish, slightly translucent variety of semi-opal is abundant in a vein of siliceous sinter, in the South Park. In this latter locality the specimens are frequently penetrated with oxyd of manganese, in massive, botryoidal and arborescent forms, often presenting specimens of rare beauty. It is also found in the San Juan region, and at Buffalo Peaks. S.

*Wood Opal*.—On Kiowa and Bijou Creeks, in great quantity and fine specimens. S.

*Ozocerite*.—Near Animas City, La Plata County.

*Pargasite*.—In small particles in quartz, in a dike north of Centreville. E.

\* *Petroleum*.—Oil wells in Oil Creek Cañon, east of Cañon City, and Smoky Creek, 10 miles south of Golden. E.

*Petzite*. In American, Slide, Prussian, Cold Spring and other telluride mines in Boulder County. An analysis published by Dr. Genth gives:

	PER CENT.
Quartz . . . . .	
Gold . . . . .	0.62
Silver . . . . .	24.10
Copper . . . . .	40.73
Bismuth . . . . .	trace
Lead . . . . .	0.41
Zinc . . . . .	0.26
Iron . . . . .	0.05
Tellurium . . . . .	0.78
	33.49

100.44



*Pickeringite*.—This mineral was found by Dr. John Le Conte, near Monument Park, crystalized in thin needles. An analysis by E. Goldsmith gave :

	PER CENT
SiO <sub>2</sub> . . . . .	38.6
Al <sub>2</sub> O <sub>3</sub> . . . . .	11.9
MgO . . . . .	4.8
(K <sub>2</sub> O+Na <sub>2</sub> O) . . . . .	0.6
Sand . . . . .	1.9
By diff. H <sub>2</sub> O . . . . .	41.9
	100.0

*Porphyry*.—Gold Hill District, and on Gregory Hill, Black Hawk, containing highly perfect xls, of feldspar from one half inch to one inch across. S.

*Prase*.—Found sparingly in the Middle Park, associated with chalcedony and jasper. S.

*Pitchblende*.—Abundant in Wood Mine, Russell District. S.

*Plumbogummite*.—On lead and copper minerals, in Dallas Mine, Black Hawk. E.

*Polybasite*.—In tubular xls. at the Terrible Mine, near Georgetown. E.

*Prehnite*.—Said to occur near Fairplay. P.

*Pronstite*.—With galenite, in Brown Mine, Georgetown. E.

*Pseudomalachite*.—Little Platte River, south of Fairplay. P.

*Psilomelane*.—Seaton Mine, near Idaho, and other places. E.

*Pyrargyrite*.—In many of the silver mines near Georgetown and in San Juan; Boulder County, etc. E.

*Pyrolnsite*.—On Silver Heels, near Fairplay, and in San Juan. P.

*Pyromorphite*.—In the Freeland, and in several lodes about Georgetown.

*Pyroxene*.—In the younger volcanic and metamorphic rocks, near Fairplay, and in San Luis Valley. P.

*Pyrrhotite*.—In Gilpin and Jefferson Counties. S.

*Quartz*.—This very common mineral is found in all our mines, some of them producing very beautiful groups of crystals, intermixed with xls. of iron and copper pyrites, zinc blende and sometimes small wires and xls. of gold. Very large xls., from two to four inches in diameter, sometimes partially covered with micaceous iron, have been found on the Platte, near Hepburn's Ranche. Fine smoky xls. have also been found on Elk Creek and at Crystal Peaks, Park County. Very fine specimens of Rock Crystal have also been found on the divide between the Platte and Arkansas Rivers, near "Dirty Woman's Ranche." Very brilliant double-terminated xls. attached to the gangue by a *stem* in the base of each, are quite common on Quartz and Nevada Hills, and in several mines on Trail Creek. They seem to have been formed by replacements on smaller xls. of a dull brownish color, the smaller xls. being the stems of the perfect ones, and are usually about one-fourth as large. Some remarkable tabular xls. also occur detached and lying loose in cavities lined with feldspar xls., at Elk Creek. The author obtained some in that locality some years since, five inches in length, three inches wide, and only half an inch thick—double terminated and perfect in every particular except the flattened form. Jet black, double terminated xls., four inches long and half an inch in diameter, of regular six sided form, were also found at the same time and place. Crystals of cubical (?) and rhombohedral forms have been observed lining geodes of chalcedony in the Middle Park. Probably formed by replacement after calc spar, as that mineral is often found lining similar geodes in that locality. Specimen in the author's collection, presented by Eugene Wilder, Esq. S.

*Rose Quartz*.—Found at Central City and on Bear Creek. S.

*Rhodocroisite*.—In Sweet Home and Tanner Boy Mines, Park County, in beautiful specimens. S.



*Rhodonite*.—Near Howardsville, San Juan. E.

*Ripidolite*.—Trail Creek, Clear Creek County, and in Little Giant Lode, San Juan. E.

*Roscolite*.—A greenish mineral found in many of the Telluride mines of Boulder County. Dr. Genth publishes an analysis as follows :

	PER CENT.
SiO <sub>2</sub> . . . . .	57.15
Al <sub>2</sub> O <sub>3</sub> . . . . .	19.94
V <sub>2</sub> O <sub>3</sub> . . . . .	8.44
MnO . . . . .	trace
FeO <sub>2</sub> . . . . .	3.51
MgO . . . . .	2.87
Si <sub>2</sub> O . . . . .	trace
Na <sub>2</sub> O . . . . .	0.91
K <sub>2</sub> O . . . . .	8.11
H <sub>2</sub> O . . . . .	not determined
	100.97

*Rutile*.—Occurs in quartz, on Ute Pass. P.

*Sapphire*.—A few pale blue specimens of this gem have been found in the drift, near Denver. S.

*Schapbachite*.—Reported near Georgetown, in silver mines. E.

*Scheelite*.—Reported in some of the mines near Baker Park, in crystals. E.

*Schirmerite*.—With tellurides at Gold Hill, and in silver mines at Montezuma. Dr. Genth gives the following analysis :

	(1) PER CENT.	(2) PER CENT.
Lead . . . . .	12.69	12.7
Silver . . . . .	22.82	24.7
Bismuth . . . . .	46.91	47.2
Zinc . . . . .	0.08	0.1
Iron . . . . .	0.03	0.0
Sulphur . . . . .	14.41	15.0
	97.94	100.0

*Salt*.—South Park, twenty miles southeast from Fairplay, where there are extensive saline springs, and works erected capable of manufacturing 10,000 pounds per day. S.

*Sard.*—*Sardonyx*. Middle Park. Fine specimens very rare. S.

*Satin Spar.*—Abundant near Mt. Vernon, associated with alabaster and arrow-head xls. of gypsum. Large and fine specimens. S.

*Schreibersite.*—Specimens in the writer's collection from the Colorado ærolite. S.

*Siliceous Sinter.*—A large vein in the South Park, five miles from the Salt Works. S.

*Selenimos.*—Occurs with sphalerite in Ætna tunnel, near Black Hawk, but in just what form has not yet been determined. S.

*Serpentine.*—Small specimens occur in the metamorphic rocks of Mosca Pass. E.

*Siderite.*—In many of the mines of Gilpin County, xld. Also at Gold Hill, Rosita, etc. S.

*Silicified Wood.*—Middle and South Parks, Cherry Creek, Kiowa, and the Platte valley generally, from the base of the mountains to Julesburg. A number of stumps of trees, completely silicified, and standing ten to twenty feet high, and six to twelve feet in diameter, were standing, a few years since, in Florissant valley, and the author has seen on Kiowa Creek, a log completely silicified, twenty inches in diameter, and of unknown length, as it was buried in the bank of the stream, with one end protruding a few feet. Specimens of the agatized variety are often met with, very transparent, and when sawed across the grain, and polished, retain all the original texture and grain of the wood. They are frequently so cut and set as gems. Fragments of roots and branches, having knots in them, are sometimes remarkably beautiful. S.

*Silver.*—*Native Silver.*—Containing a small per cent. of gold has been found in the Crystal Lode, Virginia Cañon. It occurs in the form of small wires and grains, in cavities and seams about ninety feet below the surface. It occurs in the same forms, as also in arborescent coatings in



the Coaley Lode, Black Hawk, in the Terrible, Brown, Equator, and other mines about Georgetown, in some of the Snake River Mines, the Caribou and other lodes, Grand Island, and the Hoosier, Gold Hill. Also in small nuggets, in the Gulch Mines, near Fairplay, with gold; San Juan, Gunnison, Tomichi, etc. S.

*Smithsonite*.—On sphalerite, in Jones Mine, Gilpin County. S.

*Sulphate of Soda*.—Occurs abundantly in a lake owned by Burdsal & Sons, twelve miles south of Denver. It is often four to six inches thick over an area of forty acres, and may be shoveled up in large quantities sufficiently pure for metallurgical purposes. The water in the lake, Mr. Burdsal informs me, will yield thirty per cent. crystalized sulphate, and, with proper works, thousands of tons could be produced annually. S.

*Soda, Carbonate*.—At the Hot Springs, Idaho, and other places. S.

*Sphalerite*.—Sulphuret of zinc is a very common mineral in many of our gold and silver mines, and is generally rich in the precious metals. Samples from the Georgetown silver mines, which to the eye appear to be nothing but pure zinc blende, of a deep black color, not unfrequently yield 400 to 600 ozs. silver per ton. One specimen tested by Prof. Martine, gave the very remarkable yield of 31 per cent. silver. Beautiful cabinet specimens have been taken from the Coaley Lode, Black Hawk, and the Delaware and Calhoun Lodes, Russell. In the latter lode it occurs in chalcedony, producing specimens that might be mistaken for moss agates. The blendes of Gilpin County contain both *Cadmium* and *Indium*, in considerable quantity, in a few of the mines. S.

*Spinel—Zinciferous*.—Crystal Lode, Virginia Cañon, in clear, brownish-white xls. S.

*Stannolite*.—Simple and twin xls. in micaceous schists near Mt. Oso, Quartzite Mountains. E.

*Sternbergite.* Silver mines near Georgetown. E.

*Stephanite.*—Colorado Central, Georgetown; Moose Mine, Mt. Lincoln. E.

*Stibnite.*—Terrible Mine, near Georgetown, and in Boulder County. E.

*Stilbite.*—Fine xls. in cavities of basalt, near Uncompahgre Peak, and near Golden. E.

*Sulphur.*—Native in crystalline masses, in the Hot Sulphur Springs, Middle Park, and in minute xls. with galena, in the Jones Lode, Nevada. S.

*Sylvanite.*—In xls. and crystalline masses, in the American and Grand View Mines, Sunshine; and in the Slide, Prussian, Cold Spring and others, Gold Hill. Dr. Genth publishes the following analysis of a specimen of sylvanite from the Red Cloud Mine, Gold Hill:—

	PER CENT.
Quartz . . . . .	0.32
Gold . . . . .	24.83
Silver . . . . .	13.05
Copper . . . . .	0.23
Zinc . . . . .	0.45
Iron . . . . .	3.28
Tellurium . . . . .	56.31
Selenium . . . . .	trace.
Sulphur . . . . .	1.82
	100.29

*Talc.*—Occurs in greater or less abundance in nearly all our mines. Fine specimens of indurated talc, of a dark green color, very hard, and having xls. of iron pyrites disseminated through it, may be obtained at the Ogden Lode, Montgomery. S.

*Tellurite* and *Ferro-tellurite.*—New species described by Dr. Genth. It is the result of decomposition of tellurium and tellurides. Its formula is  $TeO_2$ . Found in the Keystone and Smuggler Mines, in small xls.

*Tellur-Pyrites.*—A new species, discovered by the author, in the American Mine, Sunshine, in 1875, and first



described by Professor C. U. Shepard. It is mammillary arsenical iron pyrites, containing a high per cent. of tellurium, and usually quite rich in gold. S.

*Tellurium Native.*—In Red Cloud Mine, Gold Hill, and in large quantities in the Keystone Mine, Magnolia District, Boulder County. Dr. Genth publishes the following analysis of a sample from Magnolia:

	PER CENT.
Au . . . . .	0.60
Ag . . . . .	0.07
Te . . . . .	96.91
V <sub>2</sub> O <sub>3</sub> . . . . .	0.49
Fe O . . . . .	0.78
Hg Al <sub>2</sub> O <sub>3</sub> Mg OK <sub>2</sub> O, etc. . . . .	1.15
	100.00

*Tennantite.*—Has been found sparingly, finely crystallized, in the Freeland Lode, Trail Creek, in Buckskin Gulch, Park County, and Geneva District, Summit County.

*Tetrahedrite.*—Fine cabinet specimens, in large, beautifully formed xls. are occasionally found in the Freeland Lode, Trail Creek, and in several mines in Gilpin, Boulder, and San Juan. S.

*Torbenite.*—(Uranite.) Found by Captain Berthoud, on Lyden Creek. Also found on Griffith Mountain, near Georgetown. E.

*Tourmaline.*—In feldspathic granite, Guy Hill, and at Nevada and other places, in fine black xls. None of the red, green or blue varieties have been noticed here. A few fair xls. of the brown variety have been found in Nevada, (Colorado.) S.

*Tremolite.*—Smith's Fork of the Gunnison. S.

*Tufa.*—Calcareous. On Currant Creek; Roaring Fork; Frying Pan. Also at many mineral springs. E.

*Turquoise.*—Specimens in the author's collection obtained from a Ute Indian chief, are supposed to have been found in southern Colorado, but the precise locality could not be ascertained. The specimens are rudely cut in keystone

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form, with a hole drilled in each, and were worn in a bracelet. The stones are highly prized by the Indians, and it is with much difficulty that they can be induced to part with them. S.

*Uraconite*.—Wood Mine, Leavenworth Gulch, near Central. E.

*Uraninite*.—Occurs in large masses in the Wood Mine, near Central. Dr. O. Loew publishes the following analysis :

	PER CENT.
Uranoso-uronic acid . . . . .	11.37
Sulphides of iron and copper . . . . .	45.81
Gangue (quartz by difference) . . . . .	42.82
	<hr/>
	100.00

*Uranocalcite*.—Wood Mine, near Central.

*Vesuvianite*.—In large xls. of simple combinations, on Mt. Italia, north of Arkansas River, in granite. E.

*Wavellite*.—South Table Mountain, near Golden. E.

*Wheelerite*.—Described by Dr. Oscar Loew. It is a resin related to amber, and occurs in the lignitic coals. Its existence in each particular instance, however, can only be determined by analysis, on account of its physical resemblance to other resins occurring in the same manner. The following are Dr. Loew's analyses :

	(1)	(2)
	per cent.	per ct.
Carbon . . . . .	73.07	72.87
Hydrogen . . . . .	7.95	7.88
Oxygen . . . . .	18.98	19.25
	<hr/>	<hr/>
	100.00	100.00

*Willemite*.—Jones' Mine, near Nevada. S.

*Wolframite*.—Reported from San Juan. E.

*Wollastonite*.—Occurs in small quantities in some of the limestones near Fairplay. P.

*Wulfenite*.—Found on Gunnell Hill, near Central, and in Park County. S.

*Xenotimite*.—Reported from Cheyenne Mountain. E.

*Zincite*.—Jones Mine, near Nevada. S.



*Zinckenite*.—Sweet Home Mine, Buckskin Gulch, in small xls. P.

*Zippeite*.—Wood Mine, Leavenworth Gulch. E.

*Zircon*.—A few small but very brilliant and fine colored xls. were found by prospectors, in 1866, at the Bear River diggings, west of the Middle Park. Also small xls. are found in the feldspar of Pike's Peak, and in El Paso County. S.

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ALTITUDES IN COLORADO.

The following altitudes are compiled from the lists of Henry Gannett, of the Hayden Survey, and may be relied on as very nearly accurate:

TOWNS.

Alma . . . . .	10,254	Idaho . . . . .	7,512
Black Hawk . . . . .	7,975	Kenosha Summit . . . . .	10,100
Boulder . . . . .	5,536	Lake City . . . . .	8,550
Breckenridge . . . . .	9,674	Las Animas . . . . .	3,952
Cañon City . . . . .		Longmont . . . . .	4,957
Caribou . . . . .	9,905	Manitou . . . . .	6,296
Central City . . . . .	8,300	Old Oro (near Leadville) . . . . .	10,247
Colorado Springs . . . . .	6,032	Pueblo (north) . . . . .	4,713
Denver . . . . .	5,244	Rollinsville . . . . .	8,323
Empire . . . . .	8,583	Rosita . . . . .	8,500
Fairplay . . . . .	9,964	Saguache . . . . .	7,745
Georgetown . . . . .	8,514	Salt Works (South Park) . . . . .	8,917
Gold Hill . . . . .	8,463	Silverton . . . . .	9,400
Golden City . . . . .	5,687	Trinidad . . . . .	6,032
Greeley . . . . .	4,779	White River Agency . . . . .	6,491

MOUNTAIN PEAKS.

Arapahoe Peak . . . . .	13,520	Mount Harvard . . . . .	14,375
Blaine's Peak . . . . .	13,905	Holy Cross Mountain . . . . .	14,176
Blanca Peak . . . . .	14,464	James Peak . . . . .	13,283
Buckskin Mountain . . . . .	14,296	Mount Lincoln . . . . .	14,307
Castle Peak . . . . .	14,115	Long's Peak . . . . .	14,271
Chief . . . . .	11,833	Massive Mountain . . . . .	14,298
Mount Elbert . . . . .	14,351	Pike's Peak . . . . .	14,147
Mount Evans . . . . .	14,330	Quandary Peak . . . . .	14,269
Gray's Peak . . . . .	14,341	Torrey's Peak . . . . .	14,375

PASSES.

Argentine . . . . .	13,100	Marshall's . . . . .	10,852
Berthoud . . . . .	11,349	Mosca . . . . .	9,577
Boulder . . . . .	11,900	Poncho . . . . .	8,945
Cimmaron . . . . .	6,330	Raton . . . . .	5,896
Cochetopa . . . . .	10,032	Sangre de Cristo . . . . .	9,186
Cunningham . . . . .	12,090	Sultan Mountain . . . . .	10,460
Georgia . . . . .	11,811	Tennessee . . . . .	10,418
Hamilton . . . . .	12,370	Trinchera . . . . .	7,079
Hoosier . . . . .	11,500	Trout Creek . . . . .	9,346
Lake Creek . . . . .	12,239	Vasquez . . . . .	11,500

PARKS.

Middle Park (mean) . . . . .	7,500	South Park (mean) . . . . .	9,000
North Park . . . . .	8,500	San Luis Valley (mean) . . . . .	7,500

TIMBER LINE.

Sierra Blanca . . . . .	10,410	Gray's Peak . . . . .	11,100
Pike's Peak . . . . .	11,720	Mount Byers . . . . .	11,400
Buffalo Peak . . . . .	12,041	Mount Lincoln . . . . .	12,051
Cunningham Pass . . . . .	11,500	White Rock Mountain . . . . .	11,919



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