





COLLECTION
OF
WILLIAM SCHAUS
©
PRESENTED
TO THE
NATIONAL MUSEUM
MCMV

QH
105
C6R92
1878
Ent.

ANNUAL REPORT

UPON

EXPLORATIONS AND SURVEYS IN THE DEPARTMENT OF
THE MISSOURI,

BY

E. H. RUFFNER,

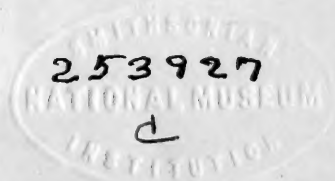
FIRST LIEUTENANT OF ENGINEERS, U. S. A.;

BEING

APPENDIX SS

OF THE

ANNUAL REPORT OF THE CHIEF OF ENGINEERS FOR 1878.



WASHINGTON:
GOVERNMENT PRINTING OFFICE
1878.





DEC 16 1938

[EXTRACT FROM THE ANNUAL REPORT OF THE CHIEF OF ENGINEERS
TO THE SECRETARY OF WAR.]

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., October 19, 1878.

* * * * *

RECONNAISSANCES AND EXPLORATIONS.

The engineer officers on the staffs of the generals commanding the military divisions and departments have been engaged during the year in surveys in the field, and in collecting and plotting geographical and other information obtained from the note-books, sketches, and maps made by the officers and soldiers in the scouts and campaigns in the West. The estimate of \$50,000 made by this department for the surveys by these officers failed at the last session of Congress, thus leaving unprovided for the work which was desired to be accomplished in the seven military departments embracing the country west of the Mississippi River, in each one of which there is an engineer or acting engineer officer. This work includes surveys in the field by the department engineers, the purchase and repair of instruments, and the expenses attending the draughting and printing of maps required for distribution to the Army.

The maps of the country covered by the recent campaigns against hostile Indians have proved in the highest degree useful to the officers engaged, and it is especially desirable that the great unexplored areas in the hostile country, and areas which in future campaigns are liable to be traversed by the troops, or by the enemy, should be surveyed and plotted and added to these campaign maps. The enlistment of topographical assistants to the engineer officers attached to the headquarters of each of the Western military geographical divisions and departments, which was authorized by the Secretary of War in July, 1877, will very much facilitate the surveys of those officers, and it is hoped, if the small appropriation asked for these surveys is granted by Congress, that much more can be accomplished than has been heretofore by the same amount of expenditure.

An estimate for the amount required to be appropriated for this purpose has been included in the estimate of this department.

* * * * *

Lieut. E. H. Ruffner, on the staff of the general commanding the Department of the Missouri, reports that but little progress has been made during the past year in the preparation of maps, or in the examination and survey of new country. Want of means and small number of troops in the department available for marches or scouts are assigned as the reasons. The total mileage of journals of scouts and marches is given at 7,214, and an additional 2,030 miles for the reconnaissance in Southwest Colorado conducted by Lieut. C. A. H. McCauley, Third Artillery, assistant to Lieutenant Ruffner. This report is submitted by Lieutenant McCauley, and is considered as very valuable and of interest to all connected with that region of country.

An edition of map No. 2, Department of the Missouri, revised and corrected to date, was issued last fall. Lieutenant Ruffner submitted a second report on lines of communication between Colorado and New Mexico, which was printed as Ex. Doc. No. 66, House of Representatives, Forty-fifth Congress, second session. The report covers 38 pages of print, and is accompanied by three maps.

Lieutenant Ruffner has employed his spare time during the year in preparing a compilation or descriptive index of the reports of the Corps of Engineers for the ten years 1866-1876, entitled "A Record of Ten Years of Engineering by the Corps of Engineers, U. S. A." The manuscript is now completed.

(See Appendix S S.)

* * * * *

ERRATA.

[Appendix S S, Annual Report of the Chief of Engineers, 1878.]

- Page 1750, line 4 from bottom, for "mess" read "mesa."
Page 1754, line 24, omit "south."
Page 1754, line 36, for "peak" read "summit."
Page 1755, line 17, for "Pundio Pass," read "Puncho Pass."
Page 1755, line 42, for "hillrocks" read "hillock."
Page 1756, line 23 from bottom, for "rivers" read "views."
Page 1760, line 40, for "summit" read "Summit."
Page 1763, line 18, for "stage" read "stages."
Page 1766, line 8, for "flourishing" read "flourishes."
Page 1766, line 14 from bottom, for "and noticed" read "and were noticed."
Page 1768, line 17, for "declaring" read "declared."
Page 1768, line 31, for "it" read "its."
Page 1768, line 11 from bottom, for "burned" read "buried."
Page 1769, line 20, for "Southern" read "Eastern."
Page 1770, line 30 from bottom, for "are merged" read "is merged."
Page 1771, line 20 from bottom, for "then" read "there."
Page 1772, strike out quotation marks before and after "fine."
Page 1774, line 12, for "indicating action" read "indicating watery action."
Page 1775, line 41, for "east" read "west."
Page 1775, line 46, after "valley," insert "there results."
Page 1776, line 9, for "locatted" read "located."
Page 1778, line 22 from bottom, for "value of" read "value for."
Page 1778, line 14 from bottom, for "along on a" read "along a."
Page 1779, line 4, insert "and" before "received."
Page 1779, line 5 from bottom, for "Sierra Carriza" read "Sierra Carrizo."
Page 1780, line 38, for "is" read "in."
Page 1780, line 41, for "rise" read "rises."
Page 1780, line 2 from bottom, for "provided" read "obtained."
Page 1781, lines 11 and 12, for "Pay-Utes" read "Pah-Utes."
Page 1781, line 27, for "from Mancos" read "from the Mancos."
Page 1782, line 34, for "mountainous" read "monotonous."
Page 1782, line 37, for "is a" read "is all a."
Page 1783, line 10, omit comma after "beyond."
Page 1783, line 29, omit quotation marks before and after "Lake City."
Page 1783, lines 15 and 16 from bottom, omit quotation marks before and after "Wagon Wheel Gap."
Page 1783, line 6 from bottom, for "Ionea" read "Loma."
Page 1785, line 23, for "90°" read "90°."
Page 1785, last line, for "Ternichi" read "Tomichi."
Page 1787, line 5, for "at Mexican" read "at the Mexican."
Page 1787, line 11 from bottom, for "Chavez's" read "Valdez."
Page 1787, line 9 from bottom, for "rivers" read "wagons."
Page 1788, line 1, for "Caledonia" read "Celedonia."
Page 1788, line 31, for "Chavez" read "Valdez."
Page 1791, line 13 from bottom, insert comma after "below," and omit comma after "valley."
Page 1796, line 7, for "Pogosa" read "Pagosa."
Page 1797, line 25 from bottom, for "Animas" read "Animas Forks."
Page 1797, line 9 from bottom, for "toll-road" read "county-road."
Page 1797, line 5 from bottom, for "lake" read "Lake."
Page 1798, line 13, for "forms" read "from."
Page 1798, line 33, for "100" read "110."
Page 1800, line 15 from bottom, for "100" read "90."
Page 1800, last line, for "therefore" read "therefor."
Page 1802, line 14 from bottom, for "summit" read "Summit."
Page 1803, line 29 from bottom, for "covers" read "comes."
Page 1805, line 13 from bottom, for "Front Lake" read "Trout Lake."
Page 1806, line 33, for "Abiquin" read "Abiquiu."
Page 1806, line 42, for "though to" read "though known to."
Page 1807, line 16, for "Zan Miguel" read "San Miguel."
Page 1811, line 8 from bottom, for "100" read "110."

- Page 1812, line 15, for "with" read "without."
 Page 1816, line 23, for "highest mine" read "highest gold mine."
 Page 1816, line 4 of table, for "The Adams Miller" read "The Adams."
 Page 1819, last line, for "Atrastro" read "Arastro."
 Page 1823, line 26 from bottom, for "quinches" read "9 inches."
 Page 1825, line 7, for "lixiviature" read "lixiviation."
 Page 1825, line 20, for "Hillsdale" read "Hinsdale."
 Page 1825, line 27, for "nearly" read "near by."
 Page 1825, lines 32 and 33, for "diocrasite" read "discrasite."
 Page 1825, line 33, for "pyragyrite" read "pyrargyrite."
 Page 1825, line 7 from bottom, for "Read" read "Red."
 Page 1826, line 15, for "120" read "130."
 Page 1826, line 32, for "Out Pat" read "Our Pat."
 Page 1828, line 22 from bottom, for "Ute" read "Ule."
 Page 1832, line 13, for "Galma" read "Galena."
 Page 1833, line 31 from bottom, for "Ranunculus nivalis L.," read "Ranunculus pygmaeus."
 Page 1833, line 29 from bottom, for "cymbalaria" read "Cymbalaria."
 Page 1834, line 2, for "Aralis" read "Arabis."
 Page 1834, line 3, for "Cardanime" read "Cardamine."
 Page 1834, line 4 from bottom, for "Nigundo" read "Negundo."
 Page 1835, line 26, for "Nufkanas" read "Nufkanus."
 Page 1835, line 27, for "rarely" read "rare."
 Page 1835, line 37, after "Potentilla Pennsylvanica, L., var." insert "Strigosa, Pursh."
 Page 1835, line 4 from bottom, for "aaueum" read "aureum."
 Page 1835, line 2 from bottom, for "L." read "DC."
 Page 1836, line 22, for "scopularum" read "scopulorum."
 Page 1836, line 6 from bottom, after "Solidago virgo-aurea, L., var." insert "Mullt-radiata, Torr. & Gray."
 Page 1838, line 17, for "Brug." read "Bong."
 Page 1838, line 25, for "grœnlandica" read "Grœnlandica."
 Page 1838, line 37, after "Stachys palustris, L., var. (240)" insert "cordata, Gray."
 Page 1839, line 17, "*Polygonum viviparum*" should be printed in Roman type.
 Page 1839, line 19, "*Polygonum Bistorta*" should be printed in Roman type.
 Page 1839, line 27, for "Comandra pallida" read "Comandra pallida DC."
 Page 1839, line 7 from bottom, for "Vexatrum" read "Veratrum."
 Page 1840, line 9, for "Burg." read "Bong."
 Page 1840, line 32, for "rizopyrum" read "Brizopyrum."
 Page 1840, line 20 from bottom, for "canicum," read "caninum."
 Page 1840, line 17 from bottom, for "strigosun" read "strigosum."

APPENDIX S S.

ANNUAL REPORT OF LIEUTENANT E. H. RUFFNER, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1878.

EXPLORATIONS AND SURVEYS IN THE DEPARTMENT OF THE MISSOURI.

HEADQUARTERS DEPARTMENT OF THE MISSOURI,
OFFICE OF THE CHIEF ENGINEER,
Fort Leavenworth, Kans., July 22, 1878.

SIR: In rendering you my annual report for the fiscal year ending June 30, 1878, I regret to say that the operations of the office have been very meager. There being but a small sum at my disposal, no opportunity has arisen to conduct surveys, and beyond the routine calls upon the draughtsmen no maps have been prepared.

An edition of sheet No. 2, Department of the Missouri, revised and corrected to date, was engraved and issued last fall.

The total mileage of journals of marches and scouts recorded in this office for the calendar year 1877 was 7,214; and the mileage of reconnaissance in the southwest of Colorado, conducted by Lieut. C. A. H. McCauley, my assistant, was 2,030 miles.

The report of Lieutenant McCauley, herewith submitted, illustrates what may be done by the indefatigable energy and untiring industry of one man. The results of his observations are given in a shape which presents the present condition of that section of country in a manner which will be of interest to all connected with it. Great credit should be given to Lieutenant McCauley for his systematic collection of notes and carefully prepared report, and it is suggested that a large edition of it be prepared separately for distribution to the many who are seeking information of this section.

A second report on lines of communication between Colorado and New Mexico, in which much of Lieutenant McCauley's notes were used, was submitted to the department commander on January 11, 1878, and was printed March 9, 1878, as Ex. Doc. No. 66, House of Representatives, Forty-fifth Congress, second session. This report covers 38 pages of print and is accompanied by three maps. In accordance with its recommendations an appropriation was made by Congress of \$5,000, to commence the roads required. This amount will not complete what was desired, as the estimates called for \$24,000.

I have employed my spare time during the year in the compilation of a work which has been thought necessary, and of which the title-page and table of contents are herewith submitted. The manuscript of this work is now in the hands of the Chief of Engineers.

All of which is respectfully submitted.

E. H. RUFFNER,
First Lieutenant of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT ON THE SAN JUAN RECONNAISSANCE OF 1877, BY LIEUTENANT C. A. H. M'CAULEY, THIRD ARTILLERY, IN CHARGE.

LETTER OF TRANSMITTAL.

HEADQUARTERS DEPARTMENT OF THE MISSOURI,
OFFICE OF THE CHIEF ENGINEER,
Fort Leavenworth, Kans., July 15, 1878.

SIR: I have the honor to transmit herewith my report of the San Juan reconnaissance of 1877, made pursuant to Special Orders No. 106, Headquarters, Department of the Missouri, June 6, 1877, and instructions in detail that were furnished me.

The country examined consisted of that part of Southwest Colorado which is known as the San Juan Region and a portion of New Mexico. Leaving Fort Leavenworth June 10, 1877, for Fort Garland, Colo., the rendezvous of the party, an escort was obtained there consisting of First Lieut. G. Valois and 22 men of the Ninth Cavalry, and the field taken June 20; being absent from Fort Leavenworth five months, of which time 123 days were in the field, 96 different camps were occupied, not including those of a supply nature.

The total distance traveled after leaving Fort Garland was 2,030 miles; this was wholly in the field, mainly with pack-trains, and is confined to that made in person, not including the mileage made by detached wagon and pack trains, or by any members of my party unaccompanied by myself.

Of the total, 1,850 miles were meander work, careful topographical notes, &c., being taken.

In addition to the regular work of the reconnaissance and the special orders in detail regarding the selection of a site for a new military post in the San Juan region, the relations between the Indians and white settlers, the intertribal relations among the Indians themselves (the three southern tribes of Utes being disaffected), and matters upon which reports not intended for publication have been rendered to the department commander, a representation of the flora, the avifauna, &c., was essayed, in accordance with my instructions that "natural history collections made would be of interest," with the following results:

In botany, a collection of 1,300 specimens, the classification of which was made by Prof. Asa Gray, and will be found in Chapter VI, relating thereto. The notes of Mr. T. S. Brandegee, civil engineer, of Canyon City, Colo., the only botanist personally acquainted with the San Juan country, were contributed gratis, and will be found in the same chapter.

In zoology, between one and two thousand of the *Articulata*, especial attention being paid to the *Lepidoptera*, *Coleoptera*, *Neuroptera*, and the *Acrididae* of the *Orthoptera*.

Classification and report upon the *Orthoptera* was made by Prof. Cyrus Thomas; upon the *Lepidoptera*, &c., by Prof. Herman Strecker, the subjects treated being contained in Chapter VII, in Entomology. Being now under orders to proceed to the field for duty with the commission appointed by the President to treat with the Ute Indians, and to make further "explorations in the San Juan country and portions of Colorado beyond," the reports of Professor Strecker, which are not yet completed, will be forwarded by him to the Chief of Engineers direct about the 15th proximo.

A general collection of the *Vertebrata* (skins), embracing mammals, birds, and fishes, was also made. The classification and report in preparation by the writer has not been concluded, and is retained for future use.

A general collection of mineralogy, consisting of about 800 specimens, largely gold and silver ore from the various mining districts, to accompany statistical and descriptive memoranda, all of which will be found in Chapter V; a number of fossils were also collected, no examination or report on which has as yet been made.

A large quantity of fragmentary pottery, &c., of the Aztec (so called) or prehistoric dwellers in mess houses previously known, and also found on the Rio Piedra, the Upper and Lower Rio de las Animas, and, in addition, upon the dry and desert region south of the Rio Dolores, sketches of habitations, masonry, &c., accompanying. Photographs of a cranium, sent to the Army Medical Museum, were furnished through the kindness

of Asst. Surg. George A. Otis, curator. The notes taken are not in shape for publication, and are retained for future use.

Specimens from mineral and thermal springs were shipped to Washington for analysis promised by a government chemist; owing to a great press of business, as we were informed, the waters were overlooked, and no report thereon can consequently be furnished.

In accordance with instructions, outline and brush sketches in pencil and water-color were taken at various points, a few of which are transmitted.

An effort has been made to render the report as interesting as possible, the great drawback being that no money was available for assistance or other purposes during the reconnaissance and pending the preparation of the report; in consequence thereof, both labor and time, which they could ill afford to spare, had to be asked of scientific men in the specialties hereafter treated.

I desire to tender my thanks to all who have furnished me information and aid at various points when in the field and since, and especially to Lieutenant Valois, who performed the not wholly pleasant duties of quartermaster of the expedition, with the labor incident thereto, in addition to escorting an officer whom he "ranked"; to Major Shorkley, commanding officer; and Captain Bean, quartermaster at Fort Garland, the base of supplies; and to Dr. P. G. Skillern, of the University of Pennsylvania, whose medical attendance on the expedition for over three months was without cost to the government.

I am, sir, very respectfully, your obedient servant,

C. A. H. MCCAULEY,
*Second Lieutenant Third Artillery, Acting Engineer Officer,
In charge San Juan Reconnaissance.*

Lieut. E. H. RUFFNER,
*United States Engineers, Chief Engineer Department of the Missouri,
Fort Leavenworth, Kans.*

CONTENTS.

CHAPTER I.—THE COUNTRY AND ITS NATURE:

- I. Its name, area, and early settlement.
- II. Its general character.
- III. Trends of slopes.
- IV. Seasons.
- V. Climate.

CHAPTER II.—AGRICULTURAL AND PASTORAL PURSUITS.

CHAPTER III.—LINES OF COMMUNICATION:

- I. Railroads.
- II. Wagon-roads.
- III. Trails.

CHAPTER IV.—POPULATION.

CHAPTER V.—MINES AND MINERAL WEALTH.

CHAPTER VI.—BOTANY:

- I. Classification of collection by Prof. Asa Gray.
- II. Notes on the botany of the San Juan by Mr. T. S. Brandege, C. E.

CHAPTER VII.—ENTOMOLOGY:

- I. Classification and reports on Orthoptera by Prof. Cyrus Thomas.
- II. Classification and reports on Lepidoptera by Prof. Herman Strecker.

THE SAN JUAN REGION.

CHAPTER I.—THE COUNTRY AND ITS NATURE.

SECTION I.—ITS NAME, AREA, AND EARLY SETTLEMENT.

The noted region known as the San Juan country, bidding fair to become in time one of the richest silver-producing sections in the world, is that portion of Colorado lying in the southwestern part of the State, to which of late emigration has rapidly increased, and the attention of capital been attracted by its fine agricultural valleys and the great mineral wealth of its mountains, so that in remote localities several towns and numerous settlements have sprung into existence, while much of the country has been occupied with a view to farming and pastoral pursuits.

The appellation of San Juan is derived from the river of the same name, into which pour all the streams and waters of the lower country.

Long before the advent of the white man upon the continent its banks teemed with an unknown population, of whose habits and mode of life history speaks not and tradition is silent, with naught to aid the intelligent investigator save fragmentary pottery and the ruins of their dwellings. After long lapses of time their former lands are being occupied by the progressive Anglo-Saxon in his inexorable movement westward.

Within the last quarter of a century the country had been penetrated in part by explorers, and reports of the wonderful wealth in its mountains had attracted thither, at the risk of death from hostile red men, numbers of prospectors. A tide of immigration set in, and nearly two decades have passed since the same kind of adventurous spirits as at present may be found there were flocking to the country. Disappointments, continual attacks of hostile Indians, and other causes combined to stay the tide, and with its reflux the lands were left to the tribes that possessed them by virtue of original habitation.

An immense wilderness, unoccupied by whites, the country remained comparatively unnoticed or forgotten until 1870, when it was again penetrated by a small party of prospectors, with the resulting discovery, near the present town of Silverton, of the "Little Giant," a gold lode famous for the value of its ore and notorious in subsequent litigation. Their wonderful discovery, bruited abroad, was the cause of another influx, solely of hardy prospectors, resulting in the establishment of a permanent population.

In the treaty of March 2, 1868, setting aside for the Utes all (save a fragment) of Colorado west of the 107th meridian, the San Juan land had become a definite portion of the Indian reserve. Despite treaty obligations, which solemnly declared that their land should not be penetrated for any purpose whatever, small incursions of prospectors into the Indian reserve occurred at intervals, but without success. Wherever appearing and locating, they were met by the Indians, whose numbers and hostility were too powerful to be overcome by the settlers within their country.

The discovery of the Little Giant and its wonderful wealth, spreading like wildfire, was followed by so large an immigration, backed by political influence, that the intruders could not be expelled.

It was the old, old story of the government preserving an Indian treaty inviolate, a solemn guarantee strictly kept, till the land becomes worth its breaking.

In brief, the white man demanded the valuable territory of the weaker one, and force compelled him to yield. What is generally known as the Brunot convention, from the name of the United States Commissioner, ensued. Articles of agreement for the cession of the San Juan were entered into September 13, 1873, by the Confederate Utes, and the necessary ratification made by Congress April 29, 1874.

The portion opened to settlement in accordance with the Brunot convention of 1874 and the territory proper of the San Juan is bounded on the east by the 107th meridian, and limited upon the south, west, and north by the line of the present reserve, rectangular in shape, save the break in the north of the Uncompahgre Park, which is Indian land. It comprises in part the county of Conejos, nearly all of Hinsdale, Ouray, and La Plata, and entirely San Juan, with a total area slightly exceeding 6,000 square miles.

Under the general name of the San Juan country, however, are commonly denoted sections contiguous thereto, but outlying the San Juan proper, such as the Summit Mining District, Del Norte, and many other points. If, therefore, we liberally include the region west of the Sangre de Cristo Range as far north as Saguache, all of which is directly interested in the industries of the mining country and is adjacent thereto, we shall have, including but a small part of the Indian reserve, a total area of 13,000 square miles, one-eighth of the entire State, and an area equal to that of Massachusetts, Rhode Island, and Connecticut combined.

SECTION II.—ITS GENERAL CHARACTER.

For convenience of treatment of the San Juan proper, the main agricultural region, watered by streams and rivers springing from the summits and flowing from the southern and western trend of the range, all on the Pacific watershed, may be distinguished as the lower country; the rest the upper. In the former are included the valley of the great San Juan River and those of its tributaries, the Navajo, the Blanco, the Piedra with its branch the Nutria, the Los Pinos and its West Fork, or the Vallecito, the Animas with its affluent, the Florida, the La Plata, and the Mancos, all flowing in a general direction to the south and southwest.

The San Juan itself passes into New Mexico some 20 miles south of the Colorado line, and after receiving the Animas and the La Plata, changes to the northwest, approaches so closely the point common to New Mexico, Colorado, and Arizona, that after leaving New Mexico but little over two miles of Colorado soil is watered ere it has entered the arid waste of Utah.

That part of the Rocky Mountain system which is seen from the great plains of Colorado as we approach from the east, extending from latitude $38^{\circ} 30'$ south to the line of New Mexico, latitude 37° north, is known as the Sangre de Cristo Range. Its name, the "Blood of Christ," arose from the prevailing color of the rocks, and was given by the Spanish settlers of the country. Here and hereabout was formerly drawn an ethnical line of settlement, which extended west through much of the San Juan, as the general nomenclature will indicate; almost wholly on the north are the inhabitants Anglo-Saxons, while upon the east the rivers' names are chiefly of Spanish origin, the Purgatoire excepted. The designation of this stream by some explorer or immigrant in the language of lovely France has not been successful; it is so written or printed only, it is never heard or spoken, and instead of the name with a Parisian accent or English signification, the stream is everywhere known as the "Picket-wire."

While it contains, it is said, the loftiest peak of the chain in the United States, known as Sierra Blanca, 14,464 feet, a magnificent peak rising abruptly from the plain upon which it stands, nearly 7,000 feet, the post of Fort Garland being at its base, the Sangre de Cristo is not a part of the main continental divide, the great backbone of the continent, for down its western slopes find their way streams that flow into the Atlantic, tributaries of the Rio Grande.

West of the range exists a great depression, the San Luis Valley, whose synclinal axis lies slightly east of south and has the area of its upper part much contracted by this mountain range in its westward tendency to meet the great continental divide. From this point, the great divide, till its passage into New Mexico, assumes the shape of a great **V**, with the vertex to the west; the width at its mouth, the distance in an air line from summit to summit being over a hundred miles. The Sangre de Cristo slopes to the southeast, so that upon the border of New Mexico its mountain tops are 80 miles east from the top of the great watershed, the most southern point of the <.

THE RIVERS.

Springing from the very summits at the vertex of the divide, fed by banks of eternal snow, is the Rio Grande, a clear and beautiful stream, flowing down to the east through the center. Leaving the mountain slopes at Del Norte, it passes southeast and south through San Luis Valley on its long passage to the sea, where it differs as radically from its clear and lovely upper waters as do the country and climate from those of its origin.

The lower part of the < or great divide is known locally as the San Juan Mountains, well named, for while their eastern slopes are washed by streams flowing to the Rio Grande, of all the waters draining their western slopes, already called the "lower country" of this region, the San Juan is the great receptacle.

Close by the vertex of the <, flowing south, is the Animas, rising a dozen miles to the north in the Uncompahgre Mountains. Immediately to the west, beyond the divide of the Animas, rises the Dolores, and hard by, scarcely 2 miles away, the San Miguel. The latter flows directly northwest, emptying into the Dolores, which, passing southwest and northwest in the shape of a rude **U**, has traversed twice the distance of the San Miguel, and is itself a feeder of the Grand in Utah.

The western ends of the Uncompahgre Mountains are washed by waters belonging to the San Miguel; their northern slopes are drained by the river of the same name, and in part by streams flowing, like the Uncompahgre itself, into the Gunnison. The latter, rising far to the north, has a general westerly course, flows into the Grand, and, watering a magnificent country, has for its tributaries streams that drain some of the finest mineral and agricultural land in the State, a large part of which, however, is the territory of the savage.

THE SAN LUIS VALLEY.

The great San Luis Valley, properly so called, though often alluded to as a park, is bounded on the east by the Sangre de Cristo Range of the Rocky Mountain system, on the west by the San Juan and other mountains, constituting the great continental divide. Although partially in New Mexico, it lies chiefly in Colorado, extending from the point where the Rio Grande crosses the line of New Mexico, nearly 100 miles in direction west of north, with a varying width, being at different places 40 miles across in an air line.

In its northern part it is drained by the San Luis Creek, rising in the extreme north near the Pundio Pass, receiving the Saguache Creek from the west.

The Sangre de Cristo Range, rising to over 13,000 feet, has for its prominent passes the Pundio in the north, the Mosca in the east, and the Sangre de Cristo and Abeyta, further south, the latter two continuous depressions in the range, all four being utilized as passage-ways for wagon-roads. A point near the Abeyta has enabled the Denver and Rio Grande Railroad (narrow gauge) to surmount the range and enter the San Luis Valley. Upon the western side the slopes of the range are far more abrupt than upon the eastern. This causes more rapid flow of the streams entering the valley, and in its upper part a large number disappear in the sandy soil, reaching the deepest depression of the valley underground. The San Luis lakes are without an outlet, and owing to the almost level surface of the water-flow, a series of swamps arise, advancing and retreating in area with the rise and fall of the streams, the surfaces being the haunts of myriads of water fowl.

Upon the western side of the valley, emerging from the mountains as if from a gateway, at Del Norte appears the Rio Grande coursing southeast and then to the south, gathering in the Alamosa, La Jara, and Conejos on the west, the Trinchera, the Culebra, and Costilla upon the east; all streams that enter the valley upon either side above these are totally lost.

About 6 miles below the Culebra's mouth, not far below the Chavez ferry, where the plain is 25 feet above the water, its surface heightens to the south, and the cañon of the Rio Grande begins. Deepening as it proceeds, till it is nearly 1,000 feet below the surface, with basaltic sides almost of bare cliffs, it presents a vast gorge, bespeaking the ruin of the past, through which the river has forced its passage.

The steep mountain sides, bounding the valley; the glistening dunes piled about the Mosca Pass; the depression in its central part receiving all but not yielding any waters that flow to it, the little hillrocks of sand lower down, with long stretches encountered, from which the whirling winds toss up sandy pillars that may be often noticed to an immense height flying here and there; the rise in the plain to the south and the cañon beyond of undoubted aqueous erosion, all suggest the vast inland sea of the great geological past, when the land above possessed a vegetation at present unknown; and on water and shore were probably mammalia compared to which ours are scarcely more than pigmies.

MOUNTAIN RANGES AND DETACHED SPURS.

The large number of outlying masses, separate sierras, and detached spurs from the main range, all part and parcel of the Rocky Mountain system, within the San Juan proper, may be best understood by assuming the vertex of the great < of the continental divide as the center of a square whose side is 30 miles, within which will be found more than 240 lofty peaks rising in every direction from 10,000 to 14,000 feet in height, silent monuments of the gigantic upheavals of nature. So complicated is the topography of this region that a thorough orographic description, defining and delineating in detail the various geological axes of the distinct sierras or detached groups, with their separate radial axes referred to geometrical figures, would, unless of great length, be so complicated and perplexing as to result in little save confusion worse confounded. We will therefore attempt but a general summary of the largest masses with reference to the great divide, and the rivers already mentioned.

The section within this square has been aptly likened to one of the "domes of the continent." It certainly is so of the Rocky Mountain system within the United States. Nowhere can be found, for such an area, so great a precipitation. Loftier peaks than rise in the continental divide are found without it, particularly north of the vertex; the rivers rise here and flow to every point of the compass, as a casual glance at the map will demonstrate. The Rio Grande to the east, draining the in-

terior slopes of the great \angle , the San Juan, the Los Pinos, and others on the southern side of the lower part bound south and southwest; the Animas, immediately west of the vertex, has forced a passage to the south through the mountain barriers in an enormous gorge; the Dolores and San Miguel to the west of the divide of the Animas west and northwest; the Uncompahgre beyond the source of the Animas to the north and northwest, while near by is the Lake Fork of the Gunnison flowing south, then east, and finally to the north into that river.

THE PAGOSA SPUR.

One of the handsome spurs in the lower San Juan is the divide between the headwaters of San Juan and the Piedra, extending from the main range some 12 miles to the southwest and terminating in a very handsome pyramidal peak, rising symmetrically from the mountains about, giving the general effect of a towering central spire in some fine architectural structure. Although but 12,674 feet in height, the lower elevations adjoining render it a fine point for triangulation, especially from the east, south, and west, for which it has been utilized by both the Wheeler and Hayden engineers. Its name was derived from the celebrated Pagosa Springs of Indian nomenclature, which it overlooks.

THE NEEDLES

The most remarkable geological formation certainly in Colorado, and probably in the entire country, is to the west, mainly between the Los Pinos and the Animas Rivers, south of the great divide, and particularly about the heads of the Florida, Animas tributaries, and those of the Vallecito or West Fork of the Pinos. They are designated as the Quartzite Group or Crags by the geographers, but are locally known as the "Needles."

The metamorphic changes by which the rocks were altered to quartzite, with the crystallization peculiar thereto, together with the terrible upheavals and convulsions of nature attending these alterations, have combined to distort the strata and render the peaks more rugged than any elsewhere to be found.

Their name arises from their appearance at a short distance. Instead of encircling in graceful rounded slopes, mountain valleys, well timbered and full of nutritious grasses, they rise precipitously, abruptly, with sharp summits, with thin and pointed tops, most veritable crags. Ascents with animals are impossible; on foot it is a matter of extreme difficulty and often bodily suffering. Rising to heights of 12,000 to 14,000 feet, even when there is a way to reach their summits, it is only accomplished by climbing up rock over rock, or over slopes and *débris* at the foot, lying as steeply as hard rocks will lie, the flint-like edges cutting boots and shoes invariably. This mass of steep, precipitous slopes, with ravines between well-nigh impassable, without grazing in their limits proper, can play but one part in the future economy of the San Juan, that of a portion of its mineral wealth, to be hereafter noticed. Two outline sketches (Plate I) herewith accompanying, giving east and west rivers from a peak at the headwaters of the West Fork of the Vallecito (Camp 52), will serve to convey an idea of the formations described.

THE LA PLATA MOUNTAINS.

The next range to the west appearing to the traveler in the lower San Juan is the La Plata Group, a number of peaks at the lower end of the huge divide between the waters of the Animas and those to the west. They trend gently to the west and east, and end abruptly to the south, where the La Plata River emerges from the mountains, between which, for a dozen miles or more, it has coursed its way southwest and south.

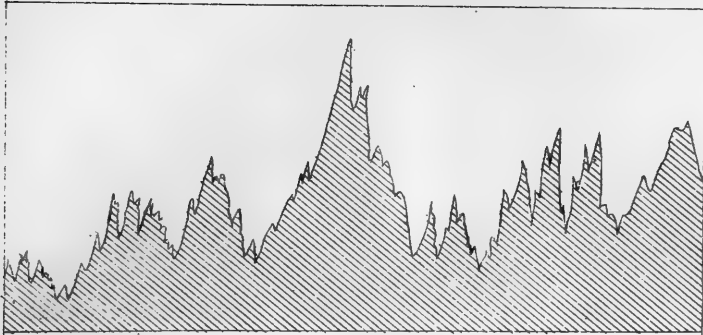
At this point of departure from the mountains, beautifully situated on a wide plateau, is Parrott City, the attractions being the lodes of silver, whence the river and mountains derive their name, and the placer deposits claimed to exist along the stream.

BAKER'S PARK.

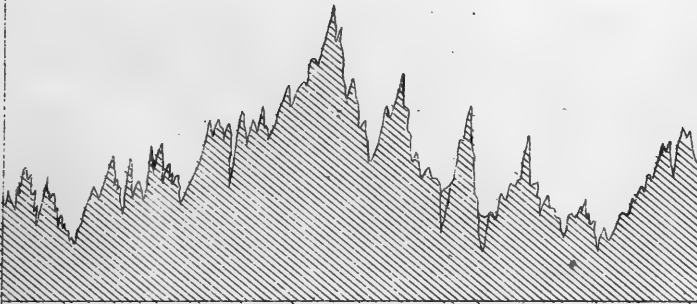
Passing up the valley of the Animas through the lovely part which the river waters and the Grand Cañon beyond, an immense gorge, varying in depth from the summits of the quartzite peaks on either side 3,000 to as great as 5,000 feet, Baker's Park is reached, noteworthy for its topographical features and for the mining interests here centered. It extends from the mouth of Mineral Creek up the Animas as far as Eureka, 10 miles along the river, with a general width of about $\frac{1}{2}$ mile. The park proper, however, is only the lower part, where at Mineral Creek it is 2 miles wide, narrowing to the north, about 3 miles in length along the stream, containing perhaps 2,500 acres.

We here pause to note this remarkable level piece of land, completely encircled by mountains rising abruptly about 4,000 feet above it, excessively steep as are all the

Plate I.



Outline of peaks and
ridges of the Animas watershed,
Angle N. 49° W. magnetic.



Outline of peaks and
ridges of the Vallecito Watershed
Angle N. 64° E. magnetic.

THE NEEDLE MOUNTAINS.

Outline Sketches from station on ridge above
Lake Columbine at head of West Fork
of Vallecito.

Sept. 4th 1878.



peaks bordering directly along the river. It lies, so to speak, like a little spot at the bottom of an immense bowl, whose sides tower nearly a mile into the skies above; the mountains are huge sugar-loaf masses of trachyte, fearfully irregular; no gentle slopes are present, but successive cliffs, with *débris* between, sheer precipices from 400 to 1,000 feet being observed; narrow gulches, at whose upper ends alone are passes found, separate the peaks themselves, while over the sides with rapid flow dash down the mountain-streams at angles from 40° to 75° into the gulches or the park below.

By whatever pass you descend to the park there obtains to the newcomer therein a sensation of confinement, a feeling of insecurity and dread, as if the huge crags above, placed around by gigantic upheavals, might totter and move from their bases; and you involuntarily contrast the situation with the huge park of the Animas below, which is passed through with a feeling of pleasure and admiration in viewing its scenic beauty. This is properly but a widening of the river's cañon; below there are places in the grand cañon of 250 yards in width, but of small extent; here it suddenly widens out to over 2,500, and the far-famed Baker's Park is the result. Elsewhere a park of this size would not seem unusual; here it is very attractive, and whether it be reached by the ascent of the cañon of the Animas, or by descent from any of the lofty mountain passes that guard it in every other direction, one is duly impressed with the remarkable topography of the situation. Viewed in the light of its central position in an immense storehouse of mineral wealth, as the seat of population and industry, as a basis of supply and a point whence all business must radiate and return, it assumes an additional importance not before possessed.

THE SAN MIGUEL MOUNTAINS.

West from San Miguel or Trout Lake, so called from its abounding in fish at an unusually high altitude, stretches, as a divide between the Dolores and San Miguel, a group known as the San Miguel Mountains, a number of the peaks exceeding 14,000 feet. To the peaks themselves names various and unlike have been assigned by the engineers of the different government parties surveying them. While this serves an economical purpose in perpetuating honor upon several individuals by the use of the same identical point, it is rather perplexing to the student of geography.

The region of the San Miguel is one of the most promising of the undeveloped sections.

THE LAKE FORK MOUNTAINS.

Passing up the Animas River, east from its headwaters and north from the vertex of the great divide, there are found several lofty peaks, about 14,000 feet, the topmost summit being known as Handie's Peak, on whose slopes are the American Basin and Burrows Park, promising mining-camps.

From its slopes flow down waters of the Lake Fork of the Gunnison, so called because the stream, an affluent of the Gunnison, widens out into a large and beautiful lake, called San Cristobal, or Saint Christopher, ere it leaves the mountain region. Apparently undecided in its course, this stream, after flowing to the south, turns to the east, and then assumes a northerly direction, which it follows until the Gunnison is reached. Over 20 miles from its head is Lake City, the most promising town in the San Juan, at the mouth of Hensen Creek, a tributary whose headwaters are not far distant, and whose course is a little north of due east.

Between Hensen Creek and the Lake Fork are the Lake Fork Mountains. While they might be adjudged but a part of the Uncompahgres themselves, from which they are separated by the gorge of Hensen Creek, they may be otherwise known from their being almost entirely encircled by the waters of the two streams mentioned.

Approaching them from any direction at a distance, they do not give that deep impression which a closer view imparts. Instead of low peaks not excessively loftier than their surroundings, you come upon deep gorges, cut by the streams washing their bases, whence rise up peaks from 3,000 to nearly 4,000 feet above, a magnificent range with graceful contours and sky-lines, deep cañons, and dashing mountain-torrents. A large lake below, in whose surface are reflected the high colors of its rocks, contrasting with the timber beneath, completes one of the handsomest mountain landscapes in the entire region. Its wealth of mineral has, moreover, attracted thither more capital than any other place in the Territory, and prosperity of a substantial nature undoubtedly exists.

THE UNCOMPAHGRE MOUNTAINS.

This range is situated at the headwaters of the Uncompahgre River and contiguous streams, and is drained upon the south by Hensen Creek and streams of the San Miguel; by the latter on the west, by the Uncompahgre and Lake Fork waters upon the north, and by the latter also upon the east. Except the Elk Mountains, this is

the farthest north of the mineral ranges of the San Juan, and has furnished some of the finest mines of the entire region.

The Uncompahgre Peak is, in its eastern part, the highest point, rising to beyond 14,400 feet, a huge precipitous mass. In its western portion, Mount Sneffles is the loftiest, being over 14,200 feet. The latter is the best known and the most important in the range on account of its mineral wealth. This has been mapped as Blaine's Peak, in honor probably of the distinguished Senator, in some of the maps of this region. By the latter name, however, can it scarcely be perpetuated, as it has long been differently called, and, being the seat of most valuable and important mining deposits, by official records it has been otherwise designated.

To the northwest the mountains slope into the Great Uncompahgre Plateau, the divide between the waters of the San Miguel on the west and those of the Uncompahgre and the Gunnison on the east. The slopes on the mountains on the immediate north are excessively steep, and the streams have cut most frightful cañons. Not content with penetrating the deep volcanic rock, they have passed into the underlying sandstones.

The lovely park of the Uncompahgre lies below, inaccessible, intervening a succession of precipices, dashing torrents, huge boulders, and fallen timber crossed and interwoven. The only passage-way is a steep and dangerous trail leading through this scene of desolation, and the journey to the park below is not made without personal danger.

Beyond stretches the great and rich agricultural valley of the Uncompahgre, from which settlers are now interdicted, it being upon the Indian reserve.

THE RIO GRANDE SLOPES.

Between masses of trachyte, looking down upon the river, until we have reached Wagon Wheel Gap, the Rio Grande is descended.

The most remarkable geological formation, *en route*, attracting the attention of the passer-by, is the Bristol Head, the southern and culminating point of the Bristol Plateau, a great trachytic mass stretching from the continental divide, about 10 miles to the south, to the vicinity of the Rio Grande, perhaps 2 and 3 in width, aggregating almost 30 square miles in area, with an altitude of nearly 13,000 feet. Along its western base, in the cañon, passes the highway from the Rio Grande to Lake City, about 3,000 feet beneath its summit, the sides of the cliff being mainly vertical. The upper part of the < of the great divide, rising to 13,000 feet, is known under the name of the Cochetopa Hills, from the stream flowing down the western slopes, an affluent of the Gunnison; its eastern sides are drained by Saguache Creek flowing east and southeast into San Luis Creek and the San Luis Lakes. The divide between this and the waters of the Rio Grande is called La Garita Hills. These sections exhibit in strong degree the plateau formations, which, cut by the various streams, give unusually steep though short cañons and abrupt mesas. An extension down to and closing upon the Rio Grande is reft by the river, giving that attractive little cañon and interesting point called Wagon Wheel Gap.

SECTION III.—TRENDS OF RANGES AND SLOPES.

The direction of the surface inclination is an important function of the value of certain sections for agricultural and other purposes. The trend of the Sangre de Cristo Range to the northwest gives its surfaces within the valley more of southern warmth than would otherwise obtain. Snow is found often upon its eastern sides long after it has disappeared from that at the same altitude upon the valley slopes. This is more noticeable when directly considered with reference to the San Juan Mountains. Contrasting the valleys of streams upon the northern flank, affluents of the Rio Grande, with those upon the southern trend at the same altitude, we find the valleys of portions of the San Juan, Weeminuche, Los Pinos, Vallecito, the plateau of the Upper Piedra, &c., notable examples which have been personally observed in regard to greater luxuriance of vegetable growth. Its effect extending slightly to climatic influences gives those upon the northern inclination a more lengthened wintry aspect than the others. We have frequently come upon hillocks in a contiguous region of an altitude approaching 8,000 feet, where in January the northern slope would be covered with nearly a foot of snow, while upon the southern the surface would be quite bare, affording fine grazing for the deer and elk. Traveling in higher regions during a series of snow-storms of continuance, this was more strongly substantiated.

Considering this influence extended to the regions above, we find the snow falls earlier, lies longer upon the ground, and there is less area adapted to the growth of cereals than in that upon the southern flank of the mountains with otherwise similar situations.

It has been stated that for a rise of 300 feet there is a decrease of temperature of 1 degree. This rule is not, however, arbitrary; there are many causes operating as

differentials thereof, of which a prominent one is the southern exposure, and if upon the surface, like isothermal curves, could run lines of limit to cereal cultivation, the comparison of their elevations upon the opposite sides of the range would be distinctly pronounced in favor of the southern. Beyond this area, where stretch at higher altitudes regions fitted for pasturage, an examination of their proper defining lines and above, the limit of arborescent vegetation, better known in the patois of the frontier as "timber-line," will be found but an extension of the rule.

SECTION IV.—THE SEASONS.

In this elevated region there are, strictly speaking, two distinctive seasons prevailing, the wet and the dry, the former the longer. The long-continued rain-storms accompanying the advent of the spring months do not obtain here as in the East with the almost daily increment of heat; in summer and early fall occurs the most frequent precipitation of rain. This varies somewhat, however, with the locality. In North Central Colorado, September is known, from personal experience, to be the rainy month, affected by proximity to the main range, however; elsewhere, within 50 miles, the precipitation being much less. The storms generally occur in the afternoon, and from the rarity of the air and the arid state of the atmosphere, within a very brief time thereafter the surcharging of the air with moisture, noticed subsequent to rain-storms in the East, disappears.

The local variation of rainfall was verified by personal observation and the record kept during the reconnaissance. In June, while along the Conejos, the La Jara, and the Alamosa rivers, and in the Summit mining district, at elevations varying from 7,800 to 12,000 feet, the weather was clear and beautiful; no rainfall occurred.

In July, while along the Conejos, part of the Chama between Tierra Amarilla and Pagosa Springs, along the Blanco, the Piedra, and the Upper Los Pinos to the Rio Grande, it rained almost daily, mainly during the afternoon and evening, three hail-storms being met with.

During the prevalence of this season, as is well known, the precipitation upon the mountain-tops is greater than below, storms there being frequently seen, while lower localities escaped. At Pagosa Springs, 7,084 feet (a supply camp), most beautiful sunsets were observed and exemption from storms was had, while they could be seen not many miles distant.

In August, while ascending and descending the San Juan and tributaries to as low as 7,000 feet in the Summit district, along the upper Rio Blanco, and the Navajo, the Chama, the Nutria, the Piedra, and the Los Pinos, we encountered twelve storms of rain, with four of hail, the heaviest met with during the trip, and the most severe being near the summits of the mountains. Several times marches were made through heavy storms to valleys of less altitude which had escaped, as was found the month before.

In September, the region traversed was the Upper Los Pinos, the Vallecito and tributaries (where snow-storms were encountered), both upper and lower parts of the same the Florida, the Animas to the San Juan and vicinity, the La Plata, the Mancos, the Dolores, and the Grand Cañon of the Animas to Silverton and Howardsville. In all these marches but six rain-storms (two of them with hail) were met with, chiefly in the mountains. All were in the first portion of September, heavy frosts occurring daily after the early part of the month.

In October, the sections passed over included the Lake City region and vicinity, the Rio Grande, including its South Fork, the Summit district, and Del Norte, the entire cañon of the Rio Alamosa, the Conejos, &c., during which but two rain-storms, with six severe snow-storms, of extended area were encountered, the localities of all being near the mountain summits or upon elevated plateaus.

From the above it will be seen that most of the rainy days were in July and part of August, and from the middle of the former for about a month the greatest precipitation was met with. None befell us anywhere in August after the 18th and scarcely any in September; in October, those occurring were but exceptional ones, till the winter's inclement season began with heavy snows in the mountains.

One of the oldest settlers upon the Animas, who came into our camp at Pagosa Springs, volunteered the information that the rains in the lower San Juan travel westward in a regular manner; that is, that the rainy season commences earlier and ceases sooner in the eastern portion of this region than in the western; that when over at the Chama and the Navajo, they still prevail upon the Los Pinos and the Animas; in short, that had we begun in the latter country and worked to the east, this disagreeable feature of outdoor life in the mountains would have been escaped. Whether, as he insinuated, it would be possible for the traveler to commence at the west and passing east to avoid all of the storm limit save at the point of passage must remain a matter of conjecture. It is simply mentioned for the benefit of those hereafter in a like situation.

All the streams are of course higher, while in the storm area, than before and after. This was noticed in various rivers, particularly at points of the Chama, the Navajo, and the Blanco, revisited in August, originally passed a month earlier.

Ascending from the lower valleys to the summits of the mountains and points occupied for mining purposes, the seasons, with reference to warmth, may be said to consist of but winter and summer, with the latter scarcely a fourth of the former. In many places snow begins falling in October, soon blocking the trails and passage-ways, and continues until late in the spring, the greatest snowfall generally occurring, it is affirmed, in March.

The deep snows of the long seasons render work impracticable, and often access, save on snowshoes, impossible, until late in June. In fact, July, August, September, and October in part, can alone be counted upon as the working-season above ground in a mining-camp. All such are at a great altitude, probably in the main above 11,000 feet, frequently up to and over 13,000. Here it rarely rains; save for scarcely over a month the storms are all of snow, which accumulate to a great depth.

The precipitation at Denver (elevation 5,200 feet), situated at the base of the mountains, was, for the year ending June 30, 1875, 15 inches; during that closing on June 30, 1876, 24 inches; and the average annual rainfall for 5 years, from 1872 to 1876, inclusive, but 16.1 inches.

At the Summit mining district, southwest of Del Norte, in the San Juan, at an altitude of 11,300 feet, where an accurate meteorological record has been kept for three years, and which was kindly furnished me by Prof. Charles E. Robins, of the Little Annie Mining Company, the annual precipitation of snow was nearly 290 inches, aggregating 24 feet for three years in succession, July being the only month without snowfall.

The immense precipitation at the summit and like situations along the topmost ridges of the continental divide, where lie chiefly the most valuable mining-camps, and the resultant severity of the long winters, will at once be understood.

The average annual temperature at the summit for the same period, from 7 a. m. to 9 p. m., was 32°, and during eight and one-third months, save on snowshoes, nothing could be done in the way of outdoor employment.

While this low temperature is the average between the hours named, the heat of the noonday sun is intense, being augmented by the reflection of the snow and other causes. There exists, in short, a tropical heat of brief duration, preceded and followed by an arctic cold.

The rarity of the air and consequent difficulty of physical exertion, the severity of the season, the long intervals of isolation from civilization, and the cessation of mail facilities, exert deleterious effects upon all subjected thereto. Consequently, during most of the year, mining-camps are found deserted, the population almost wholly departing for lower localities with the advent of the wintry season, returning late in the spring. Illustrative thereof may be mentioned the population of the summit, which, aggregating 125 in June last, was during the previous winter but 12.

The comparatively small rainfall of Denver, Colorado Springs, and similar localities of the dry region along the high table-lands and bases of the mountains, may be better comprehended by a glance at the annual rainfall of the following interior and sea-coast points of the United States, obtained from the records of observers of the Signal Office, for the year ending June 30, 1875:

	Inches.
Denver	15
Colorado Springs	11
Philadelphia	39
Washington	31
Saint Louis	44
Boston	47
New York	36
Baltimore	36
Charleston	69
Savannah	62
Jacksonville	58
New Orleans	75

High-water season.—With the approach of summer heat the effect upon the great accumulation of snow is apparent, producing the “June rise” of the rivers flowing from the range, wholly a seasonal variation. At this time all streams are at their highest period of the year. Dry arroyas and clayey banks are filled with rushing waters, small brooks are transformed into rivers, and the larger streams, the Rio Grande in particular, become formidable barriers.

Besides the annual rise in the streams of mountain origin, there is during the season of high water a distinct variation of daily occurrence. This diurnal rise and fall is not abnormal in its action, the period of lowest ebb being about 10 o'clock a. m., due to the great increment of heat accompanying the noonday sun.

The huge banks of snow that are thus rendered soft and impassable, sending forth from the bottoms of the basins wherein they lie great streams of water, harden as the sun descends, and during the night are frozen with the falling temperature.

A corresponding decrease in the snow-water sent forth, of course, results, locally a minimum with the greatest cold, making 10 o'clock the most advantageous hour for passing mountain rivers in general.

This crust on the snow-banks, which fill ravines and block the traveler's way, furnishes the only means of passage over such obstacles. As it disappears with the advent of the morning sun, we were compelled on such occasions to rise before dawn, with the temperature most decidedly arctic.

SECTION V.—CLIMATE.

Descriptive remarks on the nature of the country would be incomplete without a reference to its climate, one of its chief characteristics.

Without entering into a formal disquisition thereon, or attempting to discuss in detail its varied effects in the manifold diseases for which it is sought; without intention to intrude upon the domain of railroad companies, real-estate agencies, or mining corporations, and proclaim it the "Switzerland" of the continent, or to advertise it to the detriment of Minnesota, Southern California, Florida, or the Bermudas, as the Great North American Sanitarium, it is thought a few commonplace notes might not be found wholly devoid of interest, being based upon personal observation.

In 1875, while convalescent from an attack of chronic pneumonia in New York Harbor, being directed by my physicians to try the climate of Colorado, the writer was accordingly taken thither. A companion from home, suffering from acute phthisis, lasted but four weeks. Left alone, horseback-riding was attempted for short distances, and continued over mountains and plains with the most markedly beneficial effects, and the improvement continued until over 2,000 miles in Colorado, New Mexico, and a portion of Old Mexico had been so traversed. An extensive acquaintance with the elevated regions of the Rocky Mountains was thus in time obtained.

The seat of thickest population in the State is thus far in the belt of the great plains, along the immediate bases of the mountains on the east, of which Denver is the most important point. Its elevation is 5,200 feet, the land rising to the south, where is the divide between the waters of the Platte and the Arkansas. Pueblo is below 5,000 feet, and Trinidad is nearly 6,000 feet.

Of elevations in the basin of the San Juan River we have 7,100 feet at Pagosa Springs, 5,300 at the mouth of the Animas and the La Plata, descending to 4,600 at the mouth of the Mancos, where it leaves the State for Utah.

To the north are great ranges, as there are to the west of Denver and the towns to the south of it. Beyond and to the north of the "Dome of the Continent," the great mountain center and mining section of the upper San Juan, lies the extensive valley of the Gunnison in the Indian reserve, similarly situated as the San Juan below.

The Indians will ere long be compelled to retreat; this great valley, like the lower one, will in time be thickly settled, and whatever peculiarities or advantages of climate have been found existing near Denver will without radical difference be found to obtain here.

Taking the area of mountain and plain, the average altitude of the State is between 6,000 and 7,000 feet, approximating 6,000. Appertaining to this elevated region are several climatic features remarkably different from those of the great States in the East, rendering it a most desirable home for invalids suffering from certain diseases.

Prominent is its altitude, with accompanying atmospheric phenomena, as the large amounts of electricity, the large number of bright sunny days, and the increased proportion of ozone. In addition thereto is the rarity of the atmosphere with its slight humidity, its exceptional clearness, and the moderate rainfall already mentioned.

To those enjoying good health the sensations attendant upon the first entrance into these regions are generally pleasant. The nervous system, which controls the vital parts so strongly, is at once excited by climatic influences to a marked degree of tension. A difficulty of breathing upon slight exertion, dependent on the degree of health, at once appears, increasing as the high regions and mountains are penetrated. This partly disappears as one becomes acclimated. The physical functions, whether in good play or disordered, are immediately excited to a strength of action to which the system is a stranger; the appetite is increased, digestion is perfect, and sleepless nights are unknown. This is the most marked beneficial result, and one is astonished at his great craving for food.

With the setting sun all warmth departs, the heated summer nights of the East are unknown, and one or more blankets are always a necessity.

The statement has been made that the rise of 300 feet in altitude gives a decrease of one degree in temperature—a rule subject to much and local variation, as shown in the average climate of various points of Colorado, influenced, doubtless, by sheltering ranges, &c.

The average temperature is about that of New York and Philadelphia, but heat and cold are not so perceptible, since the hot nights experienced in the East are unknown here, and on account of the excessive dryness of the air there follow many bright and lovely days. The latter fact is attested by any one's experience, and the meteorological records of Denver show that during three years there were but twelve days during which the sun was totally obscured by clouds. The former is a well-known fact, a temperature of 10° above zero in New York Harbor being far more severe upon the system than that of 10° below in the mountains. With the moist atmosphere of the seashore a similar degree of cold would in the mountains be unbearable. No matter how warm it be in the sun, a breeze or current of air will always be felt in the shade. The diurnal variation of the temperature is considerable, and increases with the altitude. With an increase in rarefaction corresponding to the elevation, the heat of the sun passes more readily through the atmosphere, and upon the highest mountains the midday heat is burning; with the setting of the sun the atmosphere as readily gives forth its warmth and an opposite temperature succeeds. Within a valley of 8,500 feet elevation in August, traveling at noonday was almost intolerable, while during the night water was frozen in buckets near our tents.

The air being at the bases of the mountains, say, one-fifth lighter than at the seacoast, there would be a square inch pressure of 12 pounds instead of 15 as at the seashore, whence would result the extra exertion of the respiratory organs to the extent of one-fifth to obtain the requisite amount of oxygen.

With increased altitude is associated also greater amounts of electricity. At lofty elevations electric phenomena are often more marked than pleasant. In snow-storms upon mountain tops we have witnessed the strongest and most disagreeable manifestations thereof, with peals of thunder accompanying, to the delight of neither man nor mule.

The increased respiration necessitated, resulting soon in greater chest development, the stimulated nervous system, the increased blood circulation, with diminished atmospheric pressure, all combined with the electrical influences of a tonic nature, have directly resulting effects in a more salutary condition of existence.

The diseases for which this climate should be sought are asthma, chronic bronchitis, and incipient phthisis pulmonalis. By invalids suffering chiefly from troubles allied to the many stages and forms of pulmonary consumption this region will be always sought. All such as go in time will be benefited; with proper care and treatment, and the mode of life adapted to their cases, they will recover. Those going too late, will have their disease assume advanced forms sooner than elsewhere, and the later stages and death will sooner occur.

The number of consumptives who have sought relief in Minnesota and Florida is very great, readily understood from the statement by high medical authority that over 20 per cent. of deaths in the East from all causes are from this malady.

The railroad companies have extensively advertised the climate of Colorado as a sure specific for this disease, and many in stages far advanced are lured from homes and fond ones only to find an earlier grave. But to those who go in time, not hopelessly yielding to the malady, not content to remain in first-class hotels and boarding-houses, but determined to lead an outdoor life, with the fascinations of "camping out" amid magnificent scenery and the sports and pleasures to be found therein, to them will come a new lease of life.

In order, however, to arrive at these gratifying effects, various degrees of altitude should be essayed by the invalid, as their adaptation varies with the case and its condition. Those with weakest lungs and suffering from hemorrhage should avoid great elevations.

In the older time, before the railroad spanned the plains and the journey from the Missouri River necessitated a month or more, invalids became acclimated as they traveled slowly up the great plateau to the mountains, and when the base was reached, a cure had almost been effected. The rapid transit of the present day is to the detriment of the invalid. If the elevation does not bring improvement, the patient should try one of less altitude and ascend later; an exercise of good judgment will soon determine what point is best suited to his case, when an outdoor life should be followed.

There are a number of diseases, chiefly of chronic nature, upon which the effects of high altitudes are not yet positively known and for which they should, therefore, not be sought. Such are chronic rheumatism, neuralgia, chronic catarrh, and the periodical malady known as "hay-fever." The remedial effect of some of the hot sulphur springs of the State in rheumatic troubles of long standing is yet to be definitely determined.

Other diseases exist to which these great altitudes are highly aggravating, chiefly epilepsy, chorea, and all forms of cardiac disease. To those so afflicted approach to lofty elevations should never be made, as in many instances fatal results have ensued.

To those camping out in the open air, slight inconvenience is at first found in the effects of the dryness of the atmosphere and the hot rays of the sun. The skin, when exposed, on hands and face, peels off in the most annoying manner and soreness ensues,

a most mottled facial appearance resulting. The worst case ever noted was an Englishman of title, with whom the writer was hunting for five weeks in the upper parks of Colorado. To his facial appearance, while being "acclimated," the old simile of a "boiled lobster" would be inadequate.

The enjoyment of traveling is occasionally marred by high wind-storms, with accompanying dust, chiefly in the lower regions. These were noticed mainly in the spring months.

The many sunny days, the possibility of outdoor sleeping without liability to cold, and the great clearness of the atmosphere are charming realities, that must be seen, that must be experienced, to be fully appreciated. The wonderful atmospheric clearness is especially to be remarked, rendering distances exceedingly deceptive; mountains that seem but ten miles away will often be found more than double the distance.

The sojourner in this region is apt occasionally to suffer from a troublesome malady, known locally as the "mountain fever." Though so called from its prevalence in the higher altitudes, it extends to the lower regions, and at least part of the plains beyond. As severe a case as was ever observed was that of a resident of Pueblo, below 5,000 feet. Unless aborted at its start, this fever is of a continued nature, with regular stage, chills and remissions occurring. While at a mining camp in Upper Colorado in 1875, the writer was troubled with an attack of this malady and treated by the old miners with copious doses of tea of the sage-brush (*Artemisia tridentata*), afterward taking quinine. Dr. Smart, U. S. A., who has devoted much time and study to this obscure malady, has demonstrated its origin as due to the organic taints contained in the mountain streams from vegetable matter therein; that these airy substances, arising in microscopic forms from lowlands, are swept by prevailing winds to the higher regions above, where precipitation from the upper atmosphere, with falling snow, occurs.*

CHAPTER II.—AGRICULTURE AND PASTORAL PURSUITS.

The agriculture of the San Juan, like the rest of the State, can never be of a very extensive character; that Colorado can ever produce sufficient cereals for home consumption is as yet a matter of speculation, scarcely now affirmed by the most enthusiastic inhabitant. Owing to the great rarity of the air, the increased dryness of the atmosphere, and the lighter rainfall, with alkaline constituents more largely in the soil, the moisture precipitated immediately disappearing, the amount is not adequate for the sustenance of vegetable growth like that existing in regions nearer the level of the sea, and save along water-courses the vegetation is of a limited nature. Such obtains upon the great prairies east of the bases of the mountains and near its foot-hills.

By irrigation alone can agriculture thrive, and, despite statements to the contrary, the amount of arable land or tracts that can be cultivated without the expenditure of enormous sums for irrigating-canals, the total area producing marketable amounts of cereals must, when compared with the territory of the entire State, bear but little larger proportion than does the flower-garden of the housewife to the great acres of the farm. At present the main supply of grain comes from Kansas, destined to become the great granary of the West.

The soil in the valleys and near the foot-hills adapted for agriculture, being the result of denudation from the mountains above, is generally dry and sandy, and owing to the alkaline depositions which frequently appear upon the surface of the ground, there results a marked effect on the vegetable products. The crops and produce of the soil of all kinds are very rich, more particularly noticeable in the cereals. The flour of Colorado is remarkably fine, and the visitor will at once observe the unusually fine and white appearance of the bread.

It is said there are tricks in every trade, and to the wheat supply there is no exception. The supply of Colorado flour being unequal to the demand, a large quantity of Kansas production is ground at the flouring-mills, and, in Colorado sacks, is sold for the genuine domestic article.

The cereal area is limited to lower elevations, the high valleys possessing seasons too long and severe for the perfect maturing of the grain. The exact altitude to which this is limited varies locally, and is, of course, higher in the San Juan in general than in Northern Colorado, and higher also in the lower region, where its northern flanks are sheltered by the main range, than in the upper country. Then within each section of similar elevation the summer season may deviate or alternate within a range which, permitting a harvest during one year, might the next prevent the perfect growth of grain. In Northern Colorado, along the Upper Boulder, in a narrow valley of about 8,000 feet, less than 10 miles to the east of the main range, in 1875, a crop of

*Smart, Mountain Fever and Malarious Waters. Am. Jour. Med. Sc., July, 1878, pp. 17-43.

oats is remembered to have failed to ripen and, damaged by early frosts, was harvested in the stalk. There was, however, some exceptionally severe weather early in the season, and on the 18th of September nearly 10 inches of snow fell, the storm covering a very great area in both Northern and Southern Colorado, including the plains. The year previous, we were informed, a similar crop had matured and was successfully harvested.

As the altitude is increased, the diurnal range of temperature is greater, and hence the danger from early frosts.

The agriculture of the San Juan is as yet in its primitive stage, almost all the attention and capital of the country having been concentrated in mining interests.

The San Luis Valley bears witness to the wealth of the produce returned by the soil under proper cultivation. In following up the Rio Grande, the Mexicans have ascended divers tributary waters, and upon these and along the main river can their apologies for farms be seen. Generally content with simple existence, but little variety in the produce of their lands is observed. The turning of the soil with oxen and a sharpened stick, the thrashing by flail and trampling under foot, and the crushing of the grain between stones can be so frequently seen, that the charm of novelty is lacking and one's curiosity is soon satiated. Progress is not their hope or desire, and content to eke out a bare subsistence, their ambition does not extend beyond a *barle*, or the tripping of the "light fantastic," with surroundings that are here, as a rule, far from enchanting. Their cultivation of the soil tells of Eastern origin and traditions, and is by irrigation from *acequias* or ditches. Smaller ditches at intervals lead out from the main, being connected by parallel ones thereto; furrows of earth of varying height are raised at stated points parallel and perpendicular to one another, cutting up the entire area into many patches nearly square and of small extent. With the planting of the seed and the main ditch filled, all the smaller outlets and various sections being simultaneously overflowed, the entire area is carefully submerged, the little furrows confining the water in each section. To the inexperienced farmer the first successful irrigation of his land is a matter of considerable labor and pains. Besides the thorough moistening of the earth obtained by the gradual settling of the waters, a fertilizing process is at the same time insured. These streams carry in solution much rich and valuable material from the denudation of sections drained in their passage, which is left in deposit like a superstratum of manure. The latter is never used, the farmer depending upon irrigation for the supply of those constituents extracted from the soil in the growth of produce.

The Rio Grande descends from 7,750 feet at Del Norte to 7,400 on leaving the State for New Mexico. Upon its western side numbers of locations are along the Piedra Pintada, which sinks a few miles from the Rio Grande, the Alamosa and La Jara, but chiefly along the Conejos, the most thickly-settled of all its tributaries; upon the eastern are the Trinchera, Culebra, and Costilla, the Culebra above San Luis being on this side the seat of largest habitation.

In the upper part of San Luis Valley is situated the finest land of that section. With the mountain range encircling it upon the east, north, and west, exposed only upon the south, whence do not come the heavy snow-storms and coldest winds, it contains the finest land for cereal and other productions. Drained by the San Luis Creek and the Sawatch, its tributary, the ranchmen who have located along the streams have been rewarded for their labor by very abundant crops of all kinds. Throughout the valley large herds of cattle find ample sustenance, the property mainly of Americans, while numerous herds of sheep of Mexican ownership are driven to and fro.

The valley of the Conejos, with its affluents, the San Antonio and Los Pinos Creek, is a most fertile region. Several miles east from Conejos, during the high stages of the rivers in June, water from the San Antonio finds its way into the former river above the latter's mouth, forming an island. This section is especially rich and there exists almost a natural irrigation, the Mexican ranchmen raising large crops of all kinds at the cost of but little labor therefor. Of all the regions west of the Rio Grande, that from the Conejos to the La Jara is the most desolate, and for ten miles of the way from the Conejos, while the hardness of the fragmentary volcanic rock of which it is constituted made it the finest of roadways, all other conditions combined to render it in June and July naught save a waste and desert.

The sage-brush and greasewood which elsewhere grew knee and waist high, was here literally burnt out to 8 or 10 inches, never exceeding a foot. This was very limited in quantity and was all that existed of a general vegetation. Now and then was seen a solitary flower, evidently lost from its brethren, with but an occasional cactus or "soap-weed," the average being not over an inch of vegetation to the square foot. Fragments of lava, basalt chiefly, and some trachyte were everywhere about. The reflected air, heated and burning the face and filling the lungs, was almost parching. Not a single insect was observed, hardly a blade or tuft of grass in a mile. Even all the feathered tribe avoided this barren place, no birds whatever being noticed save the horned lark and a single sparrow near its edge. Passing over this desolate region,

the winds from the mountains to the west alone relieved the terrible heat. For their providential occurrence one is devoutly thankful.

Three miles east of the La Jara the soil is of a gravelly, sandy nature, with clayey constituents, the trend of the land being toward the stream, bordered by ranches or farms, very productive in vegetation and crops. Here, as throughout the whole San Luis Valley, the only trees are along the banks of the river, all streams being timber fringed.

The Alamosa and La Jara, during the lower parts of their courses upon the plain, run side by side. At the foot-hills they diverge, the head of the Alamosa being for the northwest, its course throughout in a generally narrow and very deep cañon, while the upper waters of the La Jara are due west at but half as great a distance. All the portions of the former that are available for agriculture are its banks on the plain and a short part of its cañon valley within the foot-hills, upon which Mexican ranches are found. Upon the La Jara are a few more Americans than upon the former, the ranch-owners being mainly, however, of Mexican descent. A tributary, called by the geographer its North Fork, but locally known as *Aguas Calientes*, or Hot Springs Creek, where land is represented as adapted to grazing only, is found in reality to be adapted to the agriculture of the Mexicans, ranches at intervals being passed along its course.

The entire course of the La Jara may be likened in its direction to a huge frying-pan in outline, the long handle upon the plain extending to the Rio Grande, the basin within the foot-hills to its source. Before reaching the plains the stream flows to the south, east, and north, the latter part in a steep precipitous cañon strewn with basaltic rock, which the road avoids. This road, built by the county over a natural route, is in good order and affords the residents of the lower river easy access to its upper part, which, as we ascend and pass over the intervening rolling foot-hills, we find within a lovely valley, called by the Mexicans *El Valle*, to which they resort for hay. Its headwaters in this region, represented as only timbered and barren, is largely the reverse. The volcanic rock strewn along, as we ascend the foot-hills well timbered with piñon, we leave behind us as we descend into the valley, a basin eroded from the general plateau by the waters of the stream, which has cut for itself, in its lower and more rapid descent, a small but impassable cañon. This valley is several miles long, of a varying width of from three-fourths to one and a half miles, is a beautiful spot, and has been located upon by several persons for cattle-ranches. The grazing was very fine, and so nearly level was the land, that the stream, here small and at its headwaters, pursued a most tortuous course. Trout were found more abundantly than at any other point.

About 5 miles above our camp by the stream, rolling hillocks, as a divide, limit the basin of the La Jara on the north, the mountains to the west, beyond which are the waters of the Conejos, being over 1,000 feet; to the east the hills are 400. Perhaps a mile still farther to the north, in the center and bottom of another depression, is a handsome lake, nearly rectangular in shape, 1,820 feet in length by 1,140 feet wide, a clear and beautiful sheet of water, not indicated upon any of the maps. Fed by underground streams or springs, no outlet is visible or could be found. The wind blowing from the range to the west rolled the water in waves to the eastern shore, suggestive of an incoming tide, while fragments of sedges blown in upon the banks, bleached and white, gave the ground at a distance an alkaline appearance. To the north the rising ground is the extreme limit of this plateau. Beyond lies the cañon of the Alamosa, of which at this point a magnificent view is obtained. The descent of over 1,000 feet to the river below is very abrupt, and it was only after great difficulty that it was reached, the general depth of the cañon above being fully 2,000 feet and as great at some points as 2,700 feet.

No attempts at agriculture in the high valley of the La Jara have as yet been practically made by the settlers, whose small herds of stock were observed therein.

The cañon of the Alamosa, while containing some beautiful and high grassed parks of no mean dimensions, is of a general height too great to permit any agriculture. The largest was a lovely spot of nearly one hundred acres on a bench sloping from the river to the mountain walls, containing magnificent pasture. Deserted cabins, near a spring of the purest water, with mineral specimens in abundance told of the former proprietors, who, disappointed in prospecting, had left the country.

From the summit of hills east of the head of the La Jara was obtained a fine outlook, showing the general plateau-character of the country to the south and east of the continental divide, everywhere strewn with volcanic matter.

The rugged peaks above timber-line to the southwest abruptly ended at the West Fork of the Chama, the level to the south broken by the high timbered hills, and farther east beside the Conejos, while above the plains to the southeast rose the rounded sugar-loaf summit of San Antonio Mountain. Throughout this lower region, without exception, streams have with difficulty worn their passage through the great lava-flows, making all their beds cañons, narrow and confined, the sides abrupt and steep, and filled with sharp volcanic masses broken off from edges of the great flow. Agri-

culture is, therefore, limited to the valleys of the streams, all resulting from erosion, and hence narrow at their heads, generally widening out in their lower parts. It is, therefore, along the lower portions of the Conejos, San Antonio, and Los Pinos that most of the land cultivated is found. Clusters of houses here and there give a village or plaza, the largest of which is Conejos or Guadalupe, upon the river of that name. Along the Conejos, above this point and to the west about 10 miles, where the river emerges from its cañon, a rapid and turbid stream, a narrow but beautiful valley of 8,000 feet elevation extends. Agriculture flourishing in cultivated land well fenced, the settlers being the usual Mexican ranchmen. Many thousands of sheep are owned along this river, the herds being driven to the northwest and southwest.

THE CHAMA OR TIERRA AMARILLA SECTION.

Beyond this point to the west no other place is found where agriculture has been attempted, until the Tierra Amarilla section, a collection of Mexican plazas, is reached. A half mile above Los Brazos, the most northern one, is the seat of the Park View colony, where a settlement was made by inducing Chicago persons to locate here. Upon a bench near by the river was the prospective town-site, and in the river-bottom, of very fine land, the "farms," the total acreage of which under actual cultivation was found to be about 8 acres and not exceeding 10.

The plazas of the Tierra Amarilla (signifying yellow earth) are five in number, situated in close proximity upon the Rio Chama near the mouth of the Rio Brazos, its Eastern Fork, and upon Nutritas Creek near by, and comprise a total of 800 population, whose industry is agriculture and sheep-raising, from 1,200 to 3,000 head being passed daily while in this region.

This section contains the finest agricultural land in this part of New Mexico, being chiefly from 7,300 to 7,600 feet in elevation, and aggregating with the valleys of the Chama and tributary streams a total of fully 8,000 acres that will be valuable for agriculture under proper irrigation. This is derived from statements of county officials, not visiting two of the plazas personally. Personal observations included an acreage of about 5,000, of which less than half was under cultivation, and in this, moreover, the tracts were not all under proper tillage, the area being much scattered.

The amounts paid for forage here were in July 3 cents per pound for hay and 5 cents for corn, or \$60 per ton for the former and \$2.80 per bushel for the latter, which may certainly be considered as almost "bonanza" prices, when the fertility of this land is taken into consideration. This was almost 50 per cent. more than was paid at Animas City, far to the west.

The immediate river bottom, near "Park View," averages not over one-quarter mile in width and between 5 and 6 miles long, containing some 900 acres, the whole a very pretty and attractive valley. Above this were passed two deserted Mexican villages of a dozen cabins each, the land about uncultivated. The inhabitants thereof, we were informed, had stampeded one night in 1865 from fear of the Indians, who had been in grand council near by for six days and nights, and contemplated, it was thought, a general massacre.

That the Park View colonization, popularly denounced from its incipiency as a fraud, has culminated in failure is to be greatly regretted, as until ranchmen of American energy take hold of this region, its resources in an agricultural point of view will never be developed.

THE NAVAJO.

From the crossing of the Chama until the Navajo is reached there is but little land that will ever be available for anything save grazing; while it is of a nature to constitute a fine farming region, with sufficient alkaline constituents to insure large crops, there is a dearth of water, although upon all the maps it is not properly so indicated. During the three day's march from the Chama to the San Juan, from 3,000 to 7,400 sheep were daily passed, and also 200 goats. The latter are the favorites of the Indians, small herds of which are possessed by various chiefs, and noticed at various points in the mountains.

Along the Navajo, in both Colorado and New Mexico, are considerable areas of land finely adapted to agriculture, thus far almost entirely neglected by the ranchmen in choosing their locations. Extensive benches, easily irrigated, and abundance of timber are readily found, while along its upper part are clusters of hot sulphur springs of varying properties. Vegetation is luxuriant, wild berries of different kinds were found abundant, and so attractive is the river, its banks and surroundings, that the southern Utes still assert and reassert their ownership of the valleys which it waters and of which they were almost wholly dispossessed in the location of their new reserve. Upon the Navajo they wished their new agency located, and on its being built upon the Los Pinos, much dissatisfaction resulted.

Along this stream for a short distance is part of the route for the Chama-Navajo road, the shortest line from Conejos and neighboring points to the west, and when

this road is constructed, which will eventually be done, unless the whole lower San Juan shall retrograde in its present rapid settlement, the valleys of this river and affluents will certainly be located upon and valuable ranches result.

THE BLANCO.

The next river to the west, the Rio Blanco, or White River, so called from the milky appearance of its waters, can never play an important part in the agricultural economy of this region. In its upper part is a magnificent valley, but it is only with great difficulty and by trail accessible. The descent by the road from the Navajo divide is between and around very steep hills. Following up the river from this point, it is found to be confined by steep mesas or hillsides of abrupt slopes, quite often vertical.

The ascent of this stream, traveling of course without a guide, was one of the most difficult trips experienced. Following the river bed from sheer necessity, we were kept therein, and in one day's march, quite short in miles but apparently long in hardship, the river had to be forded 39 times. While mainly a good current, it was occasionally rough from rapids. At one point for several hundred yards large boulders of granite and other rock blocked the passage-way. They were from 10 to 40 feet in diameter, while occasionally was noted one of unusual size, 50 feet by 10 or 15 in diameter, rounded, and bearing the mark of glacial action. In avoiding them, the ascents and descents of the steep banks near by caused several accidents of an almost serious nature to the pack-train. Afterward there was observed extending down from the foot of the mountains and along the river a high bench formation, finely timbered, with magnificent grazing. Upon this also were strewn boulders at intervals, the largest observed being pear shaped, some 70 feet long, and over 40 in height.

In the ascent and descent of this stream (in August) the abundance of wild fruit on the hillsides was unusually great, more particularly the service-berries. Fine patches of raspberries, light-red and exceedingly luscious, of gooseberries, and also wild cherries were fortunately met with.

The Blanco in its upper part flows south and southwest, curving sharply nearly to the west, its mouth in the San Juan being nearly due west from this point.

The Navajo in its upper part flows almost due south and nearly parallel to the Blanco, and curves sharply, making also a great bend abruptly to the west, its mouth, being nearly or quite on the same parallel as the bend.

The upper waters of the Blanco and Navajo have a striking similarity, each possessing a wide and magnificent valley, separated and inclosed by huge towering mountains from 2,000 to 3,000 feet above them. In the upper part of the Blanco, where the forks unite and form the main stream, the one from the east, in descending from the Cretaceous shales, carries in solution whitish-gray matter in such decided quantities as to impart to the main stream throughout its course that milky appearance which is immediately noticed on reaching it.

The Upper Blanco was meandered during the season of daily rain and there we happened to witness a most magnificent storm effect about sunset. Heavy rain-storms had prevailed all afternoon upon the mountain tops whose effects were not entirely escaped below. Extending from a meadow on the opposite bank of the river from the camp there arose the grandest double rainbow we ever beheld, reaching up to and capping the summit of the range east and above us, and circling down to the valley on the left, the colors separate and entirely distinct without blending above, and of most surpassing brilliancy. While every one was gazing in admiration at the scene another storm coming swiftly in an opposite direction above the range stopped in its rapid course, suspended above the mountain tops, when the clouds attracted to the highest peak, assumed a funnel shape in their descent. It was a grand indescribable scene in the contrast of the deep inky blackness, the bright sunlight illuminating the peak below, and the gorgeous hues of the rainbow resting upon the mountain's center.

At the big bend of the Blanco, ascending the river, the valley widens from 500 yards to over a mile, increasing its width farther up to one and a half and two, which continues for a distance of nearly 4 miles. Like that of the Navajo, this is a very beautiful spot, of which the beaver holds possession, the largest part, nearly or quite level, being filled with willow undergrowth and beaver dams. Continuing on, cutting our way as the valley narrowed through almost impenetrable masses of aspen (*Populus tremuloides*), the stream at the mouth of a large tributary from the west presented an almost impassable barrier in the impediments presented.

The lofty mountains inclosing the valley approached and almost met, high walls from either side running to the water's edge. From either side an immense wall of vertical rock extended to the stream, its former center broken and eroded by the water, leaving a perfect gateway, through which the river dashed over boulders, huge logs, and high masses of drift, serious obstacles to passage, the ascent being made only with great difficulty. Farther on some side walls of red sandstone were worn into

most fantastic shapes; bowlders and gravel of all kinds, including volcanic rock, filling the bed of the stream everywhere.

At several points near the cañon's mouth, clinging to the bits of earth on side rocks, were bushes of red raspberries, the largest and most luscious seen anywhere, with quantities of service and goose berries, wild cherries being found in the valley below.

The Blanco is here a clear and beautiful stream; no ranchman has at any point above the road-crossing penetrated its land. While its upper valley is far handsomer for several miles than that of the Navajo, the preferred ground of the red man, on account of its being almost inaccessible from all sides no Indian has entered it, although they swarm in that of the former in search of game and wild berries, the latter their most important article of summer diet.

THE SAN JUAN.

Upon the Rio San Juan (signifying the river of Saint John), the next river to the west, and the great drainage channel of the country, agriculture has made less progress upon the upper river than upon the lower. The Pagosa Hot Springs were a bone of contention between Indians and whites, and later have been among the whites themselves, until the executive order of the President declaring them a reservation.

To the east, west, and northeast of the springs, at an elevation not exceeding 7,200 feet on both sides of the San Juan lies within a few miles a large area comprising many thousands of acres, which, with irrigation, would be very valuable for farming purposes. As yet but a few log cabins appear, and further no step has been taken to hold or improve the land. Many herds of sheep are driven to and fro through this region, nearly all tarrying at Pagosa Springs, up to which all the sheep are driven, the Mexican herders stating that the waters thereof are highly beneficial to the animals.

Some 10 or 11 miles above the springs, upon the west fork of the river, locally so called, several persons have located and were at work upon their cabins when we were there encamped. Bordered by high mountains, over 1,500 feet upon one side and approaching 2,500 on the other, at an elevation of about 7,600 feet, this valley contains a large acreage of land finely adapted to agricultural purposes. The ranchmen have already provided an outlet by a passable wagon road of their own construction, connecting with the county road at Pagosa. The San Juan and its tributaries all cañon in their upper parts, and above this elevation there are no valuable spots worthy of mention in this connection.

The most fertile region is along the lower part of this river, including the section from the east of the Las Animas down, the richest and most valuable land of the San Juan being soil of New Mexico. It is rapidly being located upon since the opening of the Jicarilla Apache reservation, and settlers will soon fill the entire area to the Navajo reserve.

The climate of this region differs most radically from that of the river above, being hot and arid away from the banks of the streams; the vegetation being chiefly of the sage and cacti order, with piñon upon the mesa sides. Little of a winter season occurs, the elevation being in the main embraced between 5,500 feet and 5,100 in altitude. Strong alkaline constituents are present in the soil and from the great denudation during the rainy season and the high stages of water which occur, its banks are each time resupplied with fertilizing elements in great abundance. Possessed, therefore, in this latitude of the mild climate of central New Mexico, several hundred miles to the south, the fine agricultural capabilities and the range of production of this region may at once be conjectured. Beyond, still farther down the San Juan, the Navajos are industrious farmers, corn being the main product, and as a sample of the crops they obtain, a handsome ear was brought back. The crop was raised upon one of the bottom holes along the San Juan, cultivated without irrigation, watered only during a high stage of the river. The corn tassels were of the height of a rider's head upon horseback.

THE RIO NUTRIA.

The Rio Nutria is the next upon the west, and a tributary to the Piedra. The name of this stream upon the maps seems to be erroneous as we were informed by Colonel Pfeiffer, a former agent of the Ute Indians, and a resident of this region for many years; that it was originally Notre Francis, being so called after a Frenchman, who with two Mexicans, was killed by the Indians near its mouth and there burned. Their graves are situated upon the mesa bank of the Piedra, overlooking the mouth of its tributary.

This stream, more properly a creek than a river, possesses but a very limited acreage adapted to farming purposes. But one ranch in the locality is worthy of mention, that of Messrs. Meyer, Stolzheimer & Co., near a spring hard by the stream, and at the edge of the Indian reservation. Their investments are wholly in the shape of stock and include some 2,300 head of cattle, 8,000 sheep, and 73 horses. This firm has a sort of treaty or agreement with Ignacio's bands, three tribes of the Utes, who permit their stock to range over their land receiving in return at various intervals quantities of the choicest beef.

THE RIO PIEDRA.

The Rio Piedra or Stony River, is most aptly so named. From the junction of its forks or the main tributaries in the plateau region to the north the distance by the river is about 20 miles to the bridge-crossing on the road. In this, it descends from 7,800 to 6,400 feet and the land it drains is viewed in its agricultural economy wholly barren and worthless. Its cañon is steep and inaccessible. In the ascent from the road over the steep mesas and rocks near and along the river to the plateau above, Colonel Pfeiffer accompanied by Indian guides was occupied over 5 days in going the distance of 20 miles by the river. The upper region we reached by avoiding these horrible mesas, by a long detour to the east near the head of the Nutria. At the point where the waters of the Piedra and affluents begin their erosion of the plateau resulting in the cañon along its course, the descent is abrupt, the rocks eroded assuming fantastic shapes, frequently chimney-like.

The descent from the surface over the underlying strata to the harder formation below is very rapid, and in a short distance the river has descended to 500 and 1,000 feet below its level on the plateau surface, the hills on its right bank being here somewhat higher than on the left. At the entrance of the cañon it is very narrow, the walls vertical, and occasionally overhanging stones dropped from above, falling into the water below. The area above its cañon, comprising the valley of the Weeminuche and the Middle and Southern Forks of the Piedra, with the plateau region to the east, is of large extent, and not greatly protected by the gradual slopes to the summit of the range on the north. They are only valuable in their relation to the grazing interests of the region. In the aggregate there are over 40,000 acres on the water-shed of this river that are of the highest value for the rearing of cattle and sheep, being all superior summer and fall ranges. A dearth of water near the head of the Nutria exists, where lies a large additional area. In the valley of the Weeminuche, the western tributary of the Piedra, a most lovely section, luxuriant grasses are passed over, which were fully 3 feet in height.

At the point where the road from the east reaches this river, altitude about 6,400 feet, it follows up its bank in a bottom for 3 miles, crossing above by a bridge; upon the opposite side the bottom continues for half a mile farther.

This was the only place observed where a farm on even a small scale could be located. It has already been taken up by several ranchmen; no land was cultivated, cabins only erected.

Descending the river the mesa formation continues, and the bottom is occupied wholly by the stream, its bed, and the thickly-grown underbrush along its course from wall to wall of the out-cropping sandstone which could but very rarely be ascended, it being in general vertical.

The valley of the Nutria, where it empties into the Piedra, is the longest noted upon the former stream, being 200 yards in width, and about 800 yards in length, with fair grazing, beyond which, on rising land, is sage-brush. The Piedra side is barren. This valley is of triangular shape, but scarcely of any value for a ranch. The hills upon the left rise sharply to 500 feet, closing in upon those on the opposite bank of the Piedra, which here takes a course slightly west of south to its mouth in the San Juan. High hills, fully 700 feet, apparently veritable "hogbacks," steep and piñon-clad, in long, successive files as far as the eye can reach, close to the waters of the Piedra upon every side; the valley is contracted to the nature of the cañon above, and the outlook has no appearance save that of desolation.

On account of the impassable nature of the mesa region bordering the Piedra, the road makes a long detour to the Los Pinos, the air-line distance apart on the line of the Indian reserve being 14 miles, that by the wagon road 20, taking a natural route along a tributary stream. Its width between hills is from 150 to 300 yards, with larger openings occasionally for 6 miles. At a distance of 4 miles from the Piedra is a very pretty bottom, a fine grassy park surrounded by high rocky walls containing 50 acres, beautiful agricultural land of easy irrigation. No one had there located, but it bore marks of having for some time been occupied as an Indian camp. This was the only spot of any size between the Piedra and the summit of the divide whose altitude is 7,010 feet, and distance 7.6 miles.

Descending, on the Pinos watershed, the country is more prepossessing and better adapted for ranches. The hills bordering the road are of a similar nature, "hogbacks" with scrub-oak predominating, well grassed, the pines being chiefly spruce. Farther down the hills are lower, the country opens, small valleys 150 to 200 and 300 yards appear, and along the streams, the profusion of undergrowth and abundance of wild hops attest the fruitfulness of the soil if cultivated. Several fine cabins were being erected, corrals established, and areas of land fenced in, to be cultivated in addition to the more important interests of cattle raising; at several points new settlers were just arriving.

It is worthy of note that while large quantities of service-berries, cherries, and other wild fruits were observed in traveling between these rivers, they were not nearly as

far matured as those at and about Pagosa and other points of a higher elevation and farther east than here.

RIO DE LOS PINOS.

The Rio de los Pinos (River of the Pines) received during last summer a remarkable emigration. Its upper waters are in the terrible quartzite region, and the ascent is fraught with danger to man and beast. One of the party was seriously injured and narrowly escaped with his life in an accident caused by his mule slipping and losing his foothold on the bare quartzite over which the trail passed. The large forests about the central part of the river were the origin of its name. Its west fork, or the Vallecito (the Stream of Small Valleys), rises in the same wonderful geological formation. It contains a large and handsome park near its mouth, and several tiny ones above. These valleys both contain magnificent pasturage, are 7,500 to 7,700 feet in altitude, and, with the contrast of the brilliant red of the rocky hills inclosing them and the long lines of level green below, are very beautiful. Beyond and above rise lofty peaks of quartzite towering to 4,000 to 5,000 feet, with snow-covered tops, magnificent, grand, and apparently inaccessible, as was afterward found to be almost the case.

Below the forks of the river there is an area for several miles of 600 yards in width, increasing to about 1,200 at their junction. Above, on the Pinos, are detached, park-like areas, the first we met being 600 yards in width, 100 yards upon the west bank, 500 upon the east; the hills, from 800 to 1,500 feet, after circling and closing abruptly on the latter side upon the river, again receded. Again for nearly 4 miles they once more recede upon the east, until we find another park of a mile in width. This latter is the finest and handsomest area of the whole section; the mountains almost meet, and seemingly offer insuperable obstacles to a direct ascent of the river. A trail here passes to the right and around the mountains, reaching the Los Pinos miles above at its headwaters; it is traveled with much less difficulty than that through the cañon.

Beyond this there is a cañon with a width of 400 yards extending for about 4 miles, when the mountains close to the width of the stream alone. There are no locations in any of these parks, above which no arable land occurs.

On the Vallecito there is no area above the large park near its mouth at all worthy of mention.

This river, it may be noted, is remarkable in that during the last 13 miles of its course no tributary whatever, save that from two small springs not worthy of note, is received from the mountains to the east, numbers of streams coming from the west. In other words, the mountain slopes of the divide which separates it from the Los Pinos are almost vertical, being terribly steep upon their western sides, while upon the other they are more gradual to the Pinos.

The general shape of this park or valley is of a rude diamond. In the upper part fully a mile is taken up by a large colony of beaver-dams, in whose waters are merged the entire river. The largest of these covers nearly 4 acres of water-surface, grassy slopes fringed by pine forest being upon either side. From the large beaver-dams to the south the valley rapidly widens, increasing in about 4 miles from 600 to 2,500 yards in width. From the beaver-dam to the southern end of the ridge in which the divide of the Los Pinos watershed terminates there is an area in the Vallecito Valley of 2,600 acres, including a small loss by beaver-dams, of which 1,350 is magnificent pasturage, the balance of the bottom from the mountain edges being pine-timbered; from this to the junction of the two rivers the area, taking the width of both valleys, of which the Vallecito is the wider, is 400 acres more, of which 350 is clear and open grazing, the remaining 50 of the valley being timbered. Throughout the park the pasturage is everywhere good; all of this is from 7,600 to 7,700 feet in altitude. We have in the aggregate a total area of Vallecito land alone of nearly 3,000 acres, about half of which is pasturage of the finest kind.

Below the junction of the forks and down the river to where the valley narrows, there is an area, lying mainly on the east bank, of 1,400 acres in the bottom, over three-fourths of which is open grass-land; the balance is covered with pine timber, extending to the base of the mountains bordering the valley and up its sides.

The bordering hills are 800 feet high on the left bank, some 200 less on the right, being lower to the south. Not a single cabin was built or location for agricultural purposes made anywhere in this valley, nor were any herds of stock seen above the Florida trail.

Shortly below the southern end of the valley last mentioned the trail from the Rio Florida reaches the Pinos and is merged in that along the river. The trail descending the Los Pinos here crosses, and we follow down upon the east or left bank.

The bottom on this side is more open, the hills closing upon the other; at some points they are here nearly half a mile distant, closing in to the river toward the south. From this point to the bridge at the county road, about 8 miles below, thence down to the line of the Indian reserve, a little over 4 miles, emigrants have flocked to the eastern bank and located upon all the available land along the river. Above the bridge

were noted six ranches in all; the upper had but a patch cultivated, and were settlers of the spring. They were building a new and larger cabin, and when passed had been busily occupied in fighting the grass-fires about their home, kindled by the vagrant Indians, who had stopped to threaten them in case they did not leave and had left the fire as memento of their friendship. The smoke was still ascending from the charred ground; the fire had extended to the forests on the hills, over which it raged for several days and spread for a long distance.

Of the next three ranches, all locations merely save one, there were but two buildings finished, the incomers living in regular tents, and improvised ones of wagon-sheets; about 9 acres were cultivated, their stock consisting of 12 horses and 20 head of cattle, in a rough corral near by, with 20 milch-cows grazing upon the hills. Below, between this and the bridge, were four or five cabins with corrals and fencing of pine, the river-bottom not here exceeding 400 yards on the eastern side, of which but about 6 acres were being tilled. The elevation is but little over 7,000 feet, and the vegetation was of a rank order close to the river-bank, where the settlers were cutting the marshy grasses and heavy masses of sedge and stacking for winter use.

Considerable quantities of arable land are found upon the western bank of the river, but the great rush for the little space unoccupied in this neighborhood was toward the eastern bank, and chiefly that from the bridge to the reservation line, about 4 miles to the south.

Immediately below the road crossing of the river the bank is high and timbered, the bottom opening out beyond. The first ranchman, located $1\frac{1}{4}$ miles below the bridge, a recent comer (in August), was living in a tent. The river-bottom is here about 100 yards wide and grazing excellent. At the distance of 1,200 yards beyond was a cabin with five wagons and tents about, accommodating three families who possessed 20 horses and 175 head of stock; of the land claimed $1\frac{1}{2}$ acres were being cultivated, their locations being along the river near by.

Within 900 yards beyond were three more cabins, the owners possessing a corral, fine fencing of pine timber and stock; 5 acres were planted, the bottom being here 1,200 yards wide. A thousand yards below was a ranchman with cabin, corral, and outfit complete, possessing 200 head of stock. Some 800 yards lower are two fine cabins, an inclosure well fenced of 1,500 feet by 600, including a well-built corral and 210 head of stock; altogether it was a first-class ranch, evidently a late emigrant, as 10 acres only of standard products had been planted. The bottom has here a width of 1,500 yards.

About 1,100 yards beyond another location was being established, the dwelling being a tent; the foundation only of the cabin was completed, no land as yet under cultivation.

Beyond and about the same distance is the last of the ranches on the river, that of Mr. R. O. Bean, which was examined in detail in order to obtain some reliable data touching the value of the Los Pinos land in the agricultural economy of the San Juan. He has a farm, 25 horses, and 150 head of stock. Settling there in the spring of 1876, he possessed in September, 1877, the most advanced and finest ranch on the river, if not in the whole lower country, surpassed, if at all, by none save one in the Animas Park. To this fact, to this palpable demonstration of the fertility of the soil, we attribute the crowding of ranchmen to his immediate neighborhood, as emigrants to the country are in general at their start undecided as to exact destination. It usually remains for some man of energy and grit to develop the possibilities of a new region.

About 160 acres were fenced in, and rather than be deemed unneighborly to the Indians, whose reservation lay below, and whose land was very rich, he went down the river as far as he deemed proper, and then located. He went, in fact, so far that the Indian agent, hearing the fact from his wards, paid Bean a visit and required him to move his fence some little distance upstream. The reservation line now passes the river-bank at his lower fence corner. His buildings are substantial, and 40 acres of land were found under cultivation. There was a rich crop of wheat, corn, rye, and oats, a trial patch of millet; and among the vegetables were noticed cabbages, beets, onions, turnips, various kinds of melons, cucumbers, radishes, peppers, tomatoes, pease, beans, and potatoes. Specimens of wheat, oats, millet, &c., including a turnip, were brought to the East, scarcely as a curiosity, but rather as indubitable proof of the excessive richness of the soil of some of the San Juan, equaling that of Kansas. The turnip aforesaid, possessing but two months' growth, was 8 inches high, $28\frac{1}{2}$ inches in circumference, and weighed $8\frac{1}{2}$ pounds.

The wheat yield was from 25 to 30 bushels per acre, while a small lot at the river-bank was estimated to reach 50 to 60 bushels. The average was, however, 28 bushels at least. Everything was unusually large and of almost immense size; wild sugarcane and hops were growing high up among the rank vegetation at the river-bank, indicative of the resources of the soil.

In 1876, no frost had been felt until October, but the night previous to the visit (September 8), which was very cold, a heavy storm raging in the mountains had sent a blighting cold, which had left its mark on the vines of tomatoes, &c.

The precipitation, it was stated, during the rainy season, which had gone by, was here very slight. As an experiment some of the corn had not been irrigated; it was but 2 to 3 feet high, while the other, which had been watered, was more than twice as tall. The chief cause for complaint was the immense number of aphides or plant-lice, with which the cabbage was particularly afflicted.

Of possible import as to the value of a farm in this region, it may be mentioned that while the price of everything was lower than earlier or much later, butter was 25 cents per pound; cabbages, 25 cents per head; onions (very large), 50 cents per dozen, &c.; the price at Animas City, during the winter previous, being per pound, onions 12½ cents, beets 10, cabbage 6, and potatoes 2½. As must be always done, the crops were produced by irrigation. The ditch leading from the river is ¼ mile long, and cost him, not including his own time and labor, \$60; a most economical and safe investment.

At this point the river-bottom is a mile across, averaging for about 6 miles below, on the reserve, 1½ miles in width; including the valley of Beaver Creek, a tributary of Pinos near by, the total width is between 4 and 5 miles. The river at this point is diverted to the southwest by a great mesa for 3 or 4 miles, after which it flows again in a southerly direction. This mesa formation is a group of rugged hills, from 300 to 500 feet in height, pinon-clad, with dwarfed spruce, which upon the opposite side of the river reappears in small mesas or hillocks of equal height, crowned with large rocks; the superposed Cretaceous sandstone denuded and bare attests the great erosion that formed the valley below. All of this portion is looked upon with envious eyes by the emigrant passing on to the west, and as soon as the country is opened to settlement by the removal of the Utes, their inevitable fate and merely a question of time, the settlers will flock thereto and it will be immediately occupied.

About 8 miles below, the middle road crosses the river going northwest to the Florida; above this point the sketch given in Plate 2 was taken to represent the general appearance and contour lines of the mountain ranges to the north and northwest, abruptly terminating at a point near the western horizon.

Near here and above were observed quantities of stock, belonging above the reservation line. The ranchmen allow them to range at will; dumb brutes are no respecters of air-lines, and quietly proceed to range over and eat upon forbidden ground, to the indignation of the possessors thereof.

The land has here the almost semi-tropical look of the soil of central and lower New Mexico, arid and parched earth—magnificent material for home-made bricks or “adobes.” The vegetation is chiefly of dry and crooked sage from 3 to 4 feet high, and the prickly-pear cactus, covering the earth away from the stream. The immediate bottom of 150 yards or more upon either side possesses high grasses and is thickly timbered with cottonwood and undergrowth. Thence upon either side extends a bench, 1 and 2 miles in width, receding and rising from the river, sparsely grassed, into which, from the higher elevations, come low, wide hollows or subvalleys, of the nature of gentle arroyos.

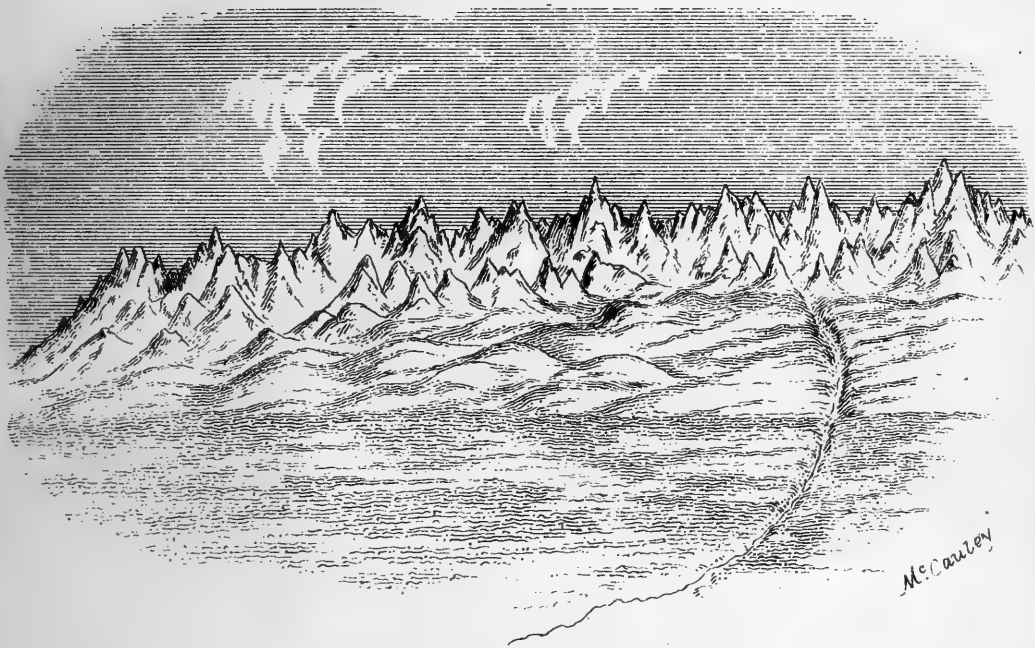
Everywhere the pebbly covered ground shows the lines of drainage and former flows of water, before erosion of this lower bed had been completed. About 5 miles below the crossing of the middle road the width of the land of “bench” character is from 4 to 5 miles, all of which is susceptible of irrigation. The river for the last 8 miles has a considerable fall, though not sufficient to be denoted as rapid.

Some 12 miles below the road-crossing, rise up lofty mesas in close succession, over 1,000 feet in height, closing in upon the river. Its whole strength is now confined to cutting its way to the San Juan below in a narrow gorge, through the high interposed plateau of Cretaceous rock. The agricultural value of the river is changed; its cañon bottom is narrow, confined, wholly unproductive and inhospitable; the entire region is of black forbidding appearance, and a scene of utter desolation as are the true mesa formations of New Mexico. The outline sketches accompanying and given on Plates 2, 3, and 4, showing a view of the Needle Mountains or Quartzite Crags and La Plata Mountains to the north and northwest and the outlook to the south of the great plateau, will aid in forming a conception of the contrasts in this region of the San Juan, a portion of a great basin which must prove in future one of the most valuable fields for agriculture.

From the Rio de los Pinos to the Rio Florida, 13½ miles, the road passes over a section of as little interest in an agricultural point of view as it is devoid of novel and startling features of landscape. Following a natural route between low hills, higher on the Florida water-shed than on the Los Pinos slopes, the road winds considerably through a line of grassy meadows from 400 yards in width at the point of departing from the Los Pinos bottom to 250 and less as we ascend, becoming more narrow upon the Florida water-shed. The timber of the region is cedar, in some cases of large size, with scrub-oak, a predominant feature in hillside vegetation.

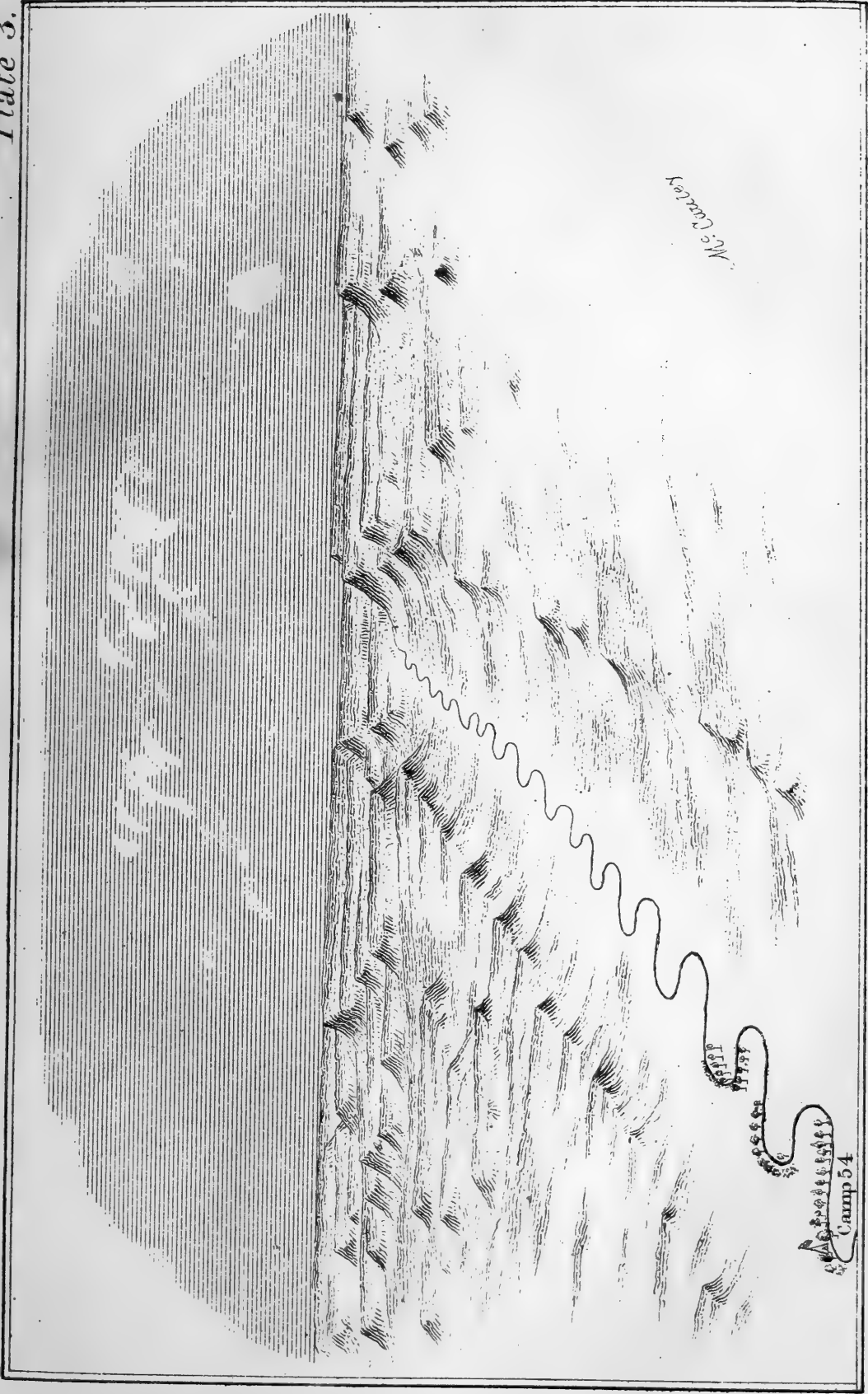
Three ranches are all that were passed *en route*, the first nearly a mile from the river, the next 1½ miles beyond, both locations of hay-cutting chiefly. The last and finest, where we noted quite a “fine” shingle-roof, glass-windows, and out-buildings, a novelty among the local ranches, is 4½ miles from the Florida, east of the divide, occupying a grassy

Plate 2.



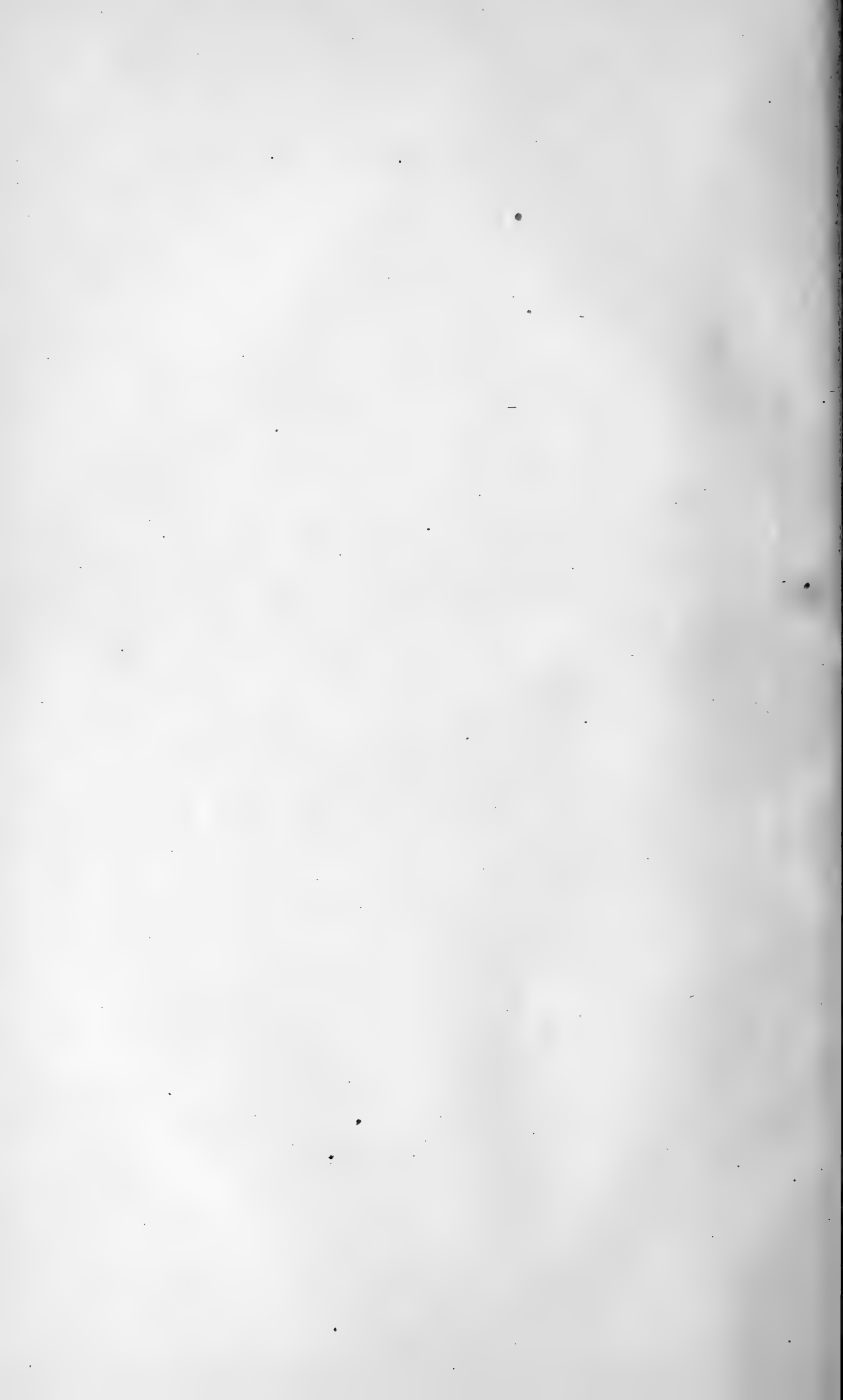
OUTLINE SKETCH
on the
Rio de los Pinos
to the North and North-west, showing the Needle Mts.
and the La Plata Range terminating in south at Parrot City
Station: Above Crossing of the Middle Road.

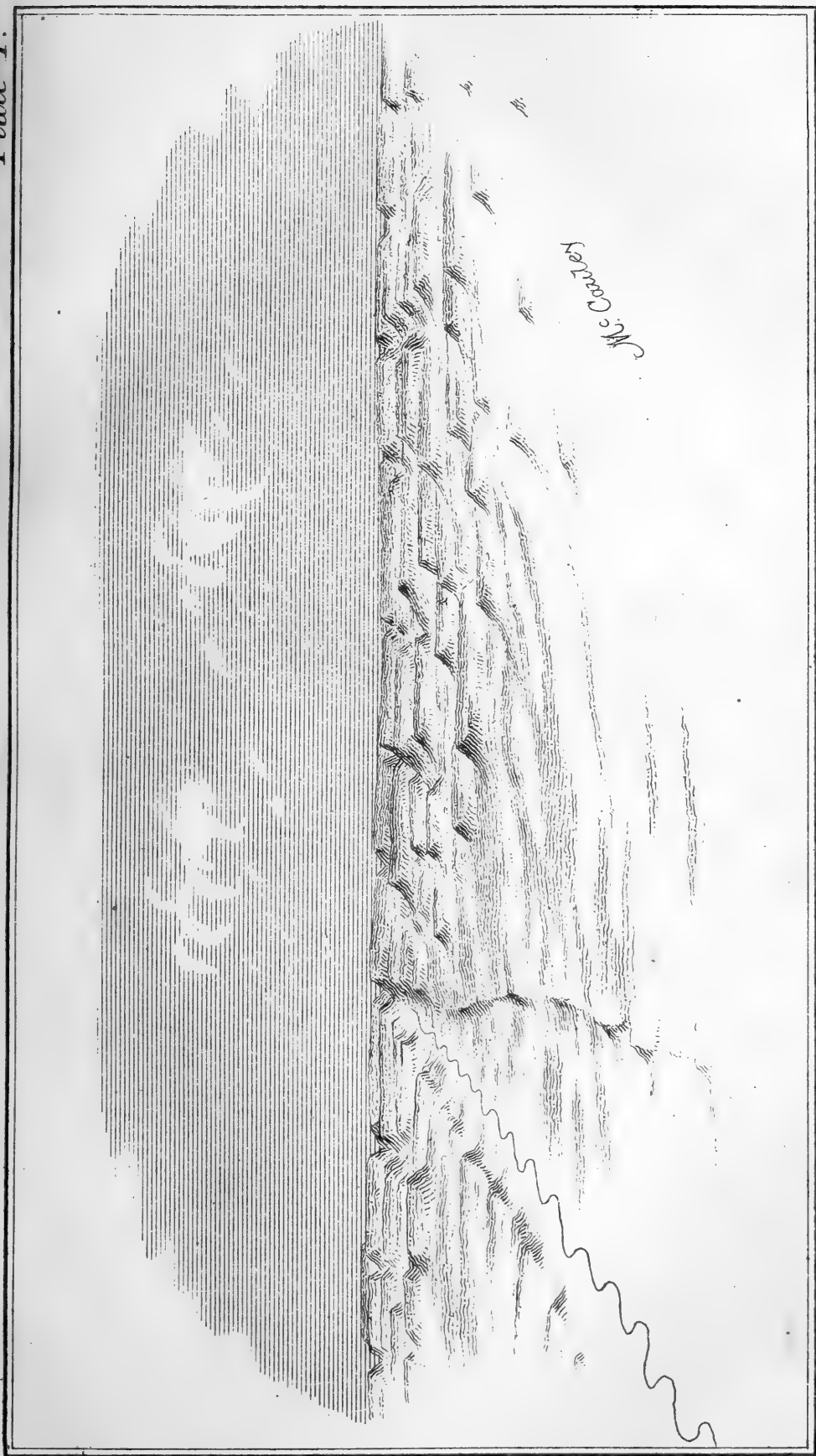




McCartey

Outline Sketch on the Rio de los Pinos, 200 feet above and near Camp 54, below crossing of Middle Road; showing the High Mesas of the Cretaceous Period. - Looking South.





Outline Sketch on the Rio de los Pinos. 3 miles to the right and 500 feet above Camp 54, - below Crossing of the Middle Road; - showing mesas of the Cretaceous Series. Looking South.



bottom; the road here abruptly turns to the north and so continues for a mile, when it as sharply pursues its former course to the west. The top of the Florida divide is but $1\frac{1}{2}$ miles from the river, the rocky hills being closer and steeper than upon the other watershed. A beautiful spring is found about a thousand yards from the river, and along the right bank of its stream the road descends. Here for the first time is noticed any work of importance, excepting the bridges on the road upon which toll is collected. It is possible that half, if not all, of the entire amount expended in its construction is annually received into the coffers of the road company.

THE RIO FLORIDA.

The Rio Florida signifies the River of Flowers or flowery banks. Taking the cue from eminent and scientific explorers who have gone before, one is inclined to doubt the fitness of things on reaching it at the road-crossing. Having observed, however, as we traveled, the peculiar adaptation of local names, whether of Spanish or Indian origin, and having also heard that the Indians haunted it as they did the Navajo, we were inclined to expect a lovely stream. Disappointed at first sight, the portion above appeared the more beautiful for that reason. Steep hills, 350 to 500 feet, increasing in height to the north, here confine the river, a modest stream of scarcely over 30 feet. Boldly protruding on the opposite side is traced a lignitic deposit, which was utilized by our blacksmith during our vicinity thereto.

At a distance of $1\frac{1}{2}$ miles up the stream was a handsome park containing 45 acres of fine grazing land, well timbered, where a cabin stood. Above this was another, smaller but more open, where another ranchman had located, the hillsides being almost precipitous, and covered with scrub-oak; thence up the stream successively are low rolling hills within the river depression, above which appear again level bottom widths of 350 to 400 yards, increasing to 600, the contents of the parks being 15, 30, and 50 acres of fine grass-land, susceptible of irrigation. Below where the general surface was 40 feet above the river, came in from the west a tributary from the Animas watershed, whose valley in extent over 1,000 yards disclosed its bounding walls of the brightest of red sandstones.

About 7 miles up the river a trail passes due east to the Los Pinos as already mentioned, 4 miles in length. The evidences of Indian camps were abundant at this point. Beyond, upon the east bank, after passing closely timbered groves of pine and aspen, a pretty park opened before us. Occasionally heavily wooded but chiefly open, the valleys succeed one another, increasing in width from 150 yards to 600, of magnificent grazing, alternating upon the river-sides, below which the true valley appears to 800 and 1,000 yards in width.

The brilliant red of the towering sandstone cliffs, a sheer vertical for over 600 feet, increasing to the north, the stretches of great pine to the grassy bottom below, long lines of meadow green sloping to the willow-fringed banks of the river, with an abundant flora, were witnesses to the stream's appropriate name. Deer (*C. macrotis* Say) in the wood, wild turkey (*M. gallopavo* Barte) and grouse (*T. obscurus* Say) in the grass and trees, and trout (*S. fontinalis* Mitch.) in the river, did not lessen its attractions.

As we continued in extended opens where the river has spread to a width of 40 feet, about 6 inches deep, the girdling mountains rose abruptly ahead upon either side nearly 3,000 feet on the east, perhaps 2,000 on the west, meeting beyond on the upper stream as links in the great chain of "Needles." The scenery was magnificent, and involuntary praise was heard from even our colored cook. The elevation of these bottoms extended from 7,600 to 8,000 feet, and nowhere has any one located.

Nature, lovely and prolific here, is as desolate ahead. An abrupt cañon region follows closely upon the last of the parks. Over precipices, down immense mountain walls, often inaccessible, dashing over bowlders reft in its struggling descent, its way clogged by huge timber and drift, the stream has worn its way; emerging from a box cañon, with perpendicular walls of 100 feet without, the river passes forth from desolation and war above to peace and quiet below.

The close proximity of the high mountains does not augur well for agriculture here, indicating short season and severe and early frosts. The portion of the river-bottom well adapted therefor is limited and near the reservation line.

From the Pagosa road-crossing the transition from the upper region is complete. The bottom is, for 4 or 5 miles, from 200 to 300 yards wide, being contracted and irregularly sloping, in which the stream winds from side to side; much of the land being too high above the water for irrigation renders agriculture impracticable.

Here passes the middle road from Animas City to Tierra Amarilla, following the river down for more than 9 miles. The river's width and volume has increased to 50 feet with a foot depth; its fringe is of cottonwood timber, with piñon upon the hills that skirt both sides, being 300 feet high on the east and about half that on the right bank. Six miles below the road-crossing there is a widening of the river-bottom to 600 yards. On account of the reservation line but 2 miles of this wider valley is avail-

able for settlement. Three fine ranches, well fenced, with good irrigating ditches, appear, the lower close to the line of the reserve. The two latter are chiefly devoted to cattle interests, each having about 500 head of stock. Upon the former were observed 10 acres of fine wheat harvested, and upon the latter over 15 acres of hay. Here, and below where the valley widens to 800 yards upon the reserve, are the best agricultural points.

This is, like the Pinos, in the great basin; the timber growth of cottonwood is here, however, much more scant. Sage-brush covers the land reaching out from the immediate banks; the level is 6 to 12 feet below that of the general valley, and wood is abundant. The hills upon either side have their steep slopes covered with piñon; their tops are chiefly clothed in sage and cacti, piñon, and scrub-oak also at intervals appearing. Pebbles and stones, indicating action, are everywhere bestrown, showing what vast areas were formerly submerged. The cattle of the settlers encroach upon the Indian land, and good grazing patches in the bottom were few and far between.

Within the reservation the valley spreads out to 1,800 and 2,000 yards of a fine agricultural appearance with an alkaline tendency. Nearly all of this might be easily irrigated.

The mesas below this point advance and recede, limiting the area along the river until the great barrier of the region is encountered. Here the valley *per se* is at an end, the river being turned sharply to the west on meeting the huge Cretaceous sandstones.

This massive mountain of the Upper Cretaceous series, if it may be so termed, rises up almost vertically fully 1,200 to 1,500 feet. Upon eroded strata, on the gradual accumulation of sufficient detritus, the piñon appeared, and between the lines the yellow sandstone apparently rises in successive ridges, from which great blocks, detached, have fallen to the water below. They clog the way and, between, the stream winds slow and sluggish with difficulty on.

The aspect here is barren in the extreme. Here and there a narrow ravine or dry arroyo enters from the north, down which are well-worn trails of cattle; high reeds and bushes conceal the water's flow; the rocks intrude so closely as to almost render passage on the trail impossible, while the vegetation is that of the usual order, befitting the general aridness. A few openings farther west and above its mouth are but oases in a sterile place.

RIO DE LAS ANIMAS.

The Rio de las Animas signifies the River of the Souls, in which appellation occurs the ellipsis of *Perdidus* ("lost").

While its signification is the "River of the Lost Souls," or Purgatory, it is neither so mapped by geographers nor thus locally known, the Purgatory of Colorado being a tributary of the Arkansas, in the southeastern part of the State.

Of all the arable land on the river the sections in which agriculture has made any notable progress may be known as the upper and lower. The upper part, where it has received attention more extensively than any other portion of the San Juan, is wholly included in that magnificent valley known as the Animas Park, the finest agricultural section, as it is the loveliest park, in the San Juan.

Except the Florida, the largest tributary of the Animas is Hermosa Creek, its name, "beautiful," being not inaptly given. Eight and a half miles below, near the mouth of Junction Creek, a town has sprung up on the right or west bank of the river, called Animas City, not located upon any Wheeler or Hayden map, and therefore of recent birth. Upon Hermosa Creek is the town of Hermosa, above which, about 4 miles, is a collection of cabins, located upon some of the maps as Animas City, now deserted. In mentioning, therefore, the above name, reference is intended to the town below, alive and in full existence, and not to the dead one above.

The most attractive feature of the Animas Park is the appearance of the red sandstones noted previously on the Los Pinos and the Vallecito, at their union, and on the Florida, but here more extensively exposed, for some distance appearing with a southern dip and a thickness approaching 1,000 feet.

These sandstones we presume pertain to the Triassic period, no reference to their geological age and position having been anywhere seen. They appear within the Animas Park, to the north of which along the river are exposures indicating the pressure of large areas of the Carboniferous formations of the Coal-Measure period.* The sandstones are of a brilliant brick red, at points aggregate perhaps a thousand feet in thickness, and slope to the south, dipping to that horizon about 20°. Their southern inclination and the character of the overlying sedimentary rocks appearing to the south undoubtedly so refer them. On both the Florida and the Animas, sections of superposed strata carry us into the sandstones and beyond to the overlying shales pertaining to the middle series of the Cretaceous period.

* F. Hawn, geologist, Lieutenant Ruffner's Reconnaissance in the Ute Country, 1873, p. 83.

Both upon the Animas, to a slight extent, and more largely upon the Florida, occur exposures of the lignites belonging to the second Cretaceous series, the upper and later sandstones of the period capping the higher mesa extending across the river below Animas City.

The handsomest outlook is from the lower part of the park, whose anticlinal axis is to the east of the meridional line and where the brilliant coloring most permanently occupies the vista of the valley.

The eroded strata are displayed in their perfect parallelism and original position, save their southern dip, resulting from subsidence or geological change of underlying strata. Rising in successive terraces, from summit to base, denudation has attracted vegetation with the passage of time, until from the long grassy bottoms and great meadows of the park the hills, no longer vertical, rise up like the steps of some giant stairway, the side or rise most brilliant red, above as bright a green. In no other valley has Nature at once been so lavish with large areas of fruitful land and displayed so beautifully the hand of the Great Architect. Not even the most uneducated person is insensible to landscape beauty; much, therefore, if not all, of the best land of the valley has been claimed and located upon.

Since returning from the reconnaissance, there has been observed a statement in a report of one of the early exploring parties that traversed the valley, which is repeated by another, that the arable land of the park "does not amount to more than three or four thousand acres." This is most certainly an error in computation or the result of but casual observations.

In a preliminary report* made soon after returning from the field, during the past winter, touching upon this valley, it was stated that "with over ten thousand acres of tillable land I found, last fall, the amount under actual cultivation to be less than one-tenth of the total." Careful computation of field-notes has not served to perceptibly change the amount.

Instructions touching the acreage of arable and timber land being included in the orders for the field, observations in detail were made during each mile of the park for determination of total area, the quantity timbered, the amount of arable land, including the possibility of irrigation, and the area of grazing, the number of ranches and the quantity of land belonging thereto under actual cultivation.

An area easily irrigated and in all respects arable, equal to that above stated to be the contents of the entire park, may be found in its lower 4 miles, or from Animas City extending to the north to the ranch of Mr. Lamb. This would be practically proven if lying in sections of high cultivation like the agricultural valleys of Maryland and Pennsylvania. From Animas City to Hermosa the amount is more than doubled. At this point there is the greatest width of fertile land in the valley, since the valley of the creek, 550 yards at its mouth, should be included.

From Hermosa the valley decreases more than half in width to the mineral springs above, a group upon the east bank, possessing both soda and sulphur constituents, covering an acre of area. From Hermosa to this point were found about 1,200 acres additional. North of the springs nothing was calculated as belonging to the arable area, although several ranches were observed with patches as great as 2 acres under cultivation near by. Deducting a fair percentage and the amount of timbered ground of the valley, an acreage between Animas City and Hermosa of 8,224, with 36 ranches noted upon the right or west bank, 33 upon the east, and 710 acres belonging thereto under cultivation; between Hermosa and the mineral springs, 1,237, with 10 ranches upon the west bank, 9 upon the east, and 106 acres tilled; near Old Animas City, 6 ranches upon the west side, 3 upon the east, and 3 acres under cultivation. This total does not include the arable land at the mouth and along Junction Creek, where 100 acres in crops were observed, nor that of Lightner Creek, or on the bottom of the Animas itself between that and Animas City, all of which forms a proper part of the acreage of this section. This sum, with that above the town already given, will somewhat exceed the aggregate that was earlier given.

The general state of the agriculture of this section, the finest of the San Juan, may be considered as but little advanced beyond an embryo condition. The ranchmen themselves may be divided into three general classes. The acquisition of fortunes more rapidly than are realized from the tillage of the soil are primarily the attractions to the majority of men entering a mining region. The necessity of a winter home, with the approach of the season too long and severe to remain at the altitude of the mineral belts, forces some men to locate a ranch; these may be said to constitute the first class. Others seek farming as a livelihood, for bare sustenance, or, as they term it, for "grub stakes" when their hopes of "finds" of silver and gold have vanished, while the third and last kind of settlers are those whose days have been passed in farm industry and who come to locate, to farm, and to work.

The first class put up a cabin; oftentimes four logs are simply crossed and sworn to as a foundation by which to locate their claim. No improvement of the land is ever

* Ex. Doc. No. 66, House of Representatives, Forty-fifth Congress, second session, p. 36.

made, as the owner is absent at his mines in the laboring season and returns in the winter only to live and hold his place.

The second class are too lazy to work, or shiftless when they do commence; they are satisfied with bare sustenance without realizing the full value of their land.

The third class are *bona-fide* farmers; they labor as farmers must do all the world over, and find their ground, the gift of a beneficent government, a source of wealth ere long.

No questions were asked and no inquiries made thereon, but from personal observations it is presumed that representatives of all three classes have located in the Animas Park. Too little time has elapsed for the completion of ditches and other things incident to and connected with thorough and systematic irrigation, but, unless greatly in error, the settlers of the third class are believed to be in a minority. Save that little necessary to establish and hold their claims, the ranchmen, in general, have made no improvements worthy of mention on their land.

A beautiful waterfall on the west side a number have utilized, and draw the supplies for their main irrigating-ditches, a few miles in length, to their several places.

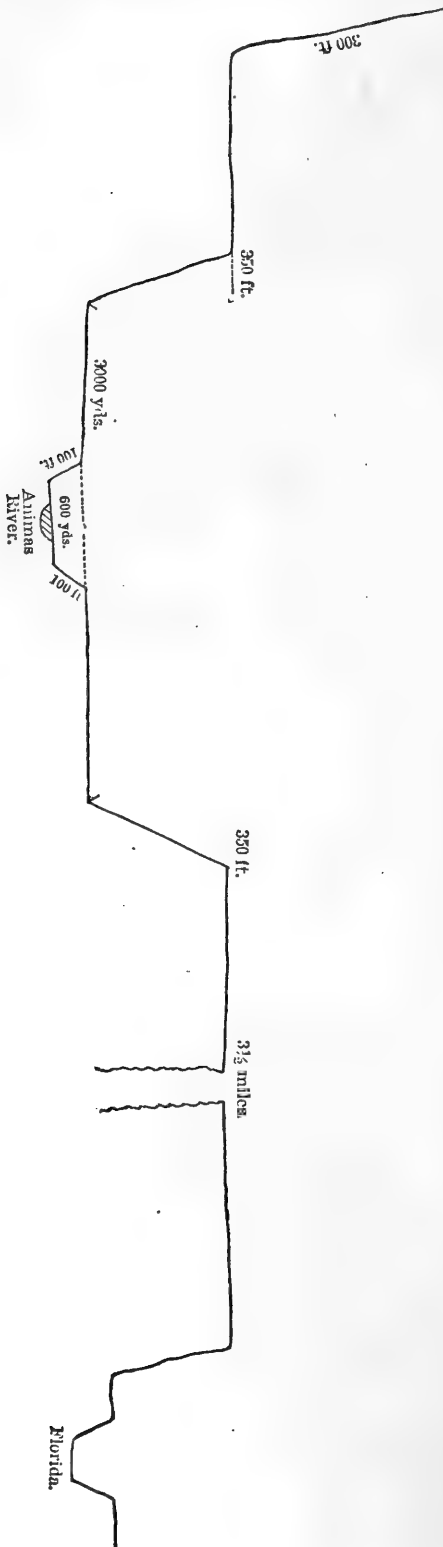
Several of the ranches, however, make a good showing in an agricultural point of view, one of which, about 4 miles above Animas City, and the property, we were informed, of Mr. J. V. Lamb, deserves especial mention for the fine appearance of the farm, with all the usual outbuildings and external signs of thrift and comfort noticeable in one of the Eastern States.

Below the Animas Park the agricultural development of the country has only begun.

That portion of the valley of this stream, of the La Plata, and of the San Juan itself, situated in New Mexico, and lying east of the Navajo Reservation, was formally included in and set aside for the Jicarilla Apache Reserve. The Indians having never been placed thereon, and never desiring it as a home, the land was finally opened to white settlement, and a heavy immigration for that section set in during the past spring, summer, and fall.

While the amount of land under tillage in September last was inconsiderable, from all things observed, it is more than probable that the acreage during the season of 1878 will be large, unless the ranchmen should be deterred from planting full crops by the threats and presumed disturbances of the Indians, who regard with unfriendly eye any approach to their own lands.

The soil of these river-banks is very rich and capable of returning large crops for the labor expended; the timber growth, high sage-brush, and other vegetation indicate a most promising agricultural section. The altitude itself in each case points to a large and varied field for the planter's selection; below the line of the Ute Reserve, which is also the boundary of Colorado, the La Plata lies at an elevation of 5,600 to 5,300 at its mouth, in the San Juan River, and the Animas from 5,900 at the same north point to 5,300 below. On the boundary of Colorado and New Mexico the Animas is 17 miles due east of the La Plata. The latter, with a tortuous course, flows to the south, its mouth being 20 miles distant; it receives no streams *en route*, all of its tributaries being wholly dry unless during the rainy season. In both peculiarities mentioned, the La Plata and the Animas are very similar. The valley of the Animas trends so strongly to



the southwest that at the distance of 27 miles its mouth, in the San Juan, is but 2½ miles due east from the La Plata, and about 4 miles by the windings of the river.

On the west bank of the Animas, a short distance below Animas City, are met the high abrupt hills of the Upper Cretaceous series, limiting on the west the great basin or depression in which lie the Florida and Animas in part, and to a greater extent the Los Pinos. Through two lateral spurs, still remaining and extending to the same series on the eastern side, the Animas has cut a gorge where it is so deflected from its former course as to include a width of a mile where the erosion of long ages has left a level area or bench, the intermediate river-bottom being here 600 yards in width.

From below the second gorge to the mouth of the Florida the terrace formation is characteristic and continuous, with lines more nearly than elsewhere equidistant from the Animas. About 7½ miles above the mouth of the Florida was made the following outline, illustrative of the general terrace structure throughout the basin, the distance east to the Florida being about 3½ miles; at several points, however, the width of the section between the rivers lying in this great depression was considerably in excess of that distance.

The river was here 250 feet wide and 2 feet deep. The height of the lower mesa above the river varied, being occasionally as low as 25 feet to the south of the Florida, and above varying from 40 to 100 feet; 60 or 70 feet being at least the average. Its width possessed as great a variation, as had also the immediate bottom.

Just below the mouth of the Florida, the line of Cretaceous hills on its south extends to the west, and the river here passes through a narrow gorge therein, the walls abrupt, almost vertical on the east, but considerably eroded upon the west. The following is an approximate outline at that point:



The encircling high walls of rock about this huge basin, the uniform level nature of these benches within, the drift of pebbly *débris* covering them everywhere on top and sides, suggest the great inland sea that here existed, portions of whose bottom at present constitute the divide between the three rivers. With the partial erosion of the confining walls on the south and the outflow therefrom, the subsidence of the waters left the Animas and the Florida distinct streams, and the latter a tributary from its failure to rupture its southern barrier and individually reach the San Juan. With a diminution of its waters and the rapid erosion (comparatively speaking) deepening its outlet through the confining walls to the south, the water fell to the height of the lower bench, whence successive and similar operations have depressed it to its present level.

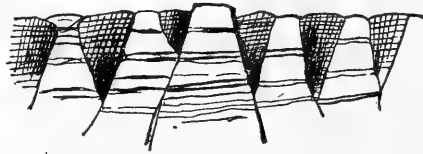
For over 8 miles from its entrance the river continues in the cañon, cut through the huge yellow sandstone cliffs, its passage in general a desolate region, relieved at the distance of 4½ miles by the successive regression and advance of its walls, leaving spaces of 900 yards or less where grazing occurs.

The cañon at its inception is very narrow, and considerably obstructed by huge blocks of yellow sandstone, fallen from the mass above. It can, however, be passed, and will in time be undoubtedly utilized as a wagon route from the settlements below, which are only reached at present by a long detour via the La Plata. Here the trail leaves the river-bottom and passes the narrow point of the cañon over the second bench. Mr. R. L. Smyth, a settler of considerable enterprise, who immigrated with

his family to the lower river from Cañon City, Colo., in September last, locating, with some 60 head of cattle, about 6 miles below the line of the Ute Reserve, deserves the credit of having first made the passage of the cañon with a wagon, it having been previously considered wholly impassable. His team consisted of four yoke of oxen, with a second wagon trailing behind. Both were safely gotten through, without damage or uncoupling.

Beyond the Indian Reserve the high hills are broken down to the south, and the valley opens, increasing rapidly in width to 2,000 and 2,500 yards, which is exceeded below toward its mouth, making it a most valuable agricultural section. The high growth and abundance of sage and cacti are full proof of the fertility of the soil. Reaching the immediate bottoms, the luxuriance of willow and a large variety of undergrowth, including wild oats and varied grasses between the cottonwoods fringing the river, attest its richness.

The bounding rocky walls of the valley have decreased in size but have become very attractive, and for some distance, chiefly upon the west side, they possess a singular beauty. With funnel-shaped portions of the sides eroded, the rest of the outer walls stand forth the frusta of huge pyramids and beautiful bas-reliefs from the water-sculpture adorn the valley sides. The huge masses of the Upper Cretaceous have disappeared, and underlying strata of shales, and lime, and sandstones are seen. (See figure.) Instead of the bright yellow above, beautiful bands stretch over the



On the Lower Animas.

fronts of the pyramids, vari-colored and perfectly parallel, of yellow, bluish-gray, and other attractive hues.

This lower valley of the Animas can be easily irrigated. It will produce immense crops, and affords room for a large population. From its altitude and situation, its winter climate is undoubtedly very fine; and but little snow, if any, can lie in this valley.

Of all the land lying in the Lower Animas and Florida, the most barren and desolate sections are contained within the boundaries of the Indian reservation.

The settlers were much scattered, and few had accomplished more than the building of their cabins. In the aggregate were found upon the river about 250 head of horses, the cattle amounting to about 1,900, passing *en route* a herd of 700 sheep, belonging to Mexicans, here temporarily only.

THE LA PLATA.

The Rio de la Plata, or the River of Silver, derives its name from the mountains whence it springs, which for a long time have been, by both Mexicans and Indians, believed to contain quantities of the precious metal; a tradition not without foundation.

Between Animas City and the La Plata, the only portions of a possible value of vegetal and more extensive crops are the limited areas of the lower parts of Junction and Lightner Creeks. Up the former the immediate trail from Animas City passes, and along the latter for a short distance is the toll-road to Parrott.

The area along both streams, already referred to, is inconsiderable save at their mouths, being confined and limited between rolling hills. Most of the ranches seen were evidently those of late comers, the largest place on Junction Creek being 50 acres, all fenced, of which but 3 were under cultivation.

The toll-road is well located along on a natural route, is in good order, and affords easy communication between the two rivers, the trail being some distance to the north, and shorter.

The hills are of the same general series as those on the Animas below the town, noting the absence of the upper sandstones; along the divide between the two creeks exposures of the underlying shales were observed.

Reaching the La Plata itself about Parrott City, its seat of thickest population, we have made but slight descent from the long divide climbed from the Animas. This section is therefore, from its height, not adapted to the growth of cereals, its elevation being over 2,000 feet above that of the same latitude on the Animas.

This river, emerging from a gorge in the La Plata Mountains, at whose mouth lies the town on a high and grassy tableland called the Mesa Verde, or "green table," from its level surface, stretching out from the mountains, is a clear and beautiful trout-stream, and was 18 feet by 8 inches when crossed there late in September.

Possessing but a single running affluent, Cherry Creek, coming from the west, it has considerable fall in its upper and central part. Its lower section, where the river is tortuous and sluggish, belongs to that already described in connection with the lower Animas and San Juan, received numbers of immigrants during last season. Like the Animas, the valley of this stream is comparatively narrow and confined, the boundary of rock being sharp and frequently vertical cliffs. Within, the same fertility and richness of the soil obtains on proper irrigation, instanced by the luxuriance of the uncultivated growth immediately adjoining the waters. The fertility and beauty of this stream has always been fully appreciated by the Indians, large numbers of Utes, as has been their wont, being encamped upon it during the fall. Many a growl will be heard before their removal is consummated.

THE MANCOS.

The Rio Mancos, or, supplying the ellipsis, the Rio de los Mancos, signifies the River of the Maimed, *i. e.*, lacking one or both hands. Its Spanish origin is unknown; whether or not it was due to such outrages upon settlers or travelers along its banks by hostile Indians, we are not aware. It has of late years gained notoriety from the reports of scientific explorers touching the cliff-houses and other vestiges of the dense population that once dwelt along its banks.

This stream rises in the La Plata Mountains, on the western slope of the ridge, and near by the La Plata itself. After coursing to the west and south, not far distant, it makes a great swing to the southwest and crosses the Colorado line over 40 miles west of the latter stream, emptying into the San Juan over 60 miles lower down the river than the La Plata.

The two branches of this stream, sometimes mapped as the North and South forks, are locally called the East and West, but erroneously, as the western body of water is the main stream, the other being but a tributary of scarcely half its length. The latter was, in September, 10 feet in width by 4 inches, the other being deeper and 15 feet in width.

With a rapid fall and greater length, the river is more than 2,000 feet lower than the La Plata at Parrott; it has also a less altitude than the Animas at Animas City. As might, therefore, be conjectured, it is a valuable agricultural section, of which it gives promise in having been formerly the seat of habitation of a dense population, whose vestiges indicate their peaceful habits and devotion to agricultural pursuits.

The Mesa Verde is a portion of the general plateau country, extending from the mountain's base to the south, west, and northwest.

This formation is of a sedimentary nature, and in its age belongs to the Cretaceous period. The highest exposed masses, formed during long periods of subsidence and which have since been elevated, are massive sandstones, brilliant yellow on close approach, best seen in the lower cañon of the Animas, where they are exposed vertically for over 1,200 feet. Underlying the upper sandstones are series of varying strata, mainly of dark shales, with alternating bands of sandstones, clays, and limestones, which, subjected to no violent action since original deposition, have preserved their original parallelism. They may, with finest landscapic effect, be best observed upon the lower Animas. This second series being softer than the upper sandstones, which themselves present but little resistance to atmospheric action, are rapidly denuded and worn from the rocks upon which they are superposed, the lowest and oldest series of the period. With the erosion of the upper sandstones covering them, the underlying shales are rapidly denuded in large areas extending underneath the upper rocks, which, deprived of support, fall in masses, leaving vertical cliffs or overhanging rocks. Cañons, therefore, formed herein would be, in their upper parts, vertical or overhanging masses of sandstone, and below in steps or narrow benches, grading to the top as successively the softer shales are met by the harder but narrower stratifications.

This mesa, composed of the Middle and Upper series of this geological period, covers an area of hundreds of miles, largely in the Indian reservation, and extends down to near the San Juan, where it towers to a height of 2,000 feet, and presents the same characteristics as the similar formation seen on the Piedra, the Lower Pinos, and Animas; steep escarpments of sandstone, almost vertical walls, sparse vegetation, its forestry limited and dwarfed, a region in all respects far from attractive, from which agriculture is banished.

Ascending it from the Animas to the La Plata at Parrott City, we find the stream here in an elevated bed, the general surface not deeply eroded. Its western boundary is near by, and from this point a fine and most extended view is obtained of the great ocean-like surface to the west, upon whose shore or banks high up we stand. Spread out before us its level is broken only by the distant tops of the Sierra Carriza in the Arizona corner, a little less than a thousand feet higher than our position; Ute Mountain, still loftier and nearer, in Colorado; and beyond, in Utah, the Sierra Abajo; and far to the northwest, but dimly seen, the tops of the Sierra la Sal, rising to 12,000 and 13,000 feet.

Descending over 1,200 feet, by a fine wagon-road and over a natural route, the Mancos is reached, its eastern branch about 12 miles from the La Plata, the main stream half a mile beyond. Grassy hills intervene, of gentle inclination, their slopes covered with scrub oak, with larger forest growth beyond. At about 7 miles from Parrott City is passed a magnificent grazing section known as Thompson's Park, about 4 miles long, averaging perhaps 2 in width, well covered with handsome spruce, and containing fully 4,500 acres of fine pasturage. The streams which are mapped as watering this region were found, unfortunately, wholly dry.

Before reaching the water of the Mancos, but a few hundred yards distant and on the right of the road, was observed a fine mineral spring with a strong but not very disagreeable odor, due to the presence of hydrogen sulphide, an element acquired in its passage over the black shales, exposed not far distant, and seen also on the opposite side of the La Plata.

The valley of the Mancos is very attractive. To the traveler from the west, after a passage of the deserts, the barren, arid wastes that intervene between running water, it seems doubly so, a sort of garden region, with its groves of lofty spruce and cottonwood and willows bordering the clear and sparkling stream with well-grassed banks.

In the most desirable portion the land is almost wholly taken up; the section preferred is that part of the valley from the crossing of the road to the south. In this distance, 7 miles altogether, there were located 27 ranches, nearly 20 of which possessed improvements generally of a meager character beyond the dwellings.

The amount of cultivated land was small, a total of but 75 or 100 acres only being well farmed; the ranch of Mr. Merritt, apparently in better condition than any on the river, contained 30 acres of corn and wheat. The former was still standing; the latter, he stated, had yielded 25 bushels per acre.

The last place on the river is that of O'Donnell, a ranchman with a genuine Irish heart, who, with Mr. Sheets, of Animas City, the principal capitalist, and a few others, are engaged in stock-raising, having about 30 horses and nearly 1,500 head of cattle. Aside from theirs, scarcely more than 400 head of stock were in the valley.

The remarkably fine condition of all the stock, which roam about uncared for, attests the fertility of the soil in the nutritious grasses growing over the waterless plains.

The ranch of O'Donnell & Co., occupying a frontier place, has suffered from depredations chiefly of the Indians. A week before our passing, four horses belonging thereto had been stolen by Mexicans. Their trail for 100 miles had been followed, thence Navajo Indians had been employed to continue the pursuit, which, without success, was not abandoned until after 12 days of very hard riding. Cattle had been stolen at various times, and in August a herd of 40 or 50 of their stock had been driven off by Indians, their trail going to the northeast is the direction of Ouray. From such loss and molestation, not only is the present settlement of the section suffering, but that of the future is being discouraged and prevented.

The aspect hence to the south is uninviting. At the distance of a mile, rise, like a huge sea-wall, above us the Mesa Verde, its line extending here directly west. Here and there, reft by small chasms or cañons, the projecting rectangular masses, desolate, black, and forbidding, extend toward us like huge castles upon some towering hills.

The Mancos now receives no running tributary; the whole region is arid and desolate; its course is southwest in an imposing cañon, at points 2,000 feet in depth cut through the middle and upper series of the mesa. Narrow below, rising in steps and abrupt outward slopes, with walls of vertical escarpments in the upper sandstones, this region is of great interest to archæologists, from the ruins and cliff-houses that lie within the cañon.

Earlier, during the rainy season, the general aspect of the country may be different, but when visited in September it had a sterile look. The Mancos itself was sunken largely, being merely in occasional holes, and not running during the last 25 to 30 miles of its course.

THE RIO DOLORES.

The Rio Dolores signifies the River of Grief, and excepting this river on the north, whose course is to the northwest, there is no running stream of any kind watering the entire section of Colorado from the Mancos to the Utah line, an area of over 1,200 square miles.

On leaving the Mancos and ascending the hills near by, over which the trail to the Dolores passes, a fine view of the outstretching country is presented; the altitude is about 7,500 feet, the atmosphere is clear, and the outlook is only limited by the range of vision.

Direct to the south the high walls of the Mesa Verde stretch out to the west; immediately below us lies, spread out to Ute Mountain, the "Montezuma Valley," filled with ancient ruins, a section susceptible, from its immense sage-brush, almost rendering it impassable, of the highest cultivation and fertility, providing water, the one thing lacking in this entire region, could be provided. Beyond, 25 miles to the southwest, rises Ute Mountain, with other elevations, to over 9,000 feet, near which is a large and

beautiful spring, its water sinking in the plain below, utilized by the Indians, whose villages are there located, and who cultivate some of the land near by.

Far to the southwest, about 60 miles distant, near the southwest corner of the State, and lying near the Arizona and New Mexico line, rise the summits of the Sierra Carizo, so named from the abundant reed-grass there; farther east, the sharp and pointed summit of the "Needles," an isolated and remarkable mass of volcanic rock, its tops sharp and needle-like, as if to pierce the great sedimentary rocks through which it has arisen solitary and alone to nearly 2,000 feet, its sides vertical, sheer cliffs for fully half its height.

To the northwest rise the low tops of the Sierra Abajo, or "Low Mountains," in Utah and 70 miles away. These are known locally to the Utes and Pi-Utes (or Pay-Utes) of Utah, roaming here, as the Elk Mountains, but are now called by the white settlers the "Blue Mountains," on account of their beautiful color at this distance, but chiefly to distinguish them from the magnificent range of that name lying in the San Juan between the headwaters of the Gunnison and the Grand. Still farther to the north and more distant, nearly 100 miles away, in Utah, in the angle between the Dolores and Grand, rise dimly the tops of the highest peaks of the Sierra la Sal, or Mountain of Salt, from its large deposits thereof. All this region is one devoid of agricultural hope. It is, beyond doubt, a fine grazing region, and the rank growth of vegetation in *arroyos*, or the dry, narrow beds of streams, is indicative of exceeding richness of the soil, but water is everywhere absent. Enthusiasts suggested their scheme of a long canal from the Dolores for irrigating the large area to the south and southwest. This is unfortunately wholly impracticable, for both the Dolores and its tributary on the south here serve their country to but little good, being confined in narrow cañons of true isolation, whose sides are almost vertical walls in the sedimentary rocks.

Before coming to the Dolores, about 4 miles therefrom and fourteen from Mancos, an affluent of the former is reached, known as the "Lost Cañon." The origin of the name was not learned, but was probably due to the disappearance of the cañon cut through sandstone as the stream is ascended. The cañon was here not excessively deep, and is reached at several points without difficulty. Utes from the Peak to the southwest, and Pi-Utes, the latter a rascally looking lot of vagabonds, from the west, were encamped near by to obtain water for their ponies. During our entire stay here, all our movements were signaled to and fro by puffs and columns of smoke in the usual Indian fashion.

The vegetation is here largely of grass, sage, and piñon, with cedars near the river, and beyond to the south, replacing the piñon, areas are covered with cacti and the soap-plant (*Yucca angustifolia*), whose fruit is the great Indian favorite.

The river was reached at the point where a direct sweep to the north is made from its western course, known locally as the "Big Bend" of the Dolores. Not far below the mouth of the "Lost Cañon" we descended from the plain to the river-bottom, a few hundred feet below; a narrow, but fertile section, well wooded and grassed, and looking more beautiful than elsewhere would appear from the very aridness of the region passed over in reaching it.

The Big Bend is, in truth, an oasis in the dry desert region surrounding it; it has been occupied for ranching purposes, and is the extreme outpost of the agricultural region, not of the San Juan only, but of the whole of Colorado. Attracting attention from its location at so distant a western point, it becomes the more interesting when to other unfavorable surroundings that of unfriendly Indians is added. It was therefore visited for examination.

The East Fork of the Dolores drains part of the La Plata Mountains and ridges to the north; its West Fork rises to the northeast on the southern sides of the Sierra San Miguel, a group of peaks whose general anticlinal axis is apparently east and west, waters tributary to the San Miguel flowing from the northern slopes. At the Big Bend, therefore, having drained an extended area, the Dolores possessed no mean volume; its size in September when we first reached here was 80 feet wide by some 8 inches deep, 3 miles below being 50 feet with a corresponding increase of depth. The river in changing and shifting its bed has worn in the sedimentary rocks a fertile valley, narrow and limited in area. Upon either side rise yellow sandstones, in general impassable cliffs; broken down upon the south, easy access is had from the plain above to the bottom below, a valley of depression; upon the east or right bank, looking down the river, the hills are 300 feet above the water, increasing shortly to 450, overhanging the stream, and 500 not far distant, in general steep escarpments; upon the left 200 feet near us, while beyond the mesa is 300 to 350 feet above the valley. Three miles below, on the latter side, the walls break off to the left and disappear in the general plain, low rolling hillocks replacing them. A gentle slope outward from the bottom to the upper surface exists, and an unusual widening of the little valley occurs; this, however, of limited extent, the hills soon reappearing, confining it as above. Approaching those on the eastern bank below they close to a cañon nature and the valley is at an end. Within the bottom the river, with a rapid current, abuts from

side to side against the sandstone walls and continues the erosion of the past, its deflection giving a tortuous flow. At its inception or southern part the valley is narrow, about 400 yards in width, decreasing to 350 farther on; gradually it broadens and at 3 miles spreads to 600, rapidly widening at the incoming little valley from the west, until, for a limited distance, is found a grassy bottom of 1,200 yards, all of which could be irrigated. A thousand yards below, the hills close upon the river, and within a mile the opposite walls draw near and the valley abruptly terminates.

The elevation at the southern part (Camp 64) was 6,980 feet; about 4 miles below, at the junction of the Ouray trail, it is but 40 feet less. The area of culture must, however, be slightly limited from the serpentine course of the river and the walls of rock, defining the initial points of irrigating-ditches. In the aggregate it contains, probably, 700 acres of good land, much of which, if not all, can be cultivated. A true valley of erosion, the bottom-land is exceedingly rich, and of its yielding fine crops on proper cultivation there can be no doubt. The grass is fine and tall; the timber, mainly cottonwood and willow, is of magnificent growth, some of the former being of immense size, under which were evidences of former Indian camps; the character of the undergrowth along the bank is at some points so rank and interwoven as to be almost impassable, which was practically learned in getting within gunshot-range of some ducks observed at a distance upon the river. Upon the first 3 miles of the valley one old and three new cabins were found; beyond that two old ones, all with the owners absent save the one at the entrance to the valley on the south. No land anywhere cultivated, the last settlers but lately arriving.

Of the absent cabin-owners a few were said to be prospecting in the mountains, and the others, after building their houses, had gone out to return with their families and stock. Upon settling here they were ordered to leave by the Indians, who threatened them in case of non-compliance, but have since not troubled them save to beg provisions. The Indians had offered for sale some American horses having Mormon and other brands. A feeling existed that they would remain undisturbed, and that a permanent settlement would be there established. Numbers of trails from all directions center here, and from its geographical situation it is a point of some value, the distance to Salt Lake City being stated to be 250 miles, which is undoubtedly incorrect, the maps of the General Land Office making it beyond 300.

Leaving the Dolores, and traversing the country to the west and south, the whole region, as already stated, is thoroughly mountainous and sterile. To the south, to the west, everywhere, near by and beyond, in Utah, exist immense areas of ruins of the ancient cities and towns now reduced, in general, to mounds and piles of *débris*. Their former conditions of being, their mode of life, origin, habits, and disappearance is a problem shrouded in mystery, as yet unsolved; their present existence in this habitat would be scarcely possible. The general surface is of the lower sedimentary rocks of the Cretaceous period, and everywhere fragments of sandstone and crystals of heavy spar were observed; piñon, sage and cacti, soap-plant here and there, with tufts of bunch-grass, alone vary the monotony and rescue it from being wholly a barren desert with its burning, alkaline soil.

The proposed irrigation of "Lookout Valley" to the south, containing perhaps 3,000 acres of good grazing, a bright relief to the traveler, may be deemed wholly impracticable, as well as that of Montezuma Valley, farther east, containing some 4,600 acres of fertile land. A spring hard by, with alkaliescent properties, soon sinking in the earth, was the only water found.

Near the latter point, in Montezuma Valley, a solitary settler had located in a "dug-out," built, it was said, for a permanent residence. In a hillside, with half of his home underground, he had chosen his abiding place with hopes of a better future, doubtless, for the outlook then was far from bright. With nothing but grazing here for cattle, and in the absence of water, which had to be hauled for any and all purposes from the distant Mancos, it was difficult to surmise the object of his location.

SUMMARY.

This closes the Lower San Juan and, with the approach to the Utah line, the section most remote, but not devoid of interest in agricultural inquiries, has been traversed.

Of the San Juan proper, the lower region is the one strictly adapted to agriculture, where it has already taken foothold, and where only it can thrive. Glancing at the valley of the Chama, the region of the Conejos and similar and adjacent sections, a great possible fertility is found to exist; the primitive inhabitants with their antiquated Mexican ideas are in possession, American enterprise has scarcely taken a bare foothold, and no material development of the country can be said to be in progress.

To the west are seen the Navajo, the Blanco, the Upper San Juan, and the Piedra rivers, almost untouched. Here and there a solitary spot is being slowly developed, lying almost unnoticed in the immense surroundings where settlements have not appeared.

Emigration has passed beyond and located within the depressed area of wide extent

from the lofty walls of the Piedra to the great mesa heights on the Animas's western bank, through which course the Los Pinos, the Florida, and the Las Animas. From the lofty mountains above, they are, apparently, parallel waters, coursing down over a great level, but are not so in reality. While ignorant of the geological causes effecting such local variation in the eroded valleys, it is yet palpable to the most ordinary observer that the groove in the great table-land, through which flows the Los Pinos, is loftier than the others, is more gently outspreading, and is less broken by the encroachments of the original barriers, whence results, for the same limited area, a region better suited to agriculture.

Within the Animas Park above, upon the Lower Animas beyond, the sandstone barriers and the contiguous sections of the San Juan and La Plata, previously referred to, appear districts of future agricultural wealth.

The Upper La Plata, elevated and high, within a tableland parallel to that of the great basin, coursing over loftier and more recent sedimentary rocks, does not become of value until it has descended to the lower and proper cereal elevation; while beyond and below it, as if at the base of a great wall, is the valley of the Mancos, not extensive in area, but fruitful in its products, and already occupied.

THE UPPER SAN JUAN.

Ascending the rivers flowing down from the "Dome of the Continent," we find clusters of mining camps clinging to the mountain sides, or established in the narrow synclinal valley of an upper stream, always locally called the "gulch." Occasionally in more favored situations of a park-like nature, at points of import, towns appear. So situated upon the Animas River in Baker's Park are Silverton, and above it, next in size, Howardsville, while the Lake Fork of the Gunnison claims Lake City, the young metropolis of the San Juan.

Silverton's altitude is about 9,300 feet above the sea, and Howardsville, some 4½ miles above, about 350 higher. They are, therefore, valueless in an agricultural point of view, and upon the lower regions must remain dependent for the produce of the soil.

At "Lake City" the altitude is about 8,600 feet, which may well be considered above the agricultural limit. A few enthusiasts have nevertheless endeavored to demonstrate, it was said, its capacity as a vegetable-producing region, and had reaped after considerable trouble a small harvest of cabbages and turnips. The cost thereof was not ascertained, nor whether it bore any relative proportion to their actual value, as did the agricultural experiments of a celebrated jurist in the East, who prides himself upon a farm in Pennsylvania where wheat has been raised at an outlay of \$25 per bushel.

A meteorological record was kept during 1876-'77 at Crooke's Works, about a mile to the south, and 50 feet above the central part of the town. In January, 1877, the coldest night was 10° below zero, the warmest day 40° above; total depth of snow, 2 inches. In February following, the coldest night was 1° above, the warmest day 42° above; snow-fall during month, 5½ inches. These were the figures furnished. It should be remembered, however, that in March and April occurs in this mountainous country the greatest precipitation of snow. From Lake City, as from other mining towns, those who can depart for the winter to less elevated localities in search of a milder temperature. Its prosperity is undoubted, but it is solely as the center of a magnificent mining region of undoubted richness.

Along the Rio Grande, the entire name being Rio Grande del Norte, or the Great River of the North, whose course was followed throughout in this region, the altitude is in general also too great for agriculture of any note. It is lined with ranches, chiefly for grazing purposes or those of a wayside inn. Antelope Park is the largest section, with a general elevation of 9,000 feet 43 miles above Del Norte.

From the mouth of the South Fork of the Rio Grande, altitude 8,000 feet, 16 miles above and west of Del Norte, the plateau or mesa formation, so prominent at "Wagon Wheel Gap," has disappeared, low hills are seen sloping to the river, and a true valley of 800 yards succeeds, possessing at points a width with incoming streams of 4,500 to 6,000 yards, narrowing again at Del Norte. The elevation is here 7,750 feet, and besides the Rio Grande land, many points are cultivated on the lower parts of Los Pinos and San Francisco Creeks, the former's mouth being above and the latter's below the town.

From the South Fork to Del Norte some 23 ranches were noted *en route*, with the usual scattered herds of stock grazing about. Passing down on the right bank, some on the opposite side may have escaped observation, a number lying on the left bank along the road to Ionea, a town opposite Del Norte, and a short distance from the river. There were, moreover, 8 seen along the Los Pinos; upon later examination, they were found to extend up the creek for 11 miles at varying intervals, in the lower section being one-fourth of a mile apart, of which scarcely more than one-fourth of the land located upon was under cultivation. In the immediate vicinity and below Del Norte, 40 ranches were counted lying within three-fourths of a mile toward the south-

east and south. Three-fourths of their area was for hay purposes, and 125 head of cattle were near.

Not far distant was passed a Mexican plaza of eight houses, and a mile beyond one still larger of a dozen, with 900 acres of land under fence, of which about half gave evidence of having produced fine crops of corn and wheat. The ranches continue along the river bank for some distance, the road to Fort Garland crossing 7 miles from town and continuing along the east bank; that for Conejos leaves the river and passes southeast and south. Sixteen miles distant is the Piedra Pintada, signifying the Painted Stone, from the bright-colored peak whence the stream flows down.

Along this stream (Camp 87), which sinks in marshy ground about 5 miles below the road-crossing, 31 ranches were observed.

Some 8 miles to the south of the Piedra Pintada the bed of Gata Creek was passed, entirely dry, no water being met with (October 22) until the Alamosa was reached. Along the road the vegetation is sparse, the soil being covered with fragments of trachytic and other volcanic rock, largely rounded from watery action. In its passage the arid desert region was less disagreeable than in July, from the absence of summer heat, and no ranches were found *en route* until the Rio Alamosa was reached, the stream signifying the river of the handsome poplars or cottonwoods, many of the latter fringing the stream. Outside of cities of old Mexico, lines of grand old cottonwoods, watered by running *acequias* or ditches, carrying the water supply of the place, afford a beautifully shaded drive, which is always known as *El Alamo*, the word itself signifying a poplar.

The Gunnison, its tributary the Uncompahgre, and farther west the San Miguel, all flowing west or northwest, draining extensive lands of the Upper San Juan, embrace within their limits large areas of magnificent agricultural land, lying, however, within territory proscribed from settlement by the whites, being within the reservation of the Ute Indians.

This region not being included in the area traversed, its agricultural extent and resources are not known. In general, however, experience has demonstrated that the ranchman should avoid an elevation exceeding 8,000 feet. To this there may be exceptions of a local nature, as southern trends of slopes, sheltering mountains, protecting cañon walls, or other advantageous situations. Fair crops of the hardy vegetables have been and may be frequently produced at a greater altitude, but in general the attempted cultivation of the more tender cereals will be often fraught with disappointment.

CHAPTER III.—LINES OF COMMUNICATION.

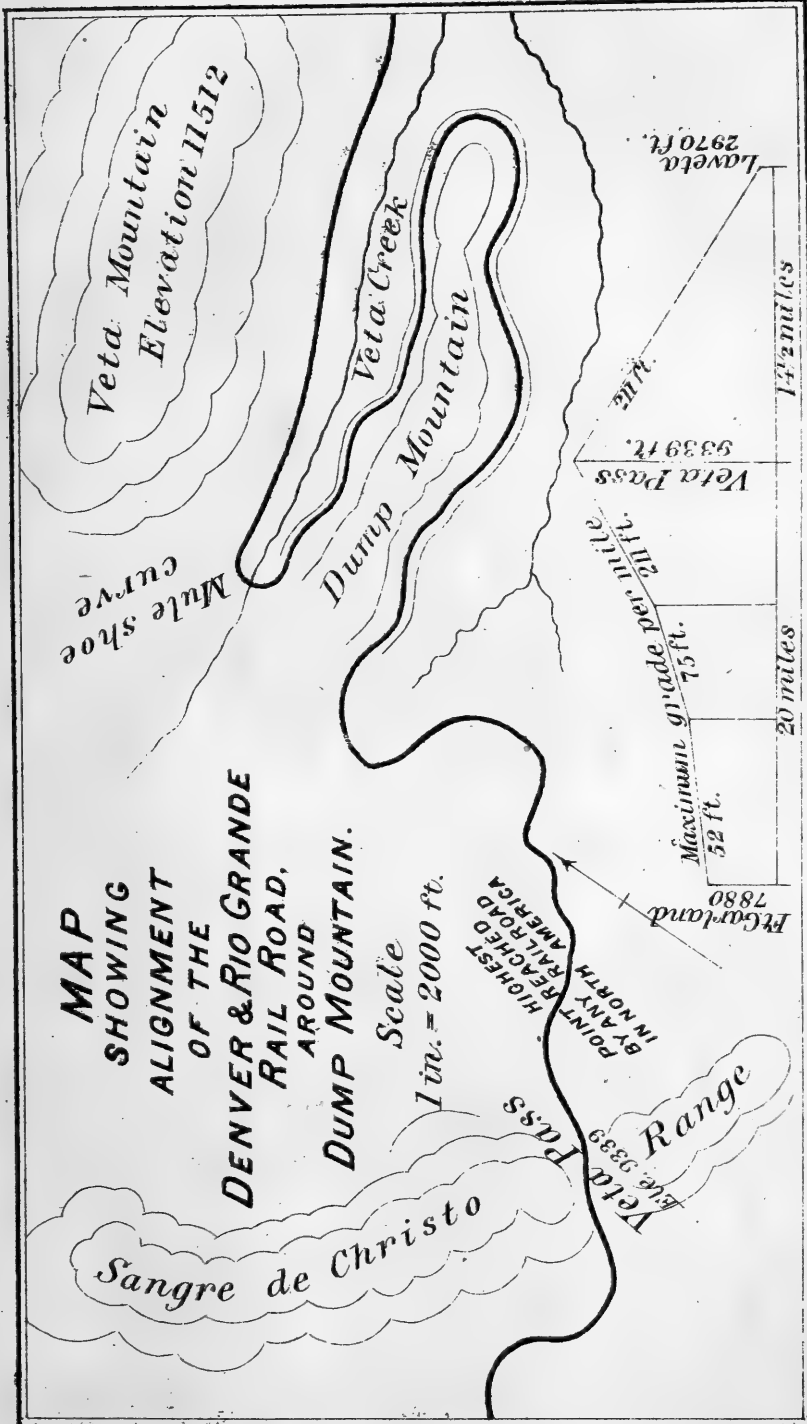
SECTION I.—RAILROADS.

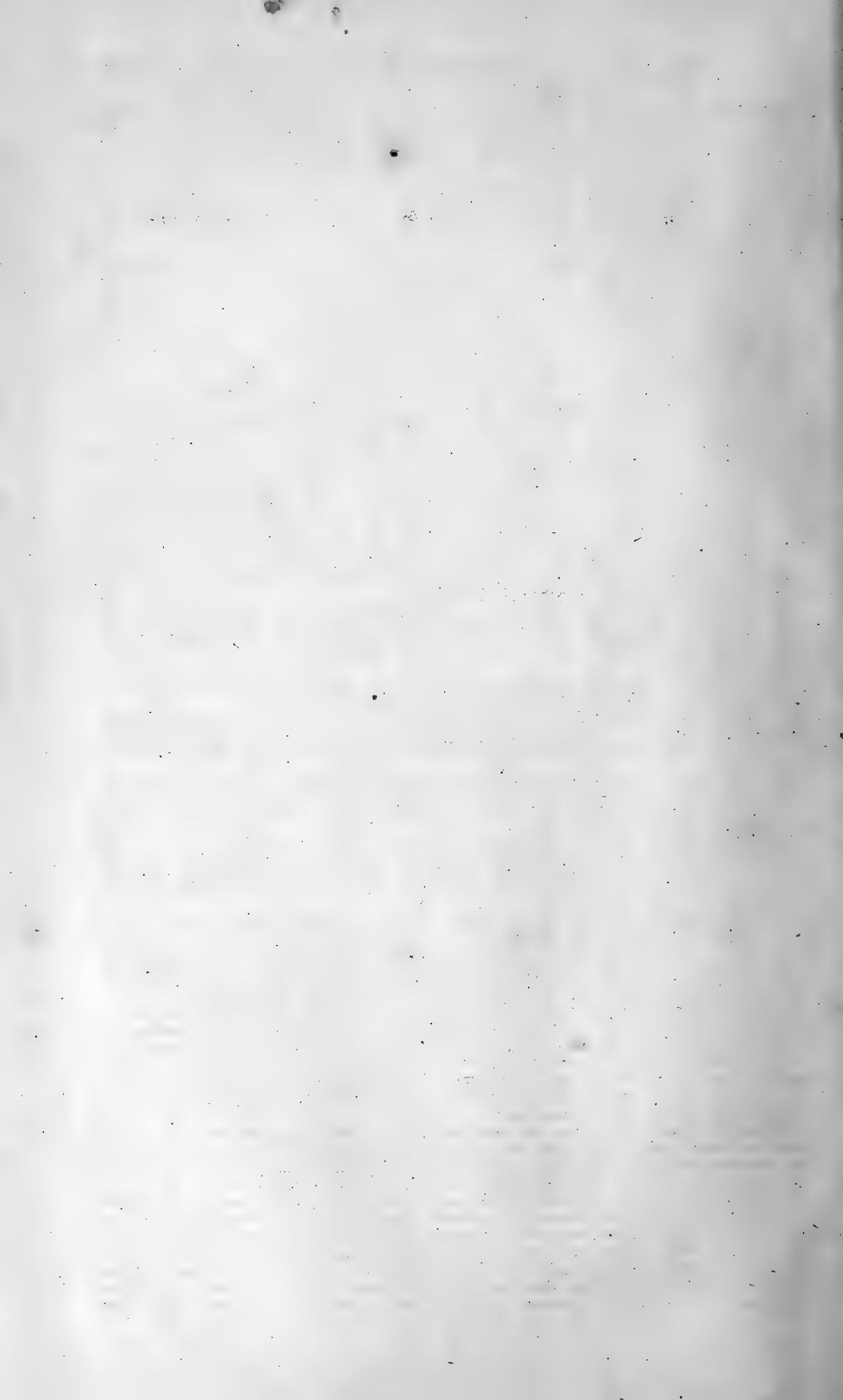
Roads are the highways of civilization. Their construction is the first and essential stage in the gradual development of any section. Without an easy outlet for its resources, no country, however productive, can acquire that wealth and prosperity which free and easy communication alone can furnish. This is particularly so in an inland section and a mountainous region. The discovery of the precious metal is almost invariably made by one or more adventurous prospectors, whose outfit, of the most modest nature, is generally borne upon "burros," or jackasses, capable of climbing over difficult mountainous country. With the discovery of a fine mineral deposit, their log cabin is established, becoming the nucleus of a mining-camp. The outlet and inlet by a trail permitting pack-trains only with the advent of new-comers, an embryo town appears, and well-watered lands *en route* are taken up for grazing and farming purposes.

With increasing signs of permanency and material wealth, the necessities for a wagon-road become daily more evident, until it is finally furnished by some enterprising capitalist, or a stock company, and the settlement is opened to the basis of supply.

From this dates permanent prosperity. Slow-moving pack-animals are succeeded by more rapid freight-trains, with greater carrying facilities, high prices for commodities of life and business are diminished, and the stage-coach appears upon the scene. Easy access, well-rewarded labor, and profitable investments invite the laborer and immigrant, as well as the speculator. The country increases in agricultural and mining industry until, with the lapse of time, the railroad approaches and the frontier settlement assumes a metropolitan air; and on the march of civilization continues.

The roads of San Juan are, therefore, of prime importance, and whatever can be done to shorten the lines of communication and open as yet undeveloped sections will be of the first and most material value. The lines of communication in Colorado are of three kinds—railroads, wagon-roads, and trails—and in their relation to the development of San Juan will be considered in the order named, the passage of a river, whether by ferry or bridge, being included in the route upon which it lies.





The advance during 1877 of the Denver and Rio Grande (a narrow-gauge railroad) over the Sangre de Cristo Range has enabled it to control all the freight and passenger traffic destined for the San Juan, as well as all of New Mexico, save the northeastern part. Its present terminus (May, 1878) is Garland City, $6\frac{1}{2}$ miles from Fort Garland, situated in the eastern part of San Luis Valley, at the foot of the western slope of the mountain, whence travel for the upper country passes northwest to Del Norte and via the toll-road up the cañon of the Rio Grande to the settlements beyond, while that for the lower takes its course due southwest, passing Conejos, a Mexican plaza, known also as Guadalupe.

In the crossing of the mountain range by the line of the narrow-gauge, some points are presented of interest to the general observer as well as to the engineer.

The elevation of La Veta, lying at the eastern base of the mountain, is 6,900 feet above the sea; that of the track on the summit of the pass, determined by the line of levels, is 9,340. The distance is 14.6 miles, giving an average rise throughout of 167 feet per mile. Most of the ascending line, however, is of a steeper average, being for a long distance 211 feet, the maximum gradient being 217.

In the accompanying plan and profile (Plate 5), showing the extraordinary alignment of the railroad in its mountain-passage from La Veta to Garland City, furnished by one of the officials of the company, the crossing of Veta Creek, along which passes a wagon-road, is by a viaduct of arched masonry, where exists a 30° curve of 193 feet radius, known as the Mule Shoe Bend, being worthy of mention as the sharpest railroad curve in the world.

The renowned Horse Shoe Bend on the Pennsylvania Railroad is stated to be a 90° curve of 637 feet radius, while the greatest in the South American Railroad, built by Meigs, the famous American contractor, is a 14° curve with a radius of 376 feet.

Beyond the Mule Shoe Bend, at the point of turning to encircle Dump Mountain, the track overlooks its own line, upon the opposite side of the ravine, from a height of 400 feet. At the highest point in the southern slope of the same mountain, the track, in its ascent, makes another 30° curve.

The summit of the pass is a natural level, of, however, short extent.

The descent upon the western side of the range to Garland City, 15 miles distant, is not as abrupt as upon the eastern; while the maximum grade reaches 211 feet per mile, the average is but 88.

The rails used were of Cambria steel, 30 pounds to the yard; the cost of the road from La Veta to Garland, including equipment, was \$16,000 per mile.

To permanently possess all the trade of the San Juan, of which this line obtained absolute control by its strategic crossing of the mountains, an extension to the western bank of the Rio Grande has been built and will be opened during the present summer.

The terminus is Alamosa, 33 miles from Del Norte and 28 from Conejos, the line of the extension being a tangent of 32 miles; Alamosa is also 85 miles from Ojo Caliente and 138 from Santa Fé via Conejos.

From Alamosa an extension to the south has been definitely resolved upon by the management of the road. The line will approach to within 4 miles of Conejos and skirting the eastern base of San Antonio Mountain will, for a long distance, pass over the great volcanic plains, finding much of the way a natural road-bed from 10 to 15 miles west of the Rio Grande.

We are informed by one of the prominent directors of the company that 100 miles of this extension to the south will be almost or quite completed by January 1, 1879.

The purpose of this road building is to assure possession of all the freight and traffic of New Mexico, except the northeastern part, and also in part the Arizona trade.

A rival company, which has been making advances to secure the heavy trade which the Denver and Rio Grande now monopolizes, is reported as tunneling in the Raton Mountains, near the boundary line of Northeastern New Mexico. Whichever line, therefore, reaches first the objective point to the south will be the winner in the contest.

The Denver and Rio Grande will, however, always be the medium of rapid transportation to the Lower San Juan; in addition thereto, it at present possesses and wholly controls the trade of the upper country also. In the latter direction the outlook for the future gives promise of completion.

Beyond Cañon City, the old terminus of the Denver and Rio Grande for the San Juan trade, before the range was passed to the south and Garland City sprung into existence like a mushroom, there exists the Grand Cañon of the Arkansas, 2,000 feet deep, containing the most feasible and practicable route for a railroad to the west.

The rival company already referred to, the Atchison, Topeka and Santa Fé Railroad, is now engaged, we are informed, in constructing a line therein. Should it continue extensive building operations up the Arkansas to the valuable mining district of California Gulch, there might be a possibility of an extension to the west, crossing the range and descending the Gunnison. The route would naturally leave the Arkansas and ascend via Puncho Creek, crossing the continental divide by the Marshall Pass, 10,850 feet, and descend the Ternichi to the Cochetopa and the Gunnison. Cochetopa

Pass, farther south in the main divide, some 800 feet lower, is naturally fitted for a railroad pass, over which and down the Cochetopa a fine wagon-road already exists. The greater expense of the long detour might probably prevent its being utilized.

A reconnaissance for a line to the west was made during 1877 by engineer corps of the Santa Fé line to the Gunnison, the Lake Fork, and the Uncompahgre. By the chief engineer we are informed that the distance by their survey from Cañon City to the Lake Fork is 159.9 miles, and to the Uncompahgre 198.

The construction of this line would be very expensive, but would result in securing the entire trade of the Elk Mountain district, which will develop rapidly with the opening of the Indian reserve to settlement, that of Lake City and vicinity and of the Uncompahgre region, both mineral and agricultural; it would, in fact, soon monopolize the whole of the Upper San Juan, which is immense, is rapidly increasing, and is well worth contention.

SECTION II.—WAGON-ROADS.

Of the Lower San Juan the seat of the largest population is the Animas Park, containing thousands of acres of tillable land susceptible of easy irrigation. Above this, however, and beyond the grand cañon of the river lies the largest populated region of the entire country and the seat of its greatest mineral wealth.

Silverton, upon the Animas, and other towns and contiguous mining camps, may be reached from the railroad and Del Norte directly by following up the valley of the Rio Grande and crossing the mountain-range that forms the divide between the waters of that and the Animas; more indirectly, by reaching the lower country and the Animas, and thence passing up the cañon of the river.

As the lower country is the least favored with respect to outer communication, it may be well to first consider it. Hemmed in upon the north and east, which, with outlying spurs that contain many peaks of great altitude and few practicable or natural passes, the summits of the mountain-chain lie approximately in the arc of a circle with Pagosa Springs nearly at the center. It is, moreover, south of the position of Garland City but 11 miles, being about 100 miles west thereof. From the railroad terminus all roads to the lower country at present have a common point, viz, the crossing of the Chama at the plaza of Los Ojos, one of the villages of the Tierra Amarilla section, whence the main-traveled line, known as the "Upper road," passes to the Animas, via Pagosa Springs. While the distance to the Animas is greater by this than by the route called the "Middle road," which, passing by the Laguna de los Caballos, Piedras de Legurados, and the Cañon Curaçoa, to the San Juan below the mouth of the Navajo, and crossing the Rio Piedra and Rio de los Pinos, unites with the upper road on the Rio Florida; it is preferable to the latter, on account of more frequent water and the fine grazing along the route, timber being everywhere abundant. Hence, from its natural position and the relative points of supply, Pagosa becomes a strategic point, and the line which will easiest and quickest enable travel to reach it will, and in fact must, become the popular and frequented route.

The Rio Grande River, which emerges from the mountains at Del Norte, taking a southeasterly course through the San Luis Valley, is, during most of the year, easily passed, being fordable with but little difficulty at a number of points from Del Norte south. Like all streams, however, that spring from lofty summits in the main range and are fed by banks of eternal snow, it is subject to great increase in its waters during the spring months of the year. The small brooks become roaring rivers, and with difficulty are crossed, where earlier and later the passage may be a matter of no difficulty. At such times the Rio Grande is a formidable barrier, and can be crossed only by bridge or ferry. A few miles below Del Norte a bridge over the river secures travel of all kinds from any interruption at all seasons, while that below, bound southwest, finds passage during high stages of water in one of two ferries that are located on the lines of travel.

The lower country.

GARLAND TO CONEJOS.

From Garland City to Conejos and the southwest two routes are optional. The first, in a general southwesterly course north and not far from the Rio Trinchera, crosses the Rio Grande just above its mouth, at a distance of $19\frac{1}{2}$ miles from Fort Garland and 26 miles from Garland City. Thence it continues some $26\frac{1}{2}$ miles due southwesterly along the north bank of the Rio Conejos, a tributary of the Rio Grande, with its mouth a mile below the Trinchera, reaching the plaza of Conejos at a distance from the railroad of $52\frac{1}{2}$ miles.

Part of the way on this route another road may be taken by crossing the Trinchera a few miles below Fort Garland and continuing south of, and near it, about as far distant as the former above. It reaches the Rio Grande at the mouth of the Conejos, whence, passing due west, it comes into the other road at a distance of 4 miles. While no appreciable distance is saved by this route, its only advantage ordinarily being,

perhaps, a preferable ford to the one at Stewart's, it, like other points, presents no crossing-place over the Rio Grande during high-water seasons and hence will not be considered.

The second route from Garland City passes a little west of south to the Rio Culebra, crossing it at Mexican plaza of Lower Culebra; thence southwest to the Rio Grande, where is the ferry formerly kept by Mr. Fred. Meyer, now in the hands of Señor Valdez, $39\frac{1}{2}$ miles from Garland City, 33 from the fort; thence the road passes due west to Conejos, 18 miles distant, and $57\frac{1}{2}$ from the railroad. Both roads lie wholly in San Luis Valley and are natural ones, as easy in traveling and as hard as the ordinary prairie, save in a few places where they are heavy from shifting sands, a belt of which extends over the valley.

In June, while in that section, a whirlwind would here or there keep in sight almost constantly a cloud of sand, and as they occasionally passed, they shut out completely earth and sky, filling eyes and ears, taking along hats and other movables if possible—happily a brief visitor, leaving as a souvenir a fine stratum of sand. The height to which these moving, flying pillars rose, seemingly gathering strength as they whirled along, was very great. The other variation to the usual monotony and far more agreeable were the occurrences of mirages, which were noticed almost daily while traveling over these level surfaces. Trees lining the banks of streams far away would be uplifted from beneath the horizon, and before us lay spread out a lovely sea or huge lake whose distant shores were hemmed in by luxurious vegetation, only to fade away as we approached, a never-resting will-o'-the-wisp, in whose place were found the burning sands of the plain.

Stewart's Ferry.—The approach to the Rio Grande on the upper or Trinchera road is over low ground. During the high-water season the river reaches back for some distance upon either side, and with its diurnal fall and rise the ground, at other seasons hard and dry, is changed to a marsh, and easy access to and from the river-ferry is for heavy teams often quite problematical.

In our crossing the ferry in June last, one of the wagons of the train, in the detour which is selected as the best approach upon the eastern bank, mired twice in the boggy ground, and caused a delay of two hours; upon the opposite shore another long and tedious delay resulted, the road being two feet under water, necessitating unloading by hand in water above the knees. There is a bend in the course of the river just above the ferry, and as the ground here rises but slowly from the stream outward, it is at the best a faulty location for such a purpose.

The river was then about 150 feet in width, with a very rapid current. The ferry-boat, rather a small affair, about 20 feet in length, barely held an army wagon and the wheel span of the team; a flimsy rail was along each side, protection chiefly in appearance, each mule requiring holding during the passage. In taking over the cavalry escort, the horses were led on the boat, heads alternating up and down stream, to equalize the load, which was limited to eight. A crossing with horses only was made in eight minutes, and four six-mule wagons, including the teams, were ferried over safely in one and a quarter hours. A small pier or planking of some kind was lacking, nothing of service in the nature of gangway being provided. The rates charged were, for single horsemen, 50 cents; light wagons, \$1.25; two-horse wagons, \$1.50; and four-horse wagons, \$1.75. The ferriage was, however, reduced in consequence of the size of the party to 25 cents per animal, riding and team, with no charge for wagons. The more direct and better road, as before stated, is up the course of the Conejos River, above and skirting the edge of the plain, always high and dry; it is, however, nearly barren of grazing, in need of which the command took a left-hand road at a distance of about 12 miles from the ferry; this passes over what is known as the Island, a long point of land included between the San Antonio and Conejos Rivers, across which, during high water, flows a net-work of small streams, rendering it the best watered and most fertile land in this section; it is, without doubt, the garden-spot of the entire valleys of the two rivers, and would be literally "flowing with milk and honey," were it in the hand of eastern farmers instead of those of Mexico as descent, whose ambition is generally satisfied with cigarettes and a "baile."

The Conejos was crossed at the plaza of Los Cerritos, "the Hills," taking the name from some high hills that are grouped near by, whence the road soon passed into that from Chavez's Ferry to Conejos.

The passage of the Conejos was made without loss, though not without difficulty; the stream high and rapid, with about a six-mile current, was in the beds of the rivers, and one of the team-mules falling in the river and becoming entangled in the harness, was with difficulty saved from drowning. From the appearance of the banks at 1 o'clock p. m., it was evident that the water had very lately fallen fully a foot.

Valdez' Ferry.—The ferry on the lower road differs in location, &c., materially from that above. It is in a direct line 18 miles south of it; by the windings of the river about twice as much; a trail leading down from the upper ferry, which is called by the Mexicans but 12 miles. This ferry, formerly known as Myer's Ferry, and described in 1874 as a "dilapidated affair," was purchased from Mr. Myer in the spring of 1875,

by Señor Caledonia Valdez, the present owner, for \$450. The boat sunk in the following fall, and last spring it was replaced by the present one, very serviceable and greatly superior to Stewart's. It is about 45 feet long and 12 in width, and strongly constructed of stout timbers. A strong side-railing is provided, and a small row-boat is in tow, for a possible necessity, certainly a wise precaution; for the river in June was here 10 feet in depth and about 250 feet in width. The cable is firmly held upon strong piles about a foot in diameter, with heavy triangular braces, thence passing over a windlass to the rear. The crossing with a load was made in four minutes. The charges are about the same as at Stewart's; its capacity greater. The owner reported that at a single crossing they had carried 400 sheep, the charge for the trip being \$5. In its location this ferry has, furthermore, an advantage over its rival. The river is here about 25 feet below the general surface of the plain, and as the road descends gradually and easily, no possible miring of teams can occur. A short distance below this point the Rio Grande enters its long cañon, which increases in depth southward, the lava sides vertical or piled with sharp-edged rock, perfectly impassable, and a veritable scene of desolation in nature.

To the San Antonio River, *en route* to Conejos from the ferry, the road is a magnificent natural one, fine, hard, and level; on the way, upon either side, some two or three miles off, rise rounded hills with sandstone strata, on which lay the cold, volcanic rocks, blessed with but little timber, and that but a poor piñon, with an occasional cedar, the only kind that will befriend so dismal, inhospitable a surface. Lava rocks lie strewn along the bases of the hills and out over the plain everywhere, its hot and parched surface relieved only by an occasional breeze from the mountains to the west. Its vegetation is exceedingly sparse, almost nothing save sage-brush and a few cacti breaking the monotony. No grazing can be found at or near the ferry, nor on the lower road to any extent beyond the crossing of the Trinchera, until the San Antonio is reached. The latter was found very high and the ordinary ford impracticable, necessitating our crossing a mile lower down.

Of the two routes from Garland to Conejos, the upper or Trinchera is preferable. Its chief disadvantage is the inferior condition, in addition to low approaches of Stewart's ferry as compared with that of Chavez, the latter as a crossing being greatly preferable. The upper route has, however, several advantages over the lower not to be lost sight of, which are mainly—

1st. It is considerably shorter.

2d. Its hard surface or natural road, save a small sandy portion, less than half of that on the other.

3d. Wood, water, and sufficient grazing for convenient camping places at no long intervals, the Conejos being timbered with cottonwood.

4th. Except the Rio Grande, but a single stream of any importance to be crossed, the Rio Conejos at the plaza of Conejos (or Guadalupe), while on the lower road are the Trinchera and Culebra east of the Rio Grande, and the San Antonio on the west. By one route a bridge is essential for the Conejos, by the other for the passage of the San Antonio. At the plaza of Conejos the river was formerly passed by a bridge which was, they there informed me, washed away in 1874. After numerous resolutions to replace it, the citizens have let the matter drop, and teams now find their way over as best they may. At the town, fortunately, there is a spot where the river broadens to over three times its usual width, so that generally a passage may be found. The river here is about 200 yards and the approaches low, so that a slight rise in the water materially increases the difficulties of passage. A superior location may be found not far distant and the river bridged at a cost not exceeding \$1,300.

CONEJOS TO PAGOSA.

Communication between the above may be considered under the following heads:

1st. Old line via Tierra Amarilla section.

2d. New line via Tierra Amarilla section.

3d. *Proposed lines.*

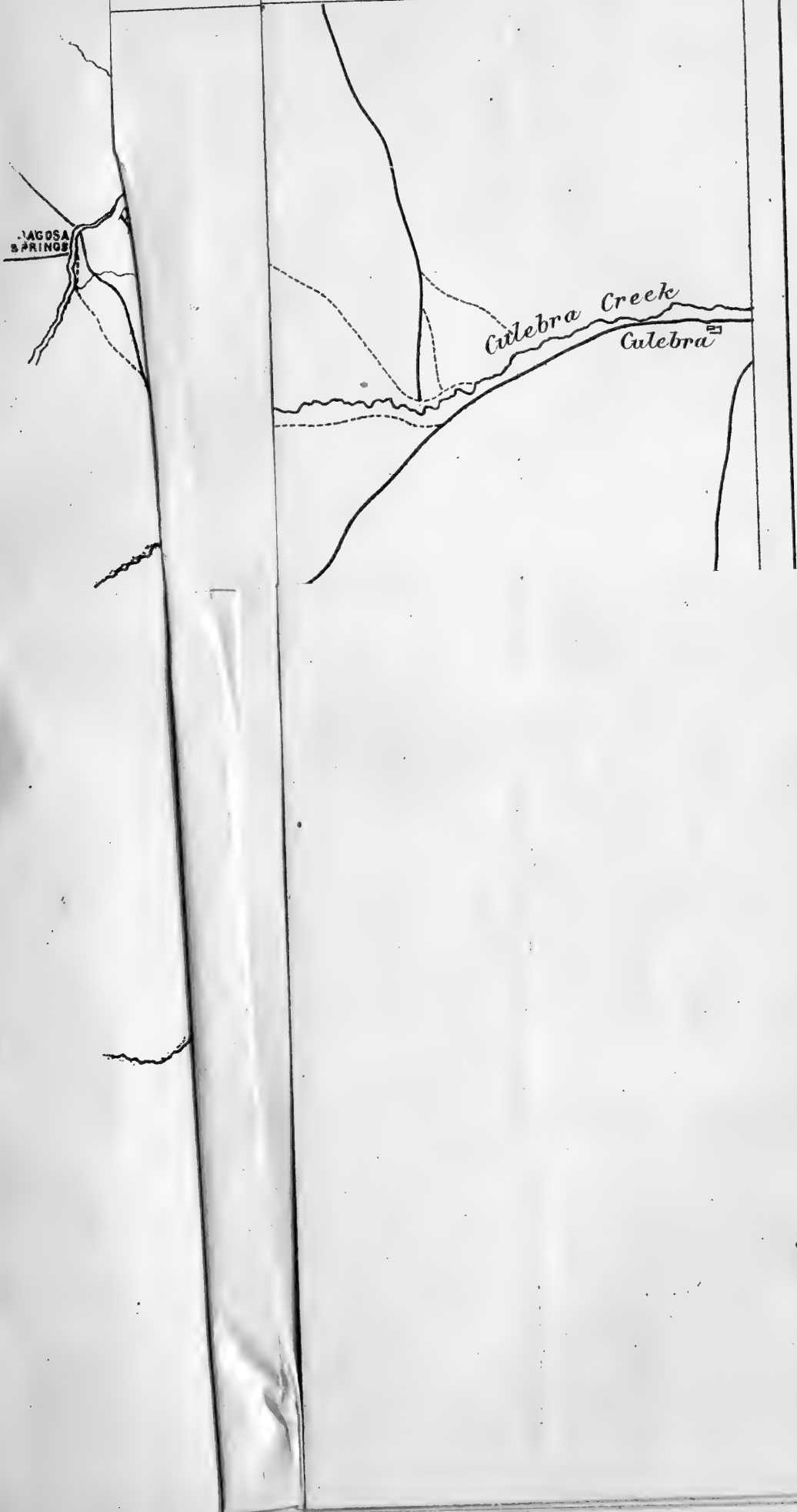
1st. *The old lines.*—Up to the present summer the only mode of access from the railroad to the Lower San Juan was from Conejos southward to Ojo Caliente and north-west to Tierra Amarilla, a distance of 150 miles. A cut-off above Ojo Caliente via Cueva, shortening this distance to 120 miles, has diverted travel in its favor. It is in general a good and easy road, being largely over country with a hard and level surface, having been the scene of volcanic eruption; some mesas passed over present difficult points, the chief objections, however, being the absence of grazing and the long distance between water making it an exceedingly hot summer route.

Crossing the Chama at Los Ojos, where it was about 75 feet wide, 2½ feet deep, the "upper" route is over a natural road, through low valleys or over gently undulating hills, covered with fine grass wherever shepherds may not have tarried. The continental divide is here a line of sharp mesas of the steepest kind, 400 to 600 feet in height, with sandstone outcroppings and sides timbered with scrubby piñon. The road winds so

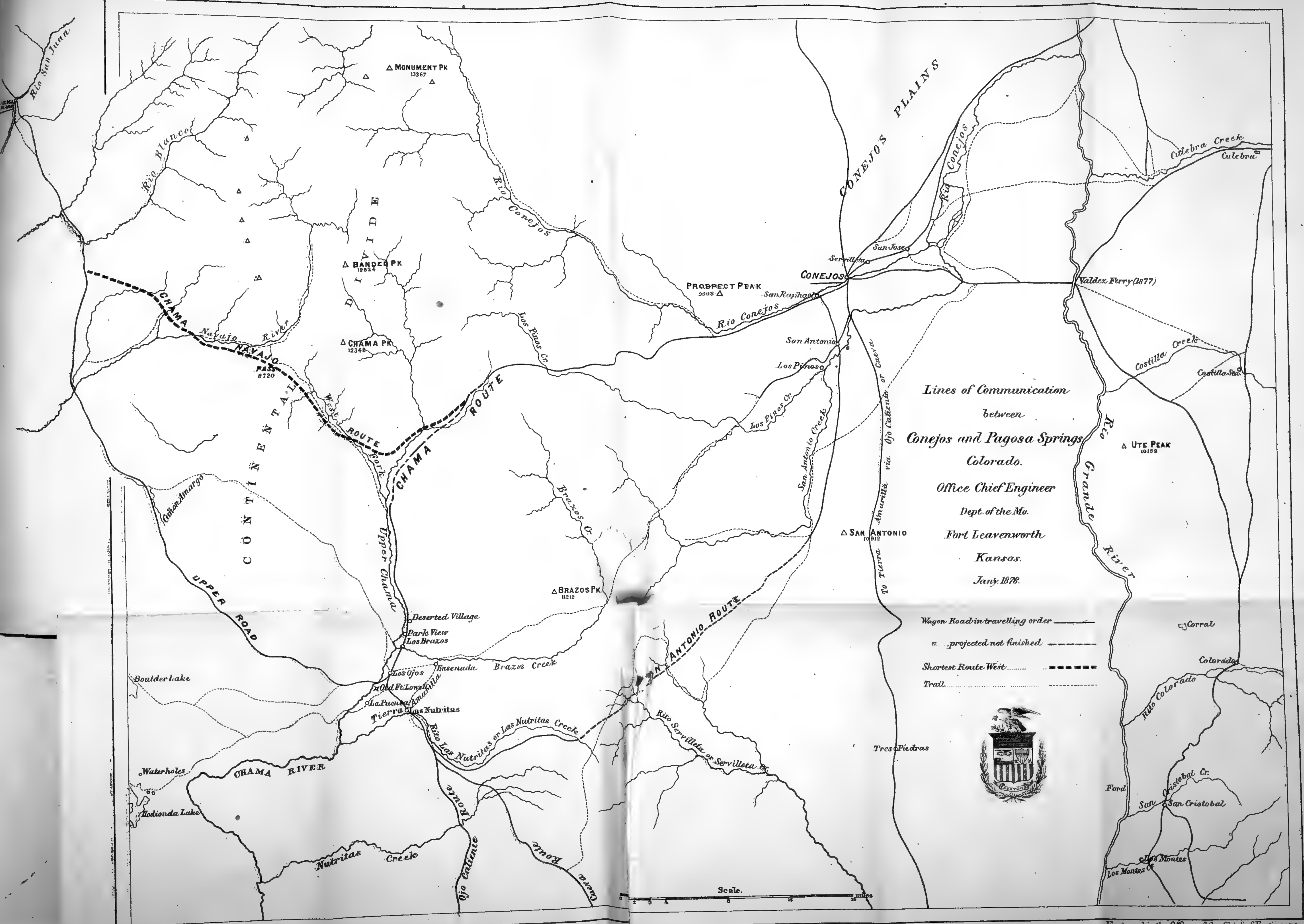
JAGOSA
SPRINGS

Culebra Creek

Culebra

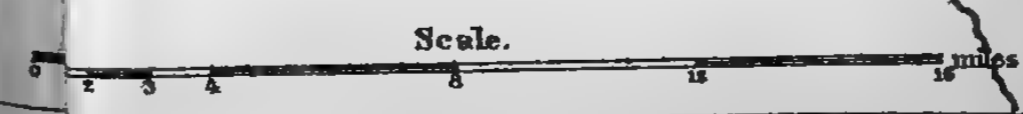


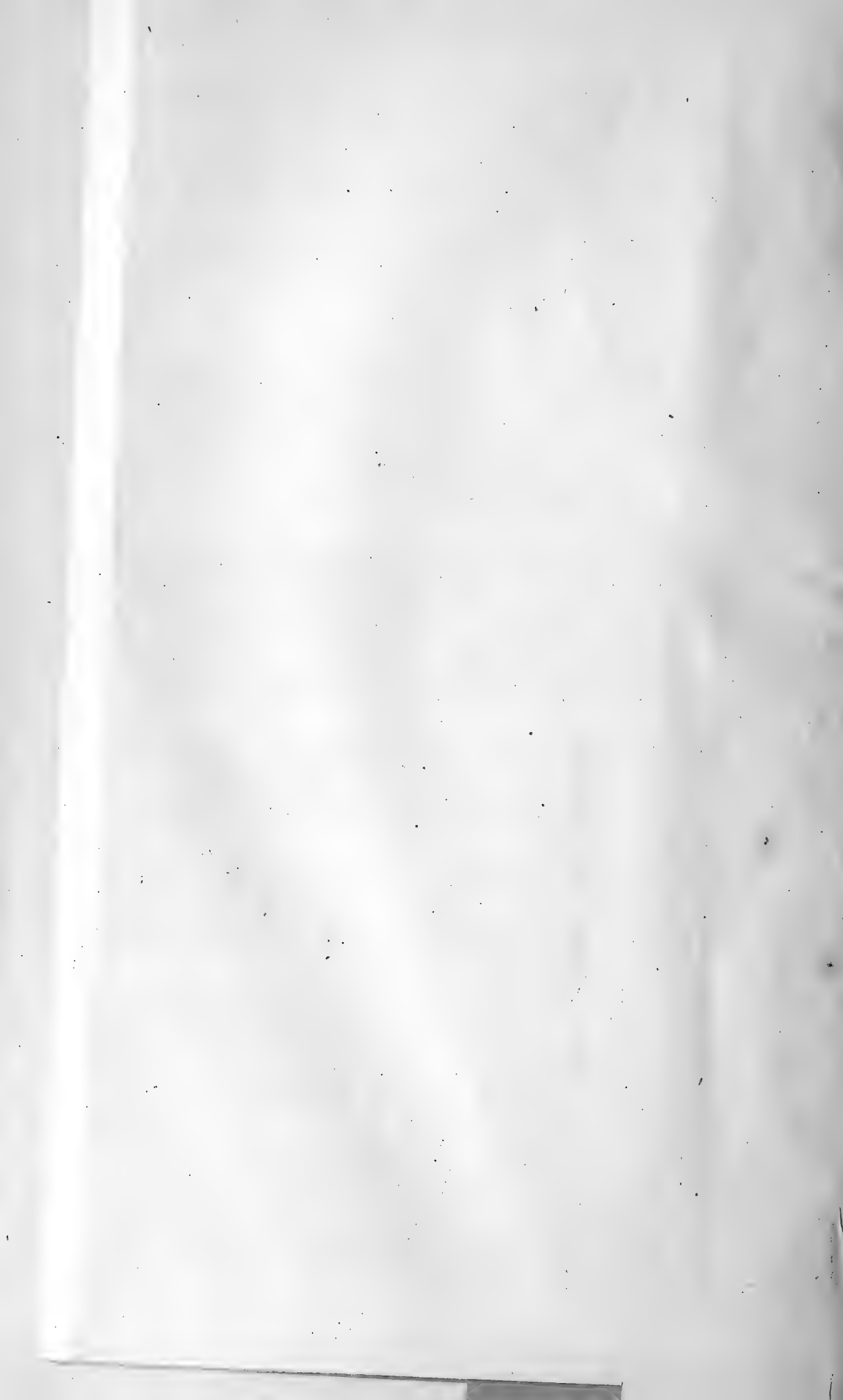




*Lines of Communication
between
Conejos and Pagosa Springs
Colorado.
Office Chief Engineer
Dept. of the Mo.
Fort Leavenworth
Kansas.
Jan'y. 1878.*

Wagon Road in travelling order —————
 " " projected not finished - - - - -
 Shortest Route West
 Trail
 Corral
 Colorado
 Rio Colorado
 Ford
 San Cristobal Cr.
 San Cristobal
 Los Montes
 Los Montes Cr.





gently through an easy pass between, that one can scarcely realize the passage from the Atlantic to the Pacific watershed. A dearth of water existed in July last between the Chama and Navajo, and for 33 miles no running water was found, although many dry beds of streams were met with, which heavy rain-storms of the previous day and night had failed to fill. The soil is to some extent alkaline, and upon pools of rain-water our camp depended. From the Navajo to Pagosa, 23 miles, water is abundant, the Blanco and tributaries being crossed *en route*. Pagosa being 56 miles from the Chama at Los Ojos, necessitated a journey of 206 miles to reach it from Conejos—reduced to but 176 via Cueva—a long and tedious trip.

2d. *New lines via the Tierra Amarilla section.*—From Conejos two roads are now constructing, both following the general lines of survey examined by Lieutenant Anderson, Sixth Cavalry, in 1874, in obedience to instructions from the chief engineer of the department.

The first, which may be known as the

CHAMA ROUTE,

ascends the Conejos for 11 miles in a fertile and cultivated valley over a natural road-bed. Its direction is a little south of west, and its grade during this distance only about 39 feet per mile, or less than 9 inches rise per 100 linear feet, practically a level. From this point it passes nearly westwardly for 20 miles, in which it reaches the Los Pinos Creek, above the deep and impassable cañon of the central part of the stream, along which it follows for about 3 miles, thence ascending the low divide that separates the watershed of the Conejos and its tributaries from that of the Chama and its branches, it passes to the slopes of the latter streams, with its highest point not over 9,800 feet. In this section the average grade is about 75 feet per mile, or a rise of 1½ feet in 100 linearly.

As the summit of the divide is approached, a number of low hills of gentle slopes are passed, along whose sides easy grades, at no point exceeding a 3 to 4 foot rise per hundred linearly, are readily obtainable, so that at no point is there anything so difficult to overcome as to need special mention. Leaving its westerly course, the road passes southwest for 13 miles, following first a tributary and then the Chama itself, and in a southerly direction by the banks of the river, some 16½ miles, to Tierra Amarilla, as the main plaza, Las Nutritas (2 miles beyond Los Ojos), is generally called, a total length of 60.69 miles, as measured last July. The entire route is well supplied with grazing, timber, and water; springs and nutritious grasses being particularly abundant in the most elevated regions. Via this line, the distance of Pagosa from Conejos is reduced to 114.7 miles.

In the spring of 1876, a settlement called Park View was located 2 miles above Los Ojos, in the valley of the Chama, by a Chicago and Santa Fé company. Circulars with information of an enticing character to promote immigration were circulated. The town was passed on the 9th of July last, in a lovely valley with about 8 acres, not exceeding 10 at most, under cultivation; eight cabins of the settlers being scattered about in the fine forest adjoining. The charter for the road from Conejos to Los Ojos was taken out with a view of making it a feeder to the colony, diverting trade of the vicinity from Las Nutritas, its present center.

To have reduced so materially the long detour by Ojo Caliente or Cueva was a desideratum; and to avoid this travel at once started over the Chama line by Park View, it being announced last spring by those in charge of its construction that it was passable. The apparent object was accomplished, that of getting teams over a part of the road which nature had prepared, when, part way in, rather than return, the freighters would work along to enable their teams to get through; for in no sense of the term was there a wagon-road in existence over most of the route.

Having been personally and authoritatively assured in June that no difficulty whatever would be experienced in getting through a wagon-train, as much machinery had already been transported over it, we started from Conejos July 4, reaching Tierra Amarilla on the afternoon of the 9th. Over the central part of the route, three entire days were taken up in going 19½ miles. This distance was over side slopes, summits of hills, and some arroyos; the train being gotten over safely, however, by changing the front wheels of each wagon to the up-hill side, the rear ones being on the lower one, holding up the wagons with ropes, using large logs as pulleys with picket lines in ascending arroyos, and resorting to similar expedients.

While the general route is one perfectly adapted to the end in view, the locations were found very faulty, the road passing over tops of little hills and abruptly down the ends, instead of seeking a uniform and easy grade along the sides. We have since been informed by the officers of the road company that it is now everywhere in complete order—new locations having been made in the faulty localities, to which, from their former incorrect statements, no credence can be attached. Lieutenant Gibbon traveled over this road in September, reaching Tierra Amarilla from Fort Garland in four days. His report contains no remarks on this part of the road, except that "12 miles remained uncompleted."

The second and rival route, which may be known as the

SAN ANTONIO,

in contradistinction to the former, approaches nearer a direct line. Ascending the valley of the Conejos, to include the plaza of San Raphael, it passes south across the plain to the plaza of San Antonio and contiguous towns in the fertile valley of that river, near which it is crossed. Thence it passes almost due south, near the right or east bank of the river, and between it and San Antonio Peak, following what was an old Indian trail southwest over the divide. Thus far the construction will be inexpensive, as there is at present a hay-road used by the Mexican teams up to this point—the chief items of cost being slopes of volcanic mesas that are met with, and the bridge over the river. When once put in traveling order, this part will but rarely need repair.

From the time of departure from the San Antonio west of the Peak, until the volcanic field intervening to the mountains has been passed, occurs an interval, much less than a day's drive, however, between water, after which it is found at short intervals. The route over the range is similar to that of the Chama line, over an easy pass and through low valleys or depressions between the elevated ridges.

Several small streams, tributary to the Servilleta, a creek flowing southeast into the Rio Grande, are crossed near their heads, together with one on the Chama or Brazos watershed. Thence it passes to Las Nutritas, not far from its head and some eight miles distant from the plaza of the same name (Tierra Amarilla), to which it proceeds along the bank of the stream in a westerly direction, the total length of the line from Conejos being 55 miles. Over this latter part is already a road used by hay-wagons, and along the trail followed in general by the route Mexican shepherds have for years driven to and fro their numerous flocks—a favorite range, on account of the fine grazing and water in the mountain parks and valleys.

Timber being abundant in the elevated regions, there will be little expense, save where it may be needed for small bridges or corduroy. The route being much of the way parallel to the line of drainage, there will be obviated what are always two items of considerable expense in such localities—cutting on side slopes for embankment, and side ditching above the road for drainage. The melting of snows on the mountain slopes, and the thawing of frozen surfaces in the spring, keep such a surface constantly moist, and a road inclined to the flow of water boggy and miry to a great extent, on being traveled.

Save the short section of 8 miles from Nutritas Creek to the plaza of that name, the entire road will be a portion of the shortest line *en route* from the railroad to Fort Wingate and the Arizona posts. From the Nutritas, the latter passes southwest to the Rio Nutria and the Chama, reaching the latter at the mouth of the former, where it is intended to bridge the river.

To consider briefly this in relation to the route to Fort Wingate, the distance, as surveyed by Lieutenant Anderson in 1874, is from the point of departure from the road to Tierra Amarilla (which place is 8 miles distant; Conejos being 47), down to the crossing of the Rio Chama, near the mouth of the Rio Nutria, 18.2 miles, making the Chama crossing distant from Conejos, by this, the San Antonio line, 65.2 miles.

Via the Chama road, as above stated, the distance from Conejos to Tierra Amarilla is 60.7 miles. The crossing of the Chama River by the Wingate road, having been found to be 14.5 miles distant from Tierra Amarilla, in an examination made during September last, by Lieut. D. J. Gibbon, Ninth Cavalry, we have the following summary to the Fort Wingate route:

Wingate crossing of the Chama River—	From Conejos.	From Fort Garland.	From Garland City.
	<i>Miles.</i>	<i>Miles.</i>	<i>Miles.</i>
Via Chama route and Tierra Amarilla.....	75.2	121.2	127.7
San Antonio route.....	65.2	111.2	117.7
Distance saved by San Antonio route.....	10	10	10

A charter for the construction of the San Antonio road, under the name of the "Tierra Amarilla and Narrow Gauge Wagon Road," was taken out March 5, 1877, and filed on the 29th of the same, the incorporators being five men of means, any one of them being alone able to construct the entire line. The capital stock is \$15,000, over

half of which, I have been informed, has been paid in to the treasurer. The necessary tools were purchased last summer, and it was intended to have the road completed and open this winter, but the small-pox epidemic, advancing up the Rio Grande, reached that section and proved a terrible scourge. Most of the able-bodied men of the country suffered from the disease, and at Tierra Amarilla, during the summer and fall, there were over 200 deaths. I have been informed by one of the officers of the company that work thereon will be commenced at both ends of the line as early as practicable in the spring, opening it for summer travel. The directors being men of capital and controlling all the trade and produce for miles about Tierra Amarilla, the statement may be relied on, inasmuch as its construction will be a good speculation, increase the business of the vicinity and probably not entail the expenditure of half, perhaps not over a third, of the capital in opening the road to passengers and freight.

The advantages of the San Antonio over the Chama route are as follows:

1st. To Tierra Amarilla from Conejos several miles shorter; to the Chama crossing, *en route* to Pagosa, about the same, nothing more, certainly, with equally fine advantages in the natural supplies of wood, water, and grass.

2d. With no portion of the route in a region more elevated, it lies farther south, and the general lines of drainage being from the summit of the range to the east and west, it will be exposed to winds and storms from such directions only, and sheltered on the north, leaving travel less liable to interruption.

3d. It is a portion of the shortest and most practicable line between the railroad and points in the southwest, as Fort Wingate and other Arizona posts, and should on that account have been built by the government. The amount of freight in the shape of Army and Indian supplies shipped to that point is very large. The charge of the toll-road company, judging from the usual prices on the mountain roads of Colorado and New Mexico, will be \$2.50 per freight-team of six mules.

No greater economic appropriation could have been made on the part of the government than the amount for the construction of this line asked for in 1876.

Turning to the San Antonio line, it will be seen to be but a portion of a mountain route through and along western slopes of the ranges, which are all a continuation of the San Juan Mountains, and part and parcel of the Rocky Mountain system, and as a mountain line it is preferable to a highway on the plain, with its natural supplies of wood, water, and grass.

At this point it seems just that the conclusions drawn and recommendations made in the prior report on lines of communication between Southern Colorado and Northern New Mexico be referred to again. In that report the predictions made concerning railroad extension and its probable influence on this subject were carefully stated, and those predictions have been literally fulfilled. In that report two lines were described as having been surveyed for improved roads; over both of these lines charters for toll-roads have been obtained, and the road over one line is in use. The recommendations made from this office, if followed out, would have resulted in economy to the government and the roads would have been better made and sooner than now reported.

3. *Proposed lines.*—1st. By both the Chama and San Antonio routes, there is required a long and unnecessary detour to Pagosa. Add to this a long march without water, or dependence upon capricious rain-storms, and pools muddied oftentimes by sheep-herds, between the Chama and the Navajo, and we find an imperative need of a shorter, more direct route, well supplied with water, wood, and grass.

The location I found preferable for so desirable a line, a cut-off on the Chama, may from its situation, be known as the

CHAMA NAVAJO.

The great continental backbone, hemming in upon the north and east the lower San Juan region, abruptly changes at about latitude 37°, the dividing line of Colorado and New Mexico, from a chain of lofty peaks with high connecting mountains to a series of lower ridges with high elevations detached and at greater intervals. Immediately to its south, and at the very base of the Chama Peak, whose elevation is 12,200 feet, occurs an exceptionally fine pass, fully 3,500 feet below the head of a valley, watered by the West Fork of the Upper Chama, completely protected on the north and east by the mountains and outlying slopes, with the summit of the divide to the northwest. This mountain valley lies sheltered and warm, exposed chiefly to winds from the south only. Possessing the requisite elevation to impart to its grasses the peculiar flavor of a mountain growth, it is perfectly adapted to heavy traffic, for which subsistence for animals should be found in abundance, and is in every respect preferable to any already described as a short line to the west.

Leaving the Chama route, on the upper part of that river, near the mouth of the main tributary that comes from the east, crossing the main stream and sweeping in a curve to the south and west to avoid high basaltic mesas and vertical walls of rock that shut out the river from passage and approach as securely in some places as a box cañon, we reach the valley of the West Fork. On easy grades it can be ascended to

the divide, which is lower than the one on the Chama line; this passed, brings us to the Navajo, down which it follows for about 5 miles in a westerly direction.

This section is an especially fine grazing region, and abundantly supplied with timber. Herds of Mexican sheep are driven into the valley of the West Fork, and the Ute Indians, for fully two months last summer, had established their camp upon the Navajo in this vicinity. This river is their preference of all the eastern streams in the lower country, and its valley will make an excellent farming or cattle region. Leaving the Navajo, at a few miles distance northwestwardly, tributaries of the river are crossed, whence, after the passage of the main divide between the water-sheds of that and the Blanco, we reach at a short distance the present "upper road" to Pagosa.

The distances on the Chama Navajo are as follows:

	Miles.
From Conejos to point of departure from the Chama road	33
Thence to Rio Navajo, via the West Fork of the Chama and over pass 8,720 feet..	14.5
Along the Rio Navajo	5.5
Thence to the present traveled road	9.9
Thence via the present traveled road, the upper one, to Pagosa	14.5
<hr/>	
Total, Conejos to Pagosa	77.4
Distance via the Chama line to Pagosa	114.7
<hr/>	
Distance saved by the Chama-Navajo road	37.3

This would bring Pagosa to within 123.4 miles of Fort Garland, and 129.9 from the railroad.

Estimate for the construction of that part of the line from the point of departure from the "Chama" until the "Upper," the present road in use, is reached, a distance, as will be seen above, of 29.9 miles, is as follows:

Rock-blasting, &c	\$3,000
Road embankment and construction, except the above	4,200
Bridge over the main Chama, including crib-work and approaches	725
Bridge over the Navajo	475
Smaller bridges <i>en route</i>	625
Contingencies	750
<hr/>	
Total	9,775
If the Army ration can be sold at cost price to laborers, deduct one-third	3,258
<hr/>	
	6,517

Upon the accompanying map are indicated the routes of all existing and proposed roads from Conejos to Pagosa, except the lower portions of the Ojo Caliente and Cueva lines.

THE ALAMOSA LINE.

From the present railroad terminus the shortest most practicable route to Pagosa is in general direction due west, and mainly, of course, a water-line; for in all mountainous regions particularly, a highway, whether a rail or wagon road, must follow a line of drainage for the line of least resistance. Crossing the Rio Grande above the mouth of the Alamosa, continuing on to near the point where it debouches from the mountains to the plain, it thence follows up the cañon of the river. Near the headwaters of the South Fork of the river, whose source is to the southwest, this water-line is left and another followed, leading up a tributary to one of the most feasible spots for a pass, for some distance, a depression between two lofty peaks. The range is crossed below timber-line, from which can be followed a tributary flowing due west into the East Fork of the San Juan, and in the cañon of that stream and the main river to Pagosa.

This is as direct a route as can be at all economically obtained. Both the La Jara and the Conejos on the Atlantic slope of the San Juan Mountains, each with a general eastern course, were carefully examined, as were also the Navajo and the Blanco, with south-westerly ones on the Pacific side. In whatever way a line be run otherwise than as thus described, there are difficulties to be overcome almost insuperable, save at great expenditure. So many streams, main rivers with their tributaries lying oftentimes in deep cañons, intervene on a direct line, that it could be constructed at great cost only, not at all warranted by the necessities of present or prospective commerce or any very material saving in distance.

Taking a bee-line from the railroad to the Rio Grande (where a wagon-road does not

exist, but where the railroad line has been located with a view to its probable construction within a year at most), we have the following distances:

	Miles.
Garland City to a point at mouth of cañon of the Alamosa River.....	52.7
Up the cañon to the mouth of the North Fork of the river.....	26
Thence up South Fork and tributary to top of range	11
Down a tributary, the East Fork, and main San Juan River to Pagosa.....	35
<hr/>	
Total railroad from Garland City to Pagosa.....	124.7

A saving of about 5 miles in all, not sufficient to warrant the great excess of expenditure when compared with the Chama-Navajo.

Under the name of Conejos, Rio Grande and Pagosa Springs Toll-Road Company, four gentlemen, during the past summer, filed the necessary articles of association for the incorporation thereof in the recorder's office at Del Norte, Colo. The papers define their object and designate the route to be "from some point on the Rio Grande up the Alamosa, with a branch to the summit, and up the stream, over the top of the range, and down one of the branches of the San Juan to or near Pagosa Springs"; capital stock fixed at \$20,000. None of the incorporators are reported as men of means, or of sufficient enterprise to construct the line, and unless others should take it in hand, the road will not be made. It was doubtless recorded having in view the extension of the railroad west, in which event the toll-road would be a capital investment financially, and their charter, as is often done, might be sold for, probably, a valuable sum

THE SUMMIT LINE.

From Garland, via Del Norte and the summit district, upon the north fork of the Rio Alamosa, near its headwaters, lying in the gulch of the stream and on the slopes of South Mountain and Mount Belleview, is the mining-district known as the "Summit," thus far exclusively gold, and the finest in the San Juan region. About four and a half miles due west is the summit of the main range, beyond which spring tributaries of the San Juan, their general course hence to Pagosa being southwest. Connecting Del Norte with the summit is an old country road, with its route up San Francisco Creek to its head, thence around and south of the mountain, at the head of the Piedra Pintada, which is designated upon the Hayden maps as Pintada Peak, upon Wheeler's as Del Norte Peak, and is locally known as Old Baldy, thence winding along above timber-line until the north fork of the Alamosa and the summit is reached. Altogether a poor route and a wretched road at its best, it is now in disuse; another and a fine road, upon which toll is taken, is now in operation, saving fully six miles or more in distance. The latter, owned by Mr. John H. Shaw, of Del Norte, follows up the Los Pinos Creek, a natural road for nearly twelve miles; thence up the mountain-slopes to the southwest, reaching the summit over a few miles of the old line. The toll-road is a very good one, though susceptible of much improvement in grade, location, &c., which would probably be made should there be sufficient increase in travel to warrant it.

From Garland the road is over the San Luis Park or Valley, is generally hard and level, to Del Norte, the Rio Grande being crossed by a bridge seven miles below the town. Distance from the fort, 60 miles; from Garland City, 66.5; from Del Norte to the Summit, via the toll-road, it is 27.8 miles, and thence over a trail to Pagosa, about 39 miles; making the springs about 67 miles distant, and the total distance from the railroad 133.3 miles, in excess of that by either the Alamosa or the Chama-Navajo lines.

SUMMARY.

This includes all of the short and practicable routes from the East across the range into the Lower San Juan.

From Pagosa to Animas City, a new settlement at the lower end of Animas Park, the distance on the upper road is as follows:

	Miles.
Pagosa Springs to Rio Nutria.....	13
Thence to Rio Piedra.....	12.1
Thence to Rio de los Piños.....	19.9
Thence to Rio Florida.....	13.6
Thence to Animas City.....	5.8
<hr/>	
Total, Pagosa to Animas City.....	64.4

From Animas City up the valley, and over the new toll-road in the Grand Cañon of the river opened in the latter part of November, the distance to Silverton is 46.7 miles,

making a total from Pagosa of 111.1 miles. With the present situation of the railroad terminus, we have, by the various mentioned lines, the following summary :

Garland City—	To Pagosa Springs.	To Animas City.	To Silverton.
	<i>Miles.</i>	<i>Miles.</i>	<i>Miles.</i>
Via Ojo Caliente and Tierra Amarilla	258.5	322.9	369.6
Cueva and Tierra Amarilla	228.5	292.9	339.6
The San Antonio route	165.3	229.7	276.4
The Chama route	167.3	231.7	278.4
The Chama-Navajo route	129.9	194.3	241.0
The Alamosa route	124.7	189.1	235.8
The Summit route via Del Norte	133.3	197.7	244.4

EXTENSION OF THE DENVER AND RIO GRANDE RAILROAD.

The opening of the new extension of the Denver and Rio Grande Railroad will materially change the aspect of affairs. Alamosa, the new terminal point, on the western side of the Rio Grande, near the mouth of the Rio Alamosa, whence its name is derived, is 25½ miles beyond Fort Garland, 33 from Del Norte, and 28 from Conejos. This will bring the last-named place about 24½ miles nearer the railroad than at present, and hence will lessen the distance to all points, including Pagosa, by the several routes passing through it to the same extent; it will diminish the Alamosa line to Pagosa still more, by 32 miles, and will shorten the Summit route to the same point by 33½ miles, whence the foregoing table becomes as follows:

From the new railroad terminus, or Alamosa—	To Pagosa Springs.	To Animas City.	To Silverton.
	<i>Miles.</i>	<i>Miles.</i>	<i>Miles.</i>
Via Ojo Caliente and Tierra Amarilla	234	298.4	345.1
Cueva and Tierra Amarilla	204	268.4	315.1
The San Antonio route	140	205.2	251.9
The Chama route	142.8	207.2	253.9
The Chama-Navajo route	105.4	169.8	216.5
The Alamosa route	92.7	157.1	203.8
The Summit route via Del Norte	99.8	164.2	210.9

The route to Fort Wingate having the choice of two of the above lines will have a corresponding decrease as follows:

The Wingate crossing of the Chama—	From Conejos.	From the railroad or Alamosa.
	<i>Miles.</i>	<i>Miles.</i>
Via the Chama route and Tierra Amarilla	75.2	103.2
San Antonio route	65.2	93.2

The extension of the Denver and Rio Grande to the south from Alamosa upon the west side of the Rio Grande, the grading and construction of which is reported as being undertaken, will shorten somewhat the routes passing westward through Conejos, the line, it is stated, passing about 4 miles east of the town.

When in operation at that point the above distances on the third, fourth, and fifth routes will be diminished by 20½ miles.

When extended still farther to the south, from some station on that line, a wagon-road will probably be opened to Tierra Amarilla, resulting in a corresponding decrease in the first three lines above given.

THE DEL NORTE AND ALAMOSA RAILROAD.

Some of the citizens of Del Norte, chiefly men of property, conscious of the fact that their town has ceased to largely increase in prosperity, and that unless a new impetus be given to revive business it will soon be outstripped by its more youthful rivals in the mining regions, have formed a company to build and operate a line of rail under the name of the Del Norte and Alamosa Railroad, to connect their town with the terminal point of the Denver and Rio Grande Railroad at Alamosa. We were informed that it would be constructed simultaneously with the extension of the Denver and Rio Grande. The distance from Alamosa, the new terminus of the Denver and Rio Grande Railroad, is by these surveys of the line, 26 miles; by the present wagon-road, we are informed, about 33; the estimated cost of grading and ties is but \$1,000 per mile, and for rails but \$2,000, a very light rail being used, the weight not exceeding 24 pounds per yard.

With the railroad at Del Norte, and the toll-road to the Summit in good order, the construction of a road thence over the range and down the San Juan to Pagosa would be most expedient. With a route judiciously selected, the distance might be shortened fully 7 miles, bringing the Springs about 60 miles distant from the railroad.

At the date of writing, however, nothing positive is known of the definite construction of the track from Alamosa to Del Norte.

RECOMMENDATIONS.

With the present situation of the railroad, we would recommend the construction of the Chama-Navajo as of prime importance for the development of the Lower San Juan. Both in a civil and military point of view would it be a most profitable investment. The entire route of travel would be settled upon at an early day, and thriving communities at various points arise, now remote from mails and other facilities. The roving and unsettled bands of Indians in the southwest corner of the State, and in adjoining territory of Utah and Arizona, committing frequent depredations on the whites, will necessitate better protection for the interests of civilization. The present post of Fort Garland, no longer a frontier station, should, in the event of its advancement west, be located somewhere in the Lower San Juan. Communication and lines of supply will necessitate the route via the Chama-Navajo.

The line of the Alamosa road will shorten the distance to Pagosa over the former but about 5 miles, and its cost being more than twice as much, its construction should not be made from any economic consideration. Being, moreover, a line of deep cañons and rocky defiles, no outlying country bordering thereon would be opened up or benefited, as in case of the Chama-Navajo, which is, especially beyond the Chama River, almost wholly a line of valleys. A lofty route and passing over the range, at about 3,000 feet greater altitude than the former, the Alamosa line would be blocked by snow and impassable for a portion of the year, unless constant traffic prevented. Upon the Chama-Navajo, with its lower situation and protection by sheltering mountains on the north, a natural blockade would not so completely occur.

In the event of the building of the railroad extension to Alamosa, the distance from its terminus to Pagosa by the Chama-Navajo would be 105 miles, and by the Alamosa about 13 miles less. This would be an important saving; but should the track be continued to that point, there is every probability of the construction of the Del Norte and Alamosa Railroad, making Del Norte a terminal point; in this event the Summit line to Pagosa assumes the most prominent position, the distance by that route being diminished, as already mentioned, to 70 miles.

The construction of the unfinished link from the Summit to the Springs, nearly 49 miles by the trail, would entail an expenditure of \$18,000. The route will pass down the East Fork of the San Juan, where judicious locations will give easy grades, and shorten the line as compared with the present trail, and afterward along the main stream, the whole a cañon region, presenting fewer difficulties of passage than that of the Alamosa. For several miles the main river above the mouth of the West Fork is inclosed in a box cañon, and here would be essential a considerable amount of blasting. Several ranchmen located last summer on the West Fork, in a fine open valley, above its mouth, and thence to Pagosa have made for their accommodation a passable way for light wagons, distance about 11 miles.

COMMUNICATIONS OF ANIMAS CITY AND PARK.

The most thickly populated section of the lower country, the settlements in the Animas Park ending at Animas City on the west bank of the river, near the mouth of Junction Creek, have outer communication as follows:

North.—By the toll-road through the Grand Cañon of the Animas with Silverton and points beyond.

East.—By two routes, known as the Upper and the Middle roads.

On the upper, the line followed was mainly that of an old Indian trail and a natural route to Tierra Amarilla via Pagosa Springs. This is a toll-road; work done, very slight beyond bridging of rivers *en route*.

At Animas City, it should be mentioned, a fine bridge exists, constructed by the town company; river here 170 feet wide, nearly 2 deep; very clear and beautiful, with a rapid current. Animas City to Pogosa, 64½ miles; road in good order; wood, water, and grass abundant. The toll-gate of the road company is a few miles east of Animas City; the bridge on the Florida, the first stream, was inexpensive, the stream being small with high banks.

Over the Rio de los Pinos, 13½ miles east of the Florida, is the most expensive bridge on the line; western bank being low, bridge proper with approach for high water, 245 feet long, the river in August, 1877, being here but 90 feet wide. Its width was 18 feet, and 8 feet above water; ordinary side rails, flooring of square hewn timber, being loose and without stringers; total cost, \$550.

Over the Rio Piedra, 20 miles east by the road, was the next expensive bridge, owing to the banks being high, and resultant cost of rock-filling for cribs. Length 80 feet; about 20 wide, and some 15 above the water's surface, resting on piers of the usual pine log cribbing. Flooring of usual square hewn beams, lacking stringers to keep them in place, a fault also existing at the Los Pinos. So inexpensive an item should never be neglected, as danger to passing teams results from the liability to get their feet entangled; cost of bridge was \$400.

The Rio Nutria, a puny sluggish stream, without high banks, offers no obstruction to easy passage.

The Rio San Juan, 25 miles from the Piedra, 13 from the Nutria, was the last point bridged, being crossed nearly a mile below the main spring. The river here was 85 feet wide, and about 2 deep, the bridge being 108 long, of substantial construction, costing \$300.

From Pagosa to Tierra Amarilla, 58 miles, the Blanco, Navajo, and Chama are forded, no bridges existing.

The middle road is a more direct route to the Animas from Tierra Amarilla. Its route is from the Chama, by the Laguna de los Caballos, the Piedras de Legurados, and the Cañon Curaçoa to the San Juan, reaching it about 5 miles below the mouth of the Navajo; entering the Ute Reservation, passing westerly near the San Juan for some 9 miles to the Piedra, after its crossing it continues northwest to the Florida, near the reservation line. It follows up this stream by the ranches along the river, meeting the upper road at its crossing of the Florida, *en route* to Animas City. For about 35 miles, over a third of its entire length, this road is within the Indian reserve.

Its advantages as a route to Tierra Amarilla from the Animas and Florida settlements are its being more direct than the upper road, which makes a detour by Pagosa, and its more southern position, rendering it less exposed and a warmer and better winter line.

Its objections are the scarcity of wood, water, and grazing, compared with the northern line; particularly between the San Juan and the Chama, where the country partakes of an arid nature with alkaline character, a vegetation sparse and of sage-brush rather than the nutritious grasses above, while piñon replaces the pines to the north.

West.—Communication with the settlements beyond and upon the lower river, from Animas City, is by the toll-road to the La Plata, a branch ascending to Parrott City, whence a county-road passes to the Mancos, another descending the stream to the lower La Plata, the San Juan, and the Animas.

The road was inexpensive, the toll-gate being placed four miles beyond Animas City, a point common to upper and lower travel.

A road can be constructed down the Animas River to the settlements below, along the line of the trail already existing; or less direct and not so expensive, from the road on the Florida, southwest to the Animas a few miles above the former's mouth.

From the lower San Juan, between the Animas and the Pinos, a route known as the lower road, passes southeast via Cañon Largo to Abiqui and Santa Fé, affording a direct line to these regions which is open to travel at all seasons of the year.

The upper country.

The extension of the railroad over the Sangre de Cristo Range to Garland City has resulted in making Del Norte a passing-point for nearly all travel and traffic destined for the more settled and richer mining regions of the upper country.

Saguache, on the upper and western rim of San Luis Valley, distant 33 miles, was its rival when Cañon City was the nearest railroad point to the San Juan. A wagon-road was constructed from this railroad terminus, 117 miles, to Saguache, passing up the Arkansas River for 55 miles, and crossing the range over the Puncho Pass. Thence,

from Saguache a toll-road, 95 miles in length, was built to Lake City, on the Lake Fork of the Gunnison River, via the Los Pinos Agency. At present, Lake City is over 60 miles nearer the terminus of the Denver and Rio Grande, at Garland City, than that at Cañon City, and all its supplies are received by the former branch. From Del Norte a toll-road passes west, up the cañon of the Rio Grande to Alden's Junction, in Antelope Park, distant about 44 miles.

ROAD TO SILVERTON, DIRECT.

From this point beyond, to the west, a county-road follows the general course of the Rio Grande in a direct line for Silverton, Howardsville, and the mining towns of the Upper Animas. Although it avoids, by detours, the steep cañon localities of the river, it is in a very bad condition save where the cañon bottom is level and wide and a natural road exists. With steep grades, numerous side slopes, and a lack of repair, added to the faulty original construction, it has almost entirely fallen into desuetude, and is but little used for freight-carriage, save by pack-trains. Even they do not follow the road intact, and at many points numerous and deeply furrowed trails, running side by side, pass direct where possible, when the road makes a bend to the right or left.

Beyond Carr's Cabin, a point about 27 miles above Alden's, the road has many steep gradients in its ascent to the summit of the range, about 12 miles distant, the Great Continental Divide here sweeping around to the north and east in its separation of the Rio Grande from the waters of the Animas. Above Pole Creek, an elevation of nearly 2,000 feet must be made in about 6 miles, to attain the summit, a pass above timber-line, exposed and objectionable. Owing to the many steep hills, frequent grades of 500 feet to the mile, and excessively rough roads, large amounts of freight are brought to Carr's and lower points by wagon transportation and sent over the range by pack-trains.

From the summit down to Howardsville the grade is as bad, or worse, nearly 3,000 feet being descended in less than 5 miles, an average slope of 600 feet to the mile, or fall of over 11 vertically in each 100 linearly. Necessarily, then, none save the lightest kind of a wagon, and in a case of necessity only, dare attempt the pass.

Between Howardsville and Silverton, less than 5 miles, the road is in Baker's Park, and, of course, finds no natural obstacle to overcome; it is, however, out of order at several points, where inexpensive repairs will make it a fine passage-way.

LAKE CITY AND CONNECTING ROADS.

From Alden's or Antelope Park, a good toll-road passes north and northwest to Lake City, 33½ miles. This thriving town is the seat of the greatest wealth and mining industry in the San Juan, and to its numerous roads and communication with the outer world, much prosperity is due.

The road from Antelope Park comes from the southeast. This is now under more able and wealthier management than last year, when, during the spring months, it was almost impassable. New and shorter locations, better grades, and side drains made, or under construction, will render the road good and passable at all seasons. The road from Saguache comes from the north, ascending the Lake Fork. It is continued to the southwest to the town of Animas (altitude 11,550 feet), 29 miles distant, passing *en route* up the stream through the rich mining section known as Burrow's Park (which includes Tellurium, &c.), the American Basin, and other camps, and crossing at an altitude of 12,650 feet one of the great mountain chains that here rise up with more numerous and lofty peaks than elsewhere are found upon the continent. From Animas Forks this road continues 3 miles to Mineral City (altitude about 11,500 feet), a promising town located at timber-line, near the top of a mountain spur of the Uncompahgre Range.

THE HENSEN CREEK ROUTE.

Another toll-road has been lately built to the west, passing up Hensen Creek, opening up a rich mining region and serving as an opposition route to Animas Forks, to which point it is shorter by over 6 miles than the Burrows Park road. It was an expensive line, owing to the large amount of rock-blasting necessary.

At about 10 miles from Lake City, it passes the mining settlement of Capitol City (altitude about 9,500 feet), reaching Mineral City at a distance of about 20 miles. Animas Forks, as might be inferred, is located upon the Upper Animas River, at the junction of two streams, by whose union it is formed. A toll-road is open, down the river, passing Eureka, at the mouth of Eureka Gulch, 4 miles to the south, and reaching Howardsville, at a distance of 8 miles. This route is the only one over which machinery can be readily taken to Silverton and neighboring points. From Del Norte it is a long detour by way of lake, but the difficulties, insurmountable at present, of the route up the Rio Grande, render the former preferable.

The Hensen Creek line is, from lake to Animas Forks, the most practicable one for heavy teams, for the Burrows Park route, in addition to being 6 to 8 miles longer, is, in the upper sections, in a wretched condition.

THE GUNNISON ROAD.

Down the Gunnison River from its headwaters passes a wagon-road, a great highway connecting on the north, east, and south with the South Park region, where are the mines of Mount Lincoln and other districts in the Park Range, branches leading to Cañon City and Saguache, the Los Pinos Agency, and Lake City. Avoiding the terrible Grand Cañon of the Gunnison, it crosses to the Uncompahgre, down which it follows almost to its mouth, where it passes, to the Gunnison, and follows down the latter river and along the Grand, as the Salt Lake wagon-road. This is the natural position of the extension of the Atchison, Topeka and Santa Fé Railroad, whose general line is from east to west, and present terminus, Pueblo, the line thence to Cañon City, being part of the narrow-gauge railroad, the Denver and Rio Grande.

OURAY AND CONNECTING ROADS.

On the upper part of the Uncompahgre, down the mountain range, forms Mineral City, but about 8 miles distant, and near the rich mineral deposits of Mount Sneffels, lies the village of Ouray, possessing the most flattering prospects for wealth, prosperity, and rapid increase in population of any incipient town in the San Juan.

A road passes northwest down the Uncompahgre to connect with the Gunnison road, and north and northeast to reach the Saguache and Lake City line up the Lake Fork. Business facilities with Lake City are imperatively demanded, and a shorter route should be at once constructed.

From Mineral City down the mountains to the rich agricultural valley at whose upper edge lies Ouray, is a mountain trail. The mountains here are terrible in the extreme, excessively steep, great masses of almost vertical wall, on which a footing is often a matter of conjecture, a mounted passage in the range of possibilities only. The trail is, to say the least, *very* dangerous. The *average* descent is over 600 feet to the mile, and none but a thoroughly daring mountaineer can ride over it. Trains of "jacks" or burros transport over it but a small amount of freight, nearly always with the loss of one or more animals. Old "Forty-niners" say that it has no equal in the mining country of Nevada and California. Just before Lake City was visited a man passing the trail on horseback had gone off with his animal and both been killed. The snow-capped mountains near whose summit lies Mineral City, and the end of the toll-road, are in sight from Ouray but inaccessible, and instead of Lake being reached in a drive of 28 miles, a long detour of 100 must be taken. This being directly at variance with rapid intercommunication which is demanded by the necessities of trade, a stock company has been formed for the construction of a toll-road direct from Ouray to Mineral City. After careful surveys and selection of the best grades by competent engineers, the road was commenced and is now stated to be building.

The difficulties to be overcome may be best imagined by the fact that, while the distance is short, the cost is computed at not less than \$60,000, possibly reaching \$70,000, of which amount \$15,000 stock was subscribed by the citizens of the place.

THE ANIMAS ROAD TO SILVERTON.

Silverton and contiguous camps need a shorter outlet; direct communication at an early day is absolutely essential for prosperity. The wealth of its surroundings is immense, its facilities are poor; it is shut out from the world, and is wholly subordinate to Lake City.

Owing to the difficulty of getting ores to market much industry is idle. The reduction works there buy nothing under 75-ounce ore, or rock yielding 75 ounces of silver per ton, equal to \$90. All but high-grade mines lie idle, while at Lake 40-ounce ore finds a ready market.

To the south lies a rich agricultural region and coal in abundance, shut out by the Grand Cañon of the Animas, where the river runs in a narrow gorge, inaccessible often, with mountain slopes of the steepest kind, frequently 45°, oftentimes nearly vertical, while the summits look down upon the bottom of the gorge, 4,000 to 5,000 feet above it. To enable Silverton to obtain produce and coal, most needed commodities, a toll-road through the cañon was projected, a charter obtained by four persons, and its construction commenced in August, 1876, by Mr. James L. Wightman, a thoroughly practical man. The working parties were passed on the 29th of September last, with about 4 miles of road to open, since which we have learned freight-teams are now passing up to Silverton over the entire road.

WIGHTMAN'S ROAD IN THE GRAND CAÑON OF THE ANIMAS.

This road, projected through one of the grandest and most inaccessible cañons in the whole region, deserves more than a passing mention, being on a larger and more expensive scale than any other undertaking for the general welfare and improvement

of the mining region, except the new road to connect Ouray with Mineral City, the terminus of the toll-road to Lake.

The cañon of the river well deserves the name of "Grand" bestowed upon it by geographers. For a long time, as a route of communication, it was deemed impracticable and was necessarily avoided. Leaving Silverton, below the crossing of Mineral Creek, the trail ascends the side of the mountain on the right of the cañon, and crossing the ridge of peaks cut through by the Animas at an altitude of 10,400 feet, takes a southwesterly direction. Another trail from Silverton ascends Mineral Creek and Bear Creek, one of its tributaries, to its head, crossing the same mountain range at 11,500 feet, and joining the former trail at Lime Creek. From this point the Silverton trail passes to the east of Engineer Mountain, $1\frac{1}{2}$ miles from its base, crossing Cascade Creek, and approaching to the south meets the new toll-road a short distance above the head of the Park. Previous to the building of the Wightman road Silverton had no communication with the south save by this trail. Much of the time (probably fully half) the highest portion of the route was passable only on snowshoes, being even then a dangerous trip, some of the mail-carriers losing their lives in making the crossing. In early summer the melting snows made the way boggy and miry, and even in the fall, when at its best, the trail is in many places steep and dangerous and passable for light packs only.

At the mouth of Mineral Creek, the lower point of Baker's Park, the Animas enters its cañon, which rapidly narrows; here its elevation is about 9,300 feet, while at the upper part of the park, where it debouches from its cañon into the open valley, 6,800, a fall of 2,500 feet in about 26 miles. For this distance it is inaccessible, shut out by great rocky walls, mainly high peaks of quartzite, members of the Great Needles or quartzite crags which stretch across the Vallecito and the Florida to the Animas. The walls almost close at points, the river rushing through a space of 30 yards from wall to wall, the sides of which, almost as hard as steel, seem insuperable obstacles rising up, slightly rounded from a vertical to nearly a thousand feet, at which height a greater outward slope occurs. Occasionally there is found a bottom width of 250 yards, where grazing is seen. These little parks are, however, but oases in the general rocky barrenness. The angle from the river up to the mountain summits that tower above from 3,000 to as high as 5,000 feet approaches 45° , and the widening out of the cañon makes its upper width from 2 to 3 miles. Here occasionally nature interposed great obstacles to a passage. In a narrow bed the river ran by with the velocity of a mountain stream, without foothold between it and the walls beside it, their inclination so near a vertical as to render the cost of blasting for a roadway a questionable expense. Numerous bridging was to be avoided on account of the situation and the spring rise of the river. At such places the river was occupied for a passage-way, and these were by far the most expensive points. As the river descends there is found a greater width of room, a small "bench" generally between the water and the mountain through which was easily effected a clearing giving a passage-way.

At some points where existed no bench or place for a roadway by the river bank, the mountain and slope being of rock and very steep, a high sustaining wall was necessary, in some cases as great as 20 to 30 feet (Fig 1). At other points, the mountain



Fig. I.

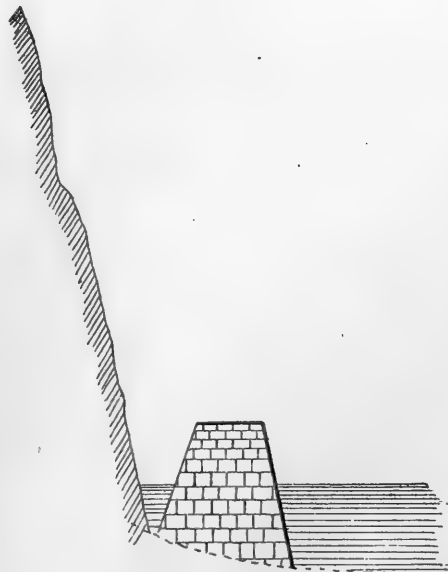


Fig. II.

slope being too nearly a vertical, and without any bank by the water, a passage was constructed in a part of the river-bed for a distance as great as several hundred yards in the shape of a pier. These viaducts were of superior workmanship, the height varied from 8 to 10 feet, and with the side slope from the bottom commensurate with the strength and endurance required, the top surface was at the widest points at least 10 feet across. (See Fig. II.) Mr. Wightman stated the cost of construction of the viaducts of the average dimension, 10 feet at base, 8 feet on a vertical, and 8 feet wide at top, to be \$1.50 per linear foot. At some points this was exceeded, the river with a rapid current and a depth of 6 feet, occupying the place where the road now passes. Here the blasting was also very expensive from the flint-like nature of the quartzite, the working being so difficult that 30 steel drills per foot were used. The most expensive filling of this nature presented the following items of interest:

Length of fill, 441 feet.

Width at bottom, 14 to 16 feet.

Width at top, 10 feet.

Deepest water, 6 feet 2 inches.

Greatest depth of fill, 11 feet 9 inches.

Average depth of fill, 5 feet 10 inches.

Cost per linear foot, \$1.72.

Cost of blasting in quartzite, open work, \$7.92 per cubic yard.

The route of the road from Silverton is upon the right bank, crossing at the end of

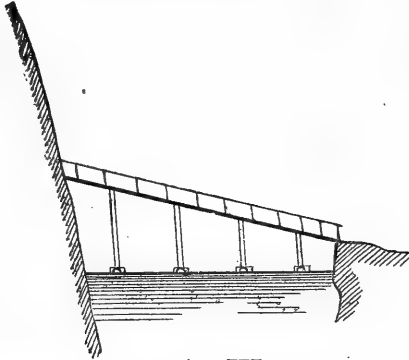


Fig. III.

Baker's Fork, below the mouth of Mineral Creek, to the east or left bank, by a plain but strongly built bridge (Fig. III) 200 feet long, 18 feet wide, and averaging about 14 feet above the water, provided with side rails, the flooring of hewn timber, the upper surface squared and pinned by stringers. The eastern end is higher than the other, the road here being along solid rock. It continues down this bank about $4\frac{1}{2}$ miles, when it recrossed to the other, at which point in September last were found standing three piers of the old bridge, built the year before and washed away during the high water of the spring. Nearly all the timber was on hand for rebuilding it, which was to be done during October. The river here was 250 feet wide; and upon the right bank the road continues throughout the entire cañon, and on to the park below.

The mouth of Cascade Creek was a formidable obstacle. Inclosed near its mouth in vertical walls, increasing to nearly 200 feet, a passage there was impossible. At this point the nature of the cañon of the Animas abruptly changes. From the end of Baker's Park, for 17 miles without the windings of the river, it is encompassed by imposing mountains of quartzite towering one upon another. Instead of hugging the trachytic formations, beginning at Sultan Mountain, and not far distant in its course, the river boldly entered upon the more difficult task of forcing a passage between these harder obstructions.

From the upper brink of the grand cañon the river like a silver thread may at intervals be seen 4,000 to 5,000 feet below. The general course has thus far been south and southwest; with the accession of Cascade Creek, the departure from the great quartzite region, the cañon of the river changes to one more nearly straight, due south in direction, its walls vertical, in places almost 1,000 feet in depth, where the river is wholly inaccessible. This is situated in a valley of rolling hills, shut in on the east by a ridge gradually diminishing to the south, while a range of cliffs of sandstone, encompassing the "Cliff Lakes" and continuing also to the south, from the western limit of this depression and the boundary on the west of the park itself.

The general average of the river's fall from Baker's to Animas Park is about 100 feet per mile. Near the beginning of the great "Box" Cañon of the river there is descent above the average, and falls and rapids of the river interpose too great for the agility of the trout. While this fish of a superior size and flavor may be taken in the Park below, none can be found in the Grand Cañon nor in Baker's Park above.

Leaning over the top of the bank at the edge of the cañon, with a firm hold on a rock or an overhanging tree and gazing down upon the water white with the foam of its dashing and surging under and against the great black rocks that obstruct and confine it, there is a feeling of awe that overcomes the beholder.

When encamped near the Box Cañon of the Animas, some hours were occupied in attempts to reach the water's edge at several points, which were unsuccessful, owing to the obstruction of vertical walls. In order to avoid these obstructions, the route of the road was changed from the bottom of the Grand Cañon, about 19 miles distant from Silverton. A high hill was ascended by three steep gradients in a zigzag, the mountain slope encircled, high retaining walls being essential, therefore, and Cascade

Creek passed above its cañon by a fine high and well-built bridge, the stream here being some 20 feet wide, with an average depth of fully a foot and the velocity that might be expected from its name.

Swinging to the west nearly 2 miles the Cliff Lakes are reached, around which, for 2 miles along their eastern sides, the road passes. These are clear and lovely sheets of water, varying in width to 600 yards with an average of about 300, beyond whose western banks rise huge mountain slopes reflected below, the surfaces frequented by water-fowl, the road almost on a level along the shore, and shaded by lofty pine and aspen. Thence to the south by a succession of easy slopes, almost a natural route, between rolling hills, the road passes to the park below. The road is well ditched, and, where needed, inclined drains of dry stone are provided. All the bridges are strong and well made, the upper surface of planking, the timbers in general square-hewn, occasionally also covered with dirt, and fastened by well-pinned stringers. Everything indicates permanence and durability.

At several places there were intervals of "slide" rock 60 to 75 yards in length, where the road was not in traveling order, but this was to be covered and completed later.

The charter of the road was taken out in 1876 and work begun September 1. Seven miles of the route, from Silverton to the south, was completed and opened during the fall at a cost of \$3,270. In 1877 work was commenced early in April at the head of the Animas Valley, and continued with a daily average of 30 hands, the pay of those at ordinary labor being \$1.50, and on rock blasting \$3, including board. At the end of September last the cost had been \$19,000. At that time about 4 miles remained unopened, the cost of completing the same and putting the entire road in perfect condition, including bridges, making an aggregate of \$30,000.

The completion and opening of this road must result in great advantages to the mining region. Illustrative of the great expense entailed by its secluded situation may be mentioned that of forage; while in the valley of the Animas, as at Animas City, hay was plenty at \$40 per ton and corn \$2.25 per bushel, at Silverton double that amount was asked. As the winter and spring approach and the passes become blocked with snow, these prices become greatly enhanced.

It must, therefore, lower the high prices existing and give free access to large fields of coal, the supply of which now comes from a long distance. In turn it will be of great advantage to the lower section in the largely-increased market for its produce and the establishment of reduction-works near to or in the coal region, since the transportation necessary for the carriage of this fuel up the Animas will in time be utilized for return loads of ore from the mines.

THE INNESS ROAD TO SILVERTON.

As already stated, the route to Silverton for heavy freight teams, previous to the opening of the Wightman road, was via the Burrows Park, or Hensen Creek line via Lake City, from the railroad, preferably the latter. In general, however, the Wightman line, as a route for freight from the railroad, is too long, its distance from Garland City being 281 miles, and with the new terminus at Alamosa 256. Presuming upon the latter situation, we have Silverton's distance by lines at present practicable as follows:

Silverton, from the railroad at Alamosa, route via—	Distance.
	<i>Miles.</i>
Conejos, Chama road, and Wightman's road, Grand Cañon of the Animas.....	253. 9
Rio Grande to Antelope Springs, Lake City, and Hensen Creek.....	145. 7
Old county road up the Rio Grande (impassable in part).....	124. 2
Inness road up Rio Grande and Cunningham Gulch (proposed).....	128. 7

Of the above, the Hensen Creek, being the only one in fine condition and about 110 miles the shorter, will, of course, be preferred. By the Conejos route the continental divide is passed at a low point; by the last two, a high mountain pass at the head of the Rio Grande must also be surmounted; while by the Lake City route, two high mountain ranges intervene, and must be crossed, before Silverton is reached. From the most casual glance at the table, it will be seen that the direct route up the Rio Grande is the desideratum, being the line of shortest communication. The route via Cunningham Gulch, though $4\frac{1}{2}$ miles longer than the old county road already referred to, crosses the range by a pass 500 feet lower, and is, therefore, preferred by all pack-trains, which were frequently to be seen, and whose trails, deeply furrowed and from 6 to 10 in number, were observed on the east side of the range below the top of the gulch. In making the descent from the summit, there were passed close by about

100 jacks, or burros, and mules, heavily laden with freight, and drivers afoot; everything indicated that a good toll-road will be a paying investment. With this impression, on the commencement of the Wightman road, Mr. Edward Inness, of New York City, obtained a charter for such a line from Howardsville to Antelope Springs, by way of Cunningham Gulch. He chose this route, being largely interested in mining property near the head of the gulch, since he was compelled to construct a way to transport his ore to Howardsville, where he had erected reduction-works; he therefore determined to continue the line beyond the range and down the Rio Grande to connect with the lower roads at their junction in Antelope Park.

On the road down the gulch, 5 miles to Howardsville, \$2,000 were expended; above his works, a mile toward the summit, was said to have cost \$4,000. This was finished in the fall of 1877, at which time his works in the gulch were also constructed.

From the levels furnished him, by Lieutenant Wheeler, Mr. Inness stated that the gradient on the old county road from the summit of the range above Howardsville to the point on the Rio Grande where Pole Creek enters was nearly 300 feet per mile, while upon the route he had selected it scarcely averaged beyond 200; the balance of the road, from Pole Creek to Antelope Springs, having a general descent of but 90 feet, or 1.7 per hundred, linearly. During 1878, it was said the balance of the road to the summit and the whole of that beyond, to Antelope Springs, a distance of 40 miles, was to be completed; the cost of finishing and perfecting the entire route aggregating \$30,000. With communication direct via the Rio Grande and the route to the agricultural region to the south open, Silverton and vicinity will at once increase in prosperity, and, with a new impetus given to every interest in all the surrounding districts, she will become one of the largest places in the San Juan.

SECTION III.—TRAILS.

A trail is the route of nature and barbarism; it has traversed the country and defined the lines of shortest communication before the white settler has entered the region, civilization following and replacing it with a road. The instinct of animals leads them to form a trail in a new country, to use one existing in an old; thereafter it is used in succession by Indians and whites.

Throughout the Rocky Mountains, a vast expanse, at points 200 miles in width, the most important sections are connected by old Indian trails, without which the forests and rocky defiles are wholly impassable. When it is known that with the absence of travel the rank summer vegetation of the mountains will in a single season cover and conceal them, while the stunted growth of limbs and broken bushes by which the Indian marks the way will become dim and almost imperceptible, it is not deemed inappropriate to add to the other lines of communication a list of trails deemed most important. They are considered of such value by the topographer, that no representation of a mountainous region is considered perfect which, with other orographic projections complete, lacks the trails by which alone can passage in general be made.

THE RIO GRANDE SECTION.

An important trail up the west side of San Luis Valley is along the Rio Alamosa, ascending its cañon. A short trail passing up Gata Creek soon crosses to and is merged in the former, descending into the cañon, here over 1,000 feet deep. The trail is mainly on the right bank of the Alamosa, well worn and easily found in general. From the upper part of the cañon at a great *rincon* (a corner, so called by the Mexicans from the mountains squarely meeting there) upon the mountain to the right may be found a dim trail, ascending abruptly 2,000 feet and meeting at the base of the Pintada Peak (locally called "Old Baldy") the old wagon-road from Del Norte to the Summit Mining District. The latter section may thus be directly reached from the plains to the east.

The main trail continues up the Alamosa, its continuation having been found with some difficulty at the *rincon*. At the mouth of the North Fork, on which the summit lies, the mines may be reached by following a very rough but direct trail up that stream. Along the South Fork, which is the main stream, the main trail follows, the gold mines of the Decatur district being here situated. It passes over the range near the Summit Peak over 13,000 feet high, and via the East Fork of the San Juan to Pagosa Springs. This trail is at points difficult, high, and circuitous, and not the preferable point for crossing the continental divide.

At the mouth of the cañon of the Rio La Jara where the settlements are thickest a well-trodden trail passes directly across the lava plain to Conejos, avoiding several miles of the detour by the wagon-road to the east and south. From the valley at this stream's headwaters and the lake beyond on the same general depression a trail was cut from the left, descending in the usual zigzag course to the bottom of the cañon of the Alamosa fully 1,200 feet below the edge of the La Jara Valley. From this point the Alamosa Cañon increases as it is ascended, being fully 2,500 feet deep at the *rincon*.

THE TIERRA AMARILLA SECTION.

From Conejos the route of the old Chama trail to Tierra Amarillo is occupied by the new wagon-road, which has been left unfinished for about 12 miles of the way; distance about 60 miles.

Another trail between the same points passes from Conejos up Los Pinos Creek for some distance, and along the great volcanic plateaus west of San Antonio Peak to the headwaters of the Rio Brazos, thence descending to the Mexican towns of the Tierra Amarilla. It is a shorter trail than the former; length about 52 miles.

Still another but a longer line between the same points reaches Tierra Amarilla or its main plazas, Las Nutritas, by following down the creek of the same name, crossing the Servilleta and other creeks *en route* from San Antonio Peak. Trails from Tierra Amarilla also pass to the southeast toward Ojo Caliente, southwest down the Chama, and northwest to Pagosa via Cañon Amargo. The latter distance by wagon-road is 58 miles; by the trail several miles shorter. Another trail up the West Fork of the Chama reaches Pagosa via the Hot Springs on the Rio Navajo, and after passing one of its tributaries and the Blanco watershed follows down a pretty valley and is merged into the county road. Trails from Tierra Amarilla also pass direct to the Rio Piedra and other points west, leaving Pagosa to the east.

THE NAVAJO AND THE BLANCO.

Up the Navajo itself a good Indian trail part way exists; hence to the Blanco a dim and very old trail is found, being followed with great difficulty, east and several miles distant from the county road.

Along the Blanco a deer-trail was followed for a few miles in the cañon, the trail in general, however, having to be cut. No evidences of any Indian camps were found in the large valley of the Blanco above the bend. From the Blanco to the San Juan below Pagosa Springs, a trail to the left, lying on the south of the county road the latter part of the way, made the route a direct line, and resulted in a saving of about two miles.

THE SAN JUAN AND PAGOSA SPRINGS.

From Pagosa Springs, always a popular resort for Indian tribes, a trail passes up the San Juan, over the range, and down the South Fork of the Rio Grande to its mouth, distance about 50 miles. On the northern side of the main divide a branch passes to the summit, about 39 miles from Pagosa. This is an old Indian trail which has been blazed by whites.

The principal trail to the Summit mining district from the springs is mainly upon the right bank and through the cañon of the river until the upper valley is attained, where the trail from some new ranches on the West Fork covers over the separating divide. The trail rapidly ascends the mountains of the upper cañon of the San Juan, and at its highest portions is very good. It passes over slopes so nearly precipitous that two hours' work were necessary within 50 yards at one place to "build it out" for the passage of pack animals, after heavy rains that had preceded us. The crossing of the continental divide is below timber-line, and this part of the way to the summit, some four miles, was excessively boggy in August from melting snow-banks.

Above Pagosa, a new trail ascending the West Fork and crossing the divide to the main river avoids the cañon locality near its mouth; it was cut by an American, and is very steep.

From Pagosa a trail passes northwest to the Piedra, about 25 miles, crossing a stream of the Nutria watershed *en route* thence 23 miles to the summit of the Weeminuche Pass, whose altitude is 10,600 feet, one of the finest passes on the great divide in the Colorado section of the Rocky Mountains. Upon the Rio Grande side, which river the pass overlooks, the slope is abrupt, the trail descending 1,300 feet to the river in the distance of about 4 miles. This trail, from the Rio Piedra, is along Weeminuche Creek, possessing one of the loveliest mountain valleys in the entire San Juan, with magnificent grazing and abundant game; it was largely frequented by the Capote Utes in August.

Beyond that it descends abruptly into the upper cañon of the Los Pinos and along that water to the pass referred to.

A branch of the main trail continues up the Middle Fork of the Piedra, and, crossing the continental divide at a good pass some 40 miles from Pagosa, reaches the Rio Grande about 12 miles distant, descending the valley of the West Fork thereof. This is in Antelope Park, here of wide extent, Alden's Junction, or Antelope Springs, a stage station on the Lake City and Del Norte road, being about 1½ miles north of the river.

THE RIO NUTRIA.

From this stream, at the mouth of the spring near which is the ranch of Colonel Pfeiffer, a trail passes from the county road to the north, reaching the Piedra at the

head of its deep cañon. The valley is in places much trampled by cattle, rendering the trail at a few points difficult to follow. It traverses a dry but magnificent grazing section, and, with the Piedra trail, is the short route from the Nutria to the Rio Grande, via Weeminuche Pass. Cattle, we are informed, have been driven by this trail to the valley of the Rio Grande.

THE RIO PIEDRA.

The trails in the upper part of this river have already been mentioned. In its lower part, from a short distance below the junction of its various forks, it is impassable on account of the terrible cañon walls that confine it upon both sides.

Upon its western side a sort of trail passes to its upper waters. It is more properly a series of climbs from rock to rock of the sandstone mesas at the risk of life and limb, it being impossible to ride an animal over any portion of it long enough to deserve mention. The nature of the region may be judged of when it is stated that the time occupied in passing from the road to the open valleys and plateaus above, a distance of 20 miles, was six days. From near the Piedra a shorter route exists to Tierra Amarilla than the wagon-road via Pagosa. From the Rio Nutria east of the Piedra Parada, or Standing Stone, a remarkable chimney-like mass of rock rising upright from its base, there passes a trail to the southeast, crossing the San Juan below the mouth of the Blanco and continuing on to the Navajo, crossing the country road *en route*. Thence it is over part of a trail already described. Like a number of other trails designated this is not upon the map, and avoiding Pagosa entirely is valuable solely as a cut-off to the Tierra Amarilla or Chama section from the Rio Nutria, the Piedra, and beyond.

THE RIO LOS PINOS AND THE VALLECITO.

The lower parts of these rivers are easily traversed, but the regions of the heads thereof are to be avoided, unless the occurrence of dangerous accidents be of trifling import.

Up the main stream a trail passes all the way, mainly on the left bank, to the Weeminuche Pass; this is, without exaggeration, a horrible trail; necessarily so, in a horrible region. Some parties of prospectors essaying to reach the "Needles" at its head went along a short distance, but abandoned the attempt. We pushed ahead, and got through with one of the party *hors du combat*, a mule and his rider narrowly escaping death by falling from the slippery rock over which passed the trail.

No description can convey any idea of the ruggedness of the great crags of these mountains. Let us presume we are looking upon Manhattan Island as it appears from the Jersey side. Instead of a single Trinity spire, multiply them till a hundred or more rise up before us everywhere. Increase their size, raising up gigantic masses between, sharp and craggy, like the edge of a huge, uneven saw, until the highest tops are a mile above the bay. Imagine among them sharpened peaks, great precipices, vertical cliffs, deep cañons before you and behind you everywhere, all of slippery rock, with treacherous footholds. In a faint degree such may be likened to the Quartzite Group, more aptly known as the Needle Mountains. With a feeling akin to dread their passage may be attempted. To avoid the cañon of the Los Pinos a trail just below its southern end, in a magnificent wide valley, passes to the right and beyond the mountains to the watershed of the Piedra, along which it continues for about 20 miles, returning to the river about 3 miles below the incoming trail from the Weeminuche, thus avoiding the region of greatest difficulty in the direct ascent of the river.

The distance from the mouth of the Vallecito to the Weeminuche Pass is, by the direct trail in the cañon, about 30 miles—long and difficult ones; by the detour to the right 5 miles farther.

On the Vallecito, or the West Fork of the Los Pinos, an old trail passes up the right bank some six miles, and there is lost in the deep bog on the left bank. Upon the left side a trail continues through the entire cañon of the river, mainly upon that bank.

At the distance of about 16 miles from the mouth of the Vallecito a mineral spring beside the trail attracts the passer-by. This is better known as the "Sheep-lick," numbers of mountain-sheep being attracted thither by the iron constituents of the water. About 7 miles beyond is a low, flat area called "Deadwood," where the east and west forks of the stream unite, the latter from the northwest, the former almost in the same line from the southeast. The name is derived from the burned, charred pine-trees standing thickly throughout the entire area, almost thrown in shadow by the huge crags towering fully 2,000 feet above. The trail follows the West Fork to its head in Lake Columbine, a crystal-green sheet of water 900 feet long by 300 wide, beautifully located in a crateriform space amid surrounding precipitous crags. The West Fork, from its mouth to its origin in the lake, is about 8 miles in length, with a very rapid fall. Outline sketches to the north and east show the horrible nature of the mountain-summits in this region, and the difficulties besetting one in making an ascent, which is at most points an impossibility.

In company with a few prospectors, this trail was opened early in September last, the "Needles" being up to that time inaccessible; since then, we are informed, hun-

dreds of prospectors have passed over it, and it is one of the most important routes in the entire region. About 6 miles below the mouth of the Vallecito a trail from the Florida, 4 miles in length, reaches the Los Pinos.

THE FLORIDA.

As already mentioned, the valleys of the Upper Florida are readily reached by trail, but its headwaters are inaccessible to man or beast, and save at but few points can the quartzite crags that guard them be climbed over and descended by any human being.

From Animas City a short route to the Rio Grande is via the road to the Florida, by trail up that river, across to the Los Pinos, up the cañon of the latter and via Weeminuche Pass to the river below, in all some 60 miles, 5 miles being added if the trail to the right of the Los Pinos Cañon be taken. From the river opposite Weeminuche Pass to Alden's Junction, in Antelope Park, the distance is 19 miles.

On the Lower Florida a trail passes to the Las Animas, connecting with the trail for the San Juan.

THE RIO DE LAS ANIMAS.

From Animas City to the mouth of the river a good trail exists to the San Juan. The trip can be made in the lower part on the trail following along in the river-bottom; but in high stages of the water, the trail on the high mesa crowning the right bank should be followed. A trail from the Florida reaches the Animas about 4 miles above its mouth, below which, at about the same distance to the south, is the line of the Indian reserve. Within this cañon region, in its course to the south, the trail crosses and recrosses the river five times within a short distance, after which it continues on the left bank.

The distance from Animas City to the San Juan is about 60 miles. Below Animas City a few miles a short trail passes to the La Plata. Farther down, about 5 miles above the large ruins upon the west bank of the river, a trail enters the Cañon Arido and reaches the San Juan at the mouth of the Cañon del Gobernador on the river above the great Cañon Largo.

THE RIO LA PLATA.

From the Rio de las Animas, part way ascending Junction Creek, a trail connects Parrott with Animas City. A "short cut," as we were informed, and but 12 miles in length, proved to be about 50 per cent. more, and but little less than the toll-road. A trail up the river from Parrott City to its head crosses the range, and continues to the East Fork of the Dolores. This has been traversed, but is not attempted by prospectors. In preference, they make a long detour to and beyond the Mancos.

THE RIO MANCOS.

To the north from the union of the forks of the river a trail passes up the West Fork of the stream, towards the upper part of the Lost Cañon and the region of the East Fork of the Dolores. To the south along the settlements is a wagon-road, and beyond that a trail continues the entire length of the river to its mouth, connecting with the great trail along the San Juan. From a point on the west bank of the river about 6 miles below the road a trail passes to the west above the line of mesas and to the north of Ute Mountain into Arizona, reaching the San Juan some distance beyond the border.

THE RIO DOLORES AND BEYOND.

The shortest trail to the Dolores from the Mancos is from the union of its forks 18½ miles north of west. *En route* a trail crosses the Lost Cañon and passes north to the junction of the East and West Forks of the Dolores (sometimes known also as the North and South).

A trail follows up the East Fork, branching near its head. One part ascends the stream and, crossing at its head to Cascade Creek, follows down to connect with the Animas trail to Silverton; the other goes northeast to San Miguel or Front Lake. About 5 miles from the lake, southeast of Mount Wilson (Hayden) or Glacier Peak (Wheeler), some 14,300 feet in height, lies the mining-camp upon the Dolores, a section of whose mineral wealth many reports were heard. From its common use by those Indians, and its leading to their reserve, this is generally called the "Ute" trail, and branches at the lake; one part passes up the Lake Fork of the San Miguel 11 miles to that river and continues on via Uncompahgre Park to the Indian agency and Ouray, the latter distance about 20 miles, while the other reaches Silverton via Mineral Creek, about 19 miles. At the big bend of the Dolores many trails congregate, its location and water supply making it a desirable point. The connections are to all points, are important, and may be described in the following manner:

The Uncompahgre trail.—From the Big Bend the trail passes northeast about 10 miles to Plateau Creek, locally known as "Beaver Creek," 16 miles up which is reached a

great depression nearly 15 miles in diameter, called the "Amphitheater." Thence one branch passes down Disappointment Creek, so called from the waters sinking in the earth, a distance of about 28 miles to the Dolores, and thence on the east side of the river about 50 miles to the Grand River, meeting the Salt Lake wagon-road running down from the Gunnison. The main trail at the Amphitheater continues on some 40 miles, meeting a trail along which to the right at the distance of 30 miles Ouray is reached, and the Uncompahgre Agency at the distance of 22 miles, being situated farther down the Uncompahgre River than Ouray.

The Ute trail.—This passes from the Big Bend to the "Pioneer Mining District," on the Dolores, to San Miguel Lake and beyond, and with its connections has been already mentioned. Both this and the Uncompahgre trail reach the Big Bend from the right.

The Navajo trail.—This is one of those arriving on the left bank of the river, coming in from the south, leading from Ute Mountain, 15 miles distant, and is so called because it is the line of travel to the country of the Navajo Indians. At the point of Ute Peak it crosses the California trail, passes to the left or east of the mountain, to the San Juan River, about 30 miles, where it forms a junction with the Santa Fé trail, via Parrott City, to Fort Defiance.

From the Big Bend a trail parallel to the former passes along for 5 miles, and, branching to the right, crosses the head of McElmo Creek, on the right-hand side (north) of Ute Peak, and is merged into the great California trail.

A trail near the Ute Mountain branches from the Navajo, passing to the left. Skirting under the foot of one of the huge mesa walls, it passes into the cañon of the Mancos, continuing on past the Cliff Houses, 11 miles within the cañon, turning up an arroyo, or more properly a side cañon on the left, reaching with some difficulty, the top of the mesa. Thence it passes to the La Plata, reaching the river below the mouth of Cherry Creek, distant about 15 miles from the top of the mesa of the Mancos Cañon. Passing down the La Plata some 12 miles, the Indian villages of the Weeminuche Utes are reached, and continuing on after crossing the stream 3 times, at a distance of about 10 miles from the villages, the trail leaves the river turning, southeast, and reaching the mouth of the Animas, about 3 miles beyond. The Animas is crossed, and soon after the San Juan itself is forded, and upon the south bank of the latter the trail continues to Cañon Largo, 23 miles from the mouth of the Animas. The trail then passes via this well known cañon to Abiquin, about 120 miles *en route* to Santa Fé.

The Santa Fé and Salt Lake trail.—This is a very important trail leading to the northwest, over a portion of which we have come from the Mancos. From its having been traveled by Captain (now Colonel) Macomb, of the United States Engineers, in his celebrated expedition of 1859, it is in some portions known as "Macomb's trail." It passes out from the Big Bend about 5 miles to the west, and thence to the northwest, reaching, 8 miles distant, the Ojo Vallecito, signifying the "Spring in the little valley." At perhaps 9 miles to the northwest another spring is found, where the trail forks. The branch going to the left, to the west, reaches the southern point of the mountains called generally the Blue, though to the Indians as the Elk Mountains. Around the Blue Mountains this trail continues to the Colorado River.

The main trail passes to the north, water being fortunately found at not very distant intervals, in the shape of springs, and continues to the Sierra La Sal. At their southern slope it changes its direction to the northeast to the Rio La Sal, which rises in the mountains from which it derives its name. This stream waters a beautiful valley, so attractive and lovely that it bears the name of the Valley of Sinbad, lying on the slope of the high mountains which trend down toward the Dolores on the east. The trail following down to the river continues down the Dolores about 20 miles to the Grand. Forging the latter it reaches, nearly 5 miles distant, the Salt Lake wagon-road coming from Ouray, the Uncompahgre Agency and the valley of the Gunnison to the east. Passing the road the trail continues on to Gunnison's Crossing of the Green River, a fine and easy passage in a region where the river is within a difficult cañon, above and below this point, so named from its use by that officer in his explorations in 1853.

At Sierra La Sal is a cut-off on the former trail. It is the main trail in reality, and is universally used in the fall and winter, but from the high stages of water in the Grand is not available during the spring and part of the summer. At the southwest edge of the Sierra La Sal it turns to the left, and crossing the Grand River passes direct to the Salt Lake wagon-road above.

The California trail.—This line, already referred to, may be mentioned more in detail, although the connecting link which we traversed is but a small part of the entire route. It passes from a point on the Mancos, about 20 miles from Parrott City, to the west some 15 miles to the Navajo trail; along this nearly 8 miles; thence 5 miles to the southwestern part of the Ute Mountain. From this point it passes to the west, about 50 miles, to Epsom Creek, a northern tributary of the San Juan, in Utah, whose mouth is opposite that of the Rio de Chelle on the south. Descending the creek to the San Juan, and ascending the Rio de Chelle in Arizona, it passes to the southwest. At San Francisco Mountain a branch goes to the south to Prescott, the main trail continuing on to beyond Fort Mojave, on the Colorado River, via Hualpai Springs.

Silverton trails.—By far the most important trail in the lower country has been for some time the trail connecting it with the mining country, known as the Animas trail to Silverton. It passes up from the Park over the cliffs and mountain-slopes and to the east of Engineer Peak, making Animas City about 48 miles from Silverton. Upon Lime Creek this trail divides, both branches reaching Silverton, the one to the east descending along the cañon sides of the river, that to the west following down Bear and Mineral Creeks to the town. This will undoubtedly fall into disuse on account of the opening of the Wightman toll-road in the cañon of the river below, which is not only a fine route but lacks also any of the excessively steep and long grades encountered on the trail.

From Silverton, trails lead into all the contiguous gulches and surrounding mining-camps of which it is the center, and are therefore, in general, but local in their value. Several, however, extend beyond the immediate vicinity, and are important in their connections.

From the west down the South Fork of the Mineral Creek comes the trail from the Zan Miguel country, prospectively a very valuable region; one up the other fork of the same creek leads to the north, connecting with mining-camps on the Upper Uncompahgre waters.

Ascending Cement Creek, a trail passes to the north and beyond to Hurricane Peak, prospectively a valuable camp; around and beyond which mountain, via the Uncompahgre River, Ouray may be reached, about 24 miles from Silverton.

Leaving the wagon-road in Cunningham Gulch, 2 miles from Howardsville, the Rio Grande trail ascends the gulch, crossing the Continental Divide on an easy rolling pass, about 500 feet lower than the wagon-road, again joining it on the Rio Grande watershed. Although a few miles longer detour to the point of meeting, the Cunningham Gulch trail is preferred by pack-trains on account of its easier gradients; that of the road, for nearly three miles to the pass, in which it ascends the mountain-side, averaging 880 feet per mile. From this an idea of the situation of Silverton may be gathered—a green patch of land closely shut in and isolated by huge encircling mountains.

The Ouray trail.—As previously mentioned under the heading of road communications down and up the Animas, wagon-roads are now in operation. From the farthest point north on the latter, Mineral City, lying at the edge of timber-line and about 11,500 feet, a trail passes down Poughkeepsie Gulch and the Uncompahgre to Ouray. This is about $7\frac{1}{2}$ miles long, and is said to be the most horrible and fearful trail in the country. Old prospectors, "forty-niners," in the San Juan, have stated that it has no rival in California or Nevada. A wagon-road projected over this route is estimated to cost over \$60,000, on account of the immense quantity of blasting necessitated.

From a point of the Hensen Creek toll-road on the divide east of Mineral City a trail passes down over the mountains east of Ouray to the Uncompahgre Park and the agency down the river; distance not known.

Lake City trails.—Fortunately for Lake City her trails are a thing of the past, and are replaced by roads which in general follow the routes of the old-established trails.

The building of toll-roads here is moreover indicative of permanent prosperity, and furnishes indubitable proof of mineral wealth of her surroundings; without such foundation they would not exist.

From Lake San Cristobal (the lake of Saint Christopher) a trail passes due southeast across the Continental Divide, meeting the toll-road on Clear Creek, continuing on also down the same stream to Galloway's and other settlements in Upper Antelope Park.

The same toll-road, west of the divide, touches Cebolla Creek, the same signifying an onion. The same stream has been mapped as "White Earth Creek," but improperly, being otherwise locally known. From this point a trail passes down Cebolla Creek about 5 miles long and $1\frac{1}{2}$ in width, a fine grazing section, lying one-third in the Indian reserve, and continues northeast to the Los Pinos Agency.

The Rio Grande.—Descending the river, the principal trail worthy of note and not already mentioned is that in the deep cañon of the Rio Grande, from the foot of the Weeminuche Pass to the head of Antelope Park. It is a cut-off on the circuitous route of the road, which, opposite the pass, ascends a hill fully a thousand feet high. The trail passes largely over slopes and small benches above the river, whose edges are vertical cliffs several hundred feet in height, and in part over masses of slide rock. The distance referred to by wagon-route is about 12 miles, that by the trail is fully 2 miles less. Ascending the Hot Springs Creek, at Wagon Wheel Gap a trail, we were informed, exists. Whether or not it crosses the divide and descends to Pagosa, via the West Fork of the San Juan, the two streams heading not far distant, we are not aware. Limited time and heavy snows, with more important lines to be examined, prevented a reconnaissance of this portion of the divide.

The trails and connections of the West and the South Forks of the Rio Grande have been previously mentioned.

On Embargo Creek, the largest tributary on the north side, below Wagon Wheel Gap, a local trail ascending the stream is at present replaced by a wagon-road, and ranches line the way.

CHAPTER IV.—POPULATION.

The wave of emigration setting in towards the valley of the San Juan nearly two decades ago, only to encounter impassable barriers in an unknown country, a wilderness impenetrable, and hostile savages, and be rolled back at every point, has again returned. From every direction settlers have come in immense numbers, more are still on the way, and in every section of the San Juan a population is arising possessing every indication of permanency.

To personally examine the various parts of the country and to report specifically upon the numbers and occupations of the dwellers therein, by whom had been made numerous requests for military protection, was one of the objects of the reconnaissance.

A brief summary or census of the principal points of settlement is therefore furnished, accompanied by a map showing the area of the country covered while in the field, the lines of communication with the roads in traveling order, and those portions of the country which have been occupied by settlers for farming, either ranching or grazing, and by prospectors for mining purposes, in which the sections that are thickly populated are so indicated.

As may be already inferred, the ends which settlers have in view are of two varied and distinct natures, agricultural and pastoral pursuits and mining, the latter attracting by far the larger majority.

The farming and grazing population establish themselves on the lower parts of rivers and streams, and are permanently thereon; the mining-camps, wholly or almost entirely, are located at the headwaters of streams or upon mountain peaks near by. Owing to the short working-season and the intense severity of the winter at that elevation, the mining-population is of a semi-permanent nature, leaving about the latter part of October, and returning in May or June, from the towns or the lower regions, where they congregate for the winter.

As an illustration of the brevity of the working-season may be mentioned the visits to the Summit, a gold-mining district southwest of Del Norte. They were three in number, and from different directions, during the reconnaissance: in June, from the Lower Alamosa; in August, from Pagosa, via the San Juan; and in October, from Del Norte. In August only was the way not impeded by snow, the total precipitation there for the year ending November 1 being 24 feet. The population, which in June was 125, had decreased in October to 23, while scarcely a dozen were to remain through the winter.

In preparing the printed table of densest populated districts attached to the map, the population belonging to various mining-camps has been so accredited, since it there properly belongs, and with other of a floating nature fully aggregates the numbers given. While there may be a percentage of error in the designated numbers in a few instances, it is, on the whole, believed to be less than the total of all the region visited from the existence of obstacles to an exact and actual count.

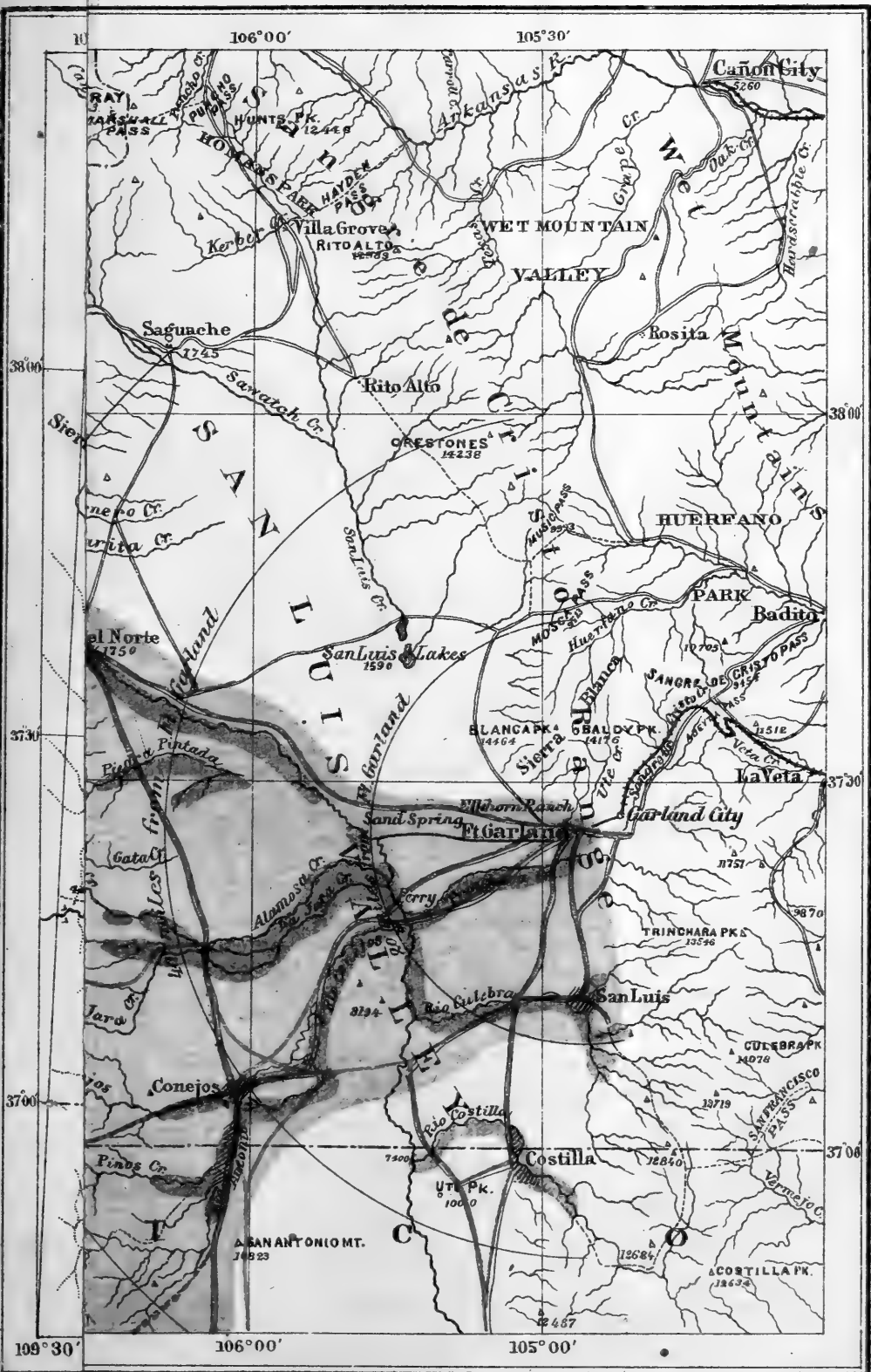
The difficulties of arriving at a thorough and perfect census in such localities may well be imagined, for while a town is drained of its winter population for the mining regions, prospectors distribute themselves through localities almost uninhabited, or waver from one section to another as its prospects change. There were, for instance, from three to four hundred more persons in Lake City last spring than are so credited, owing to their temporary stay; immigration was very great to this locality, but, disappointed in endeavors to find employment, they either returned or spread out into new districts.

THE CONEJOS SECTION

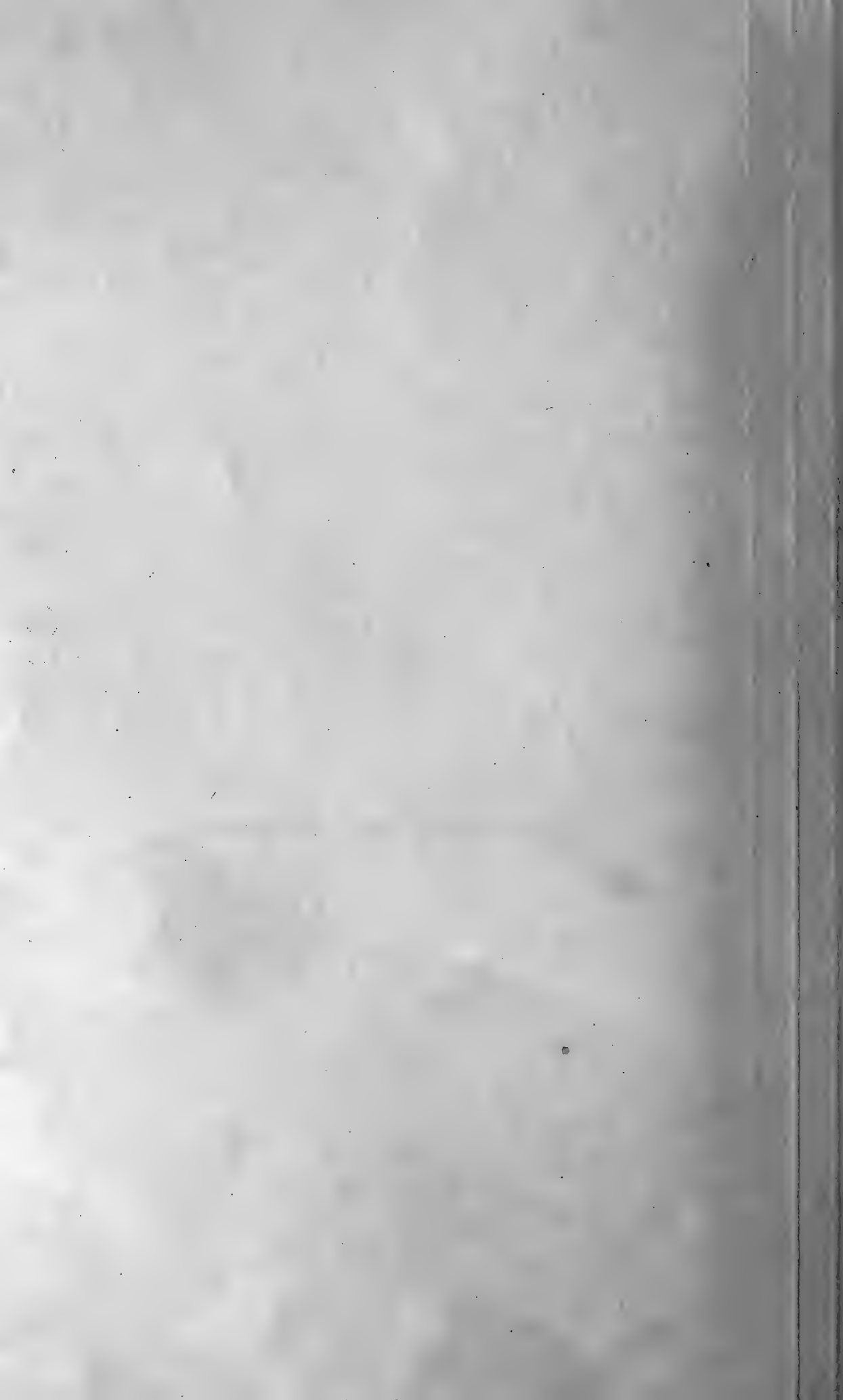
lies in Conejos County, Colorado, upon the Conejos and San Antonio Rivers, is the seat of the largest Mexican population west of the Rio Grande, and one of the most thickly settled localities of that nationality in the State. It comprises a number of plazas, or towns, and settlements, known collectively as Conejos, which have not as yet been correctly and fully indicated upon any map. Individually they are located and distinguished as follows:

Guadalupe (Guadaloupe), situated entirely on the south bank of the Rio Conejos, as indicated upon the map, being about 14 miles from La Jara, its altitude being 7,860 feet; population, about 450; contains three good stores, one American and two Mexican, a large church, residences of the priests, with fine gardens attached; all the buildings of the place being of *adobe*, a native brick of extensive use. This contains the post-office of the entire section, mails being tri-weekly from Del Norte. Major Head, lieutenant-governor of Colorado, resides here. A grand council between Ouray, claiming supremacy over all the Utes, and Ignacio, war-chief of the three southern and disaffected tribes, accompanied by their several chiefs, was held at his residence in July last, as being on neutral territory, and because he is greatly respected by all the tribes of Colorado Utes.

A small plaza on the opposite bank from Guadalupe is known as *Conejos*. It contains a good store and a small population.

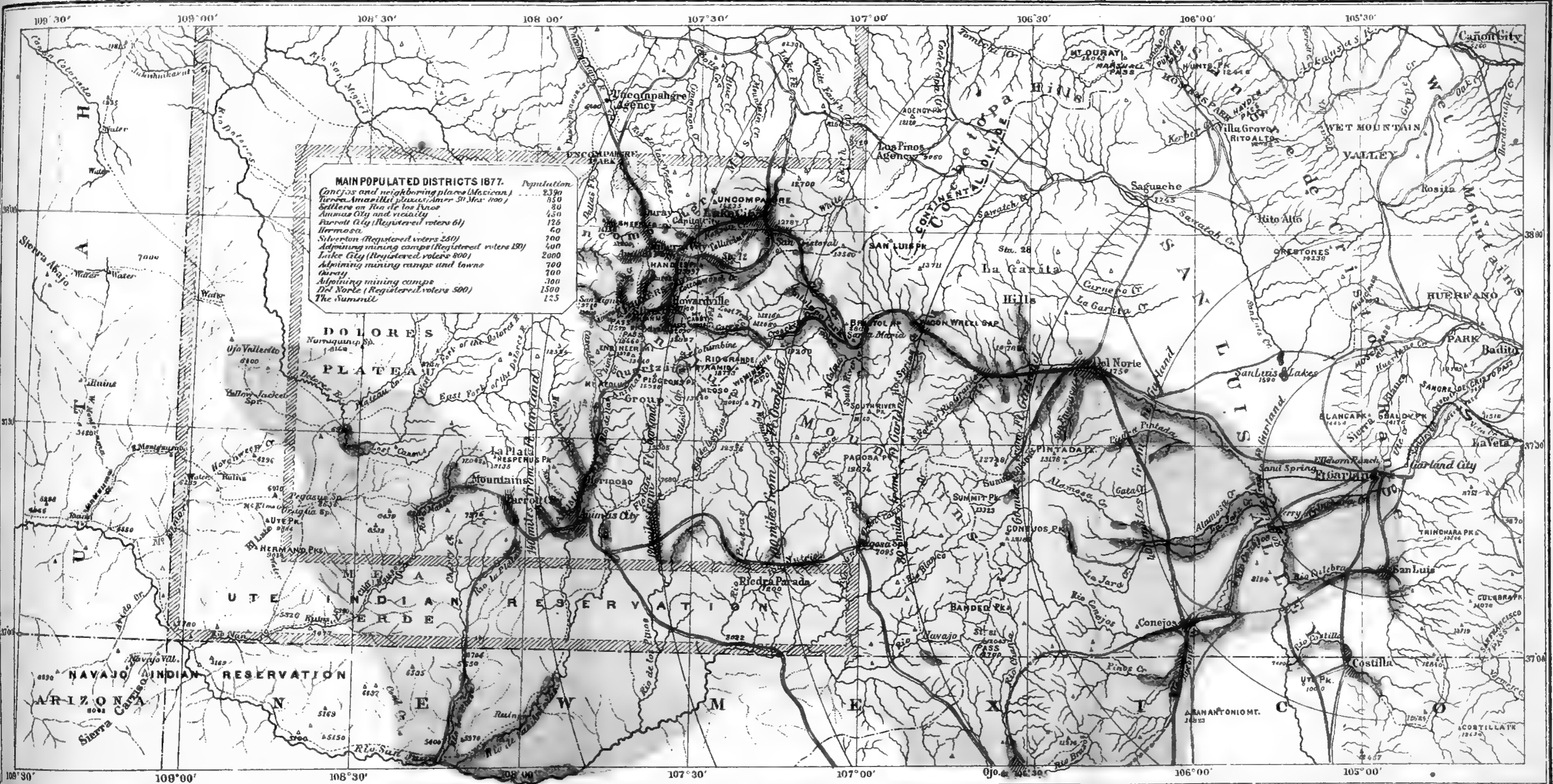


Engraved in the Office of the Chief of Engineers.





MAP OF PART OF COLORADO.



MAIN POPULATED DISTRICTS 1877.

District	Population
Conjos and neighboring places (Mexican)	2390
Tierras Amarillas (Mexican) (over 30 Mex. 1000)	850
Settlers on Rio de los Pinos	80
Animas City and vicinity	450
Parrot City (Registered voters 61)	125
Hermosa	60
Silverton (Registered voters 250)	700
Adjoining mining camps (Registered voters 120)	400
Laika City (Registered voters 800)	2000
Adjoining mining camps and towns (over)	700
Adjoining mining camps	700
Del Norte (Registered voters 500)	1500
The Summit	125

Corrections to November, 1877.

Area covered during San Juan Reconnaissance 1877
 Country settled upon or occupied for mining purposes
 Towns and thickly populated mining camps
 Toll and County Roads in traveling condition
 Ute Indian Reservation

C.A.H. McCauley
 2^d Lieut. 3rd Arty.
 in Charge.

Engraved in the Office of the Chief of Engineers.



San Rafael or *San Rafael en el Cañon*, as it is called by the Mexicans (Saint Raphael in the Cañon), is $3\frac{1}{2}$ miles west of Guadalupe, on the south bank of the Rio Conejos and along a small cañon; population, about 300.

San Antonio (Saint Anthony) is about 3 miles south of Guadalupe, on the Rio San Antonio; population, about 50.

Los Pinos (The Pines), from its situation on Los Pinos Creek, about 7 miles south of Guadalupe; population, nearly 450.

Cordon (The Line of Stones, from basaltic rocks near by), about 2 miles south of Guadalupe; population small.

Cenizaros (from *Ceniza*, ashes), about 5 miles southeast of Guadalupe; population, 300.

La Servilleta (The Napkin), about 2 miles east of Guadalupe, on the north side of the Rio Conejos; population, 150.

El Brazo (The Arm), on the north side of same stream, 4 miles east of Guadalupe; population, 125.

Fuertecitos (from *Fuerte*, the provincialism for a log cabin), 7 miles east of Guadalupe, opposite the establishment of Señor Valdez; population, 125.

San José (Saint Joseph), 7 miles east of Guadalupe, near Conejos and San Antonio Rivers, and on main road to Valdez Ferry from Guadalupe; population, about 70.

Los Cerritos (The Hills, situated near by), about 10 miles east of Guadalupe, on north bank of the Conejos; population, about 70.

Los Sauces (The Willows), 22 miles east of Guadalupe, at the mouth of the Rio Conejos; population, 200.

The entire population of this section is 2,390 souls.

THE TIERRA AMARILLA

is the center of the Mexican population of Northwestern New Mexico, the industry of the inhabitants being limited to agriculture and pastoral pursuits. In this section are included five Mexican plazas, clustered together along the Rio Chama and its tributaries.

Las Nutritas is the largest of the group, to which sometimes the name of the section itself is applied. It derives its name from the creek upon whose bank it lies, a tributary of the Chama. The name *La Nutrita*, a diminutive, signifies "the little otter." By a provincialism, however, they employ *nutria* as a beaver, using to designate an otter the expression *perro del agua*, or water-dog. The town is equidistant from Los Ojos and Encinada, 2 miles from each. It contains three stores—that of Burns, an American, annual sales of \$20,000; Johnson & Co., \$8,000 to \$10,000; and Th. Escabal, \$5,000—a shoe-shop, and blacksmith building. The post-office of the section was located here, mails being weekly only and from no direction save from Santa Fé to the south; population, 250.

Los Ojos (The Springs) is on the Rio Chama, due west from Las Nutritas 2 miles. It contains 4 stores, one a branch of Burns' at Nutritas, annual sales given as \$10,000, and three Mexican, small affairs, sales aggregating perhaps \$8,000. It is $1\frac{1}{2}$ miles below Los Brazos, and its population is 180. The Chama River is forded at this point for all directions west, its altitude being 7,300 feet, while that of Las Nutritas is 7,480.

La Puente (The Bridge), on the Chama, 2 miles from Las Nutritas and same distance southeast from Los Ojos; no stores; a small plaza; population, 100.

Encinada (The Oak) is 2 miles above Las Nutritas, on the East Fork of the Chama, sometimes called Rio Brazos, and same distance east of Los Ojos. There are no stores here; it is a second-rate plaza of 100.

Los Brazos (The Arms), from its location at the junction of the two main forks of the river, at an altitude of 7,350 feet. It is $1\frac{1}{2}$ miles north of Los Ojos, and, like it, is on the river-bank. There are no stores here, and in population it numbers 170.

The entire population of the Tierra Amarilla section is 800.

Above Los Brazos half a mile was the embryo town of Park View, all Americans. They claimed 75 persons in all, being in fact eight cabins, and aggregating, doubtless, from very reliable information, from 30 to 40 persons. Town-lots and a city-hall location were staked out, but nothing substantial was seen. This was a Chicago colony, with aspects much beclouded, being under the same management as the new "road" from Conejos. Since leaving the section we have been informed that the road is still unfinished, and that most of the colonists have gone to the Animas region.

Passing to the west via Pagosa, 122 $\frac{1}{2}$ miles from Las Nutritas, we reach the largest place in the Lower San Juan, known as Animas City, lying at the southern end of the Animas Park.

ANIMAS CITY AND PARK.

Of all the country adapted to agriculture, that drained by the Animas is receiving the largest amount of emigration, the portion known as the Animas Park extending

from the mouth of Junction Creek, about 13 miles to the north, an especially beautiful and fertile valley, with an elevation from 6,500 to 6,800 feet, having already been almost wholly occupied.

Animas City referred to is a new and growing town on the right bank of the Animas, just above the mouth of Junction Creek, at an altitude of 6,450 feet. It is not laid down on any Hayden or Wheeler map, and must not be confounded with the "Animas City" of Wheeler, which is an old, deserted place, about 12 miles above, and on the other bank of the river. The opening of the Jicarilla Apache reservation to settlement has during the past year drawn a considerable number of emigrants to the San Juan, the Lower Animas, and the La Plata.

The most thickly settled locality is in the vicinity of the town, where were counted 38 cabins, houses, and various buildings, not including a few corrals. The population was given at 250 (September), the winter force dwindling down, it was said, to 15 or 20 families. There were four stores, hardware and general merchandise, and everything had a brisk look in the way of business; containing, also, a post-office, cigar store, barber-shop, &c. Three quarter-sections were occupied as the town site, which was handsomely located at the lower end of the park, upon the right or west bank of the river, some six or eight cabins only being on the other. The town and vicinity is accredited with a population of 450.

At Hermosa, near the mouth of Hermosa Creek, some $8\frac{1}{2}$ miles above Animas City, in the Park, a dozen scattered dwellings were observed. From the best information that could be gathered, the total population may be placed at 60.

In this La Plata country there were stated to be 11,000 sheep and 5,000 head of stock, mainly in the Animas Park.

The only other town in the Lower San Juan is

PARROTT CITY,

to the west upon the La Plata, at an altitude of 8,650 feet 18 miles by a trail, scarcely two more by the toll-road, elsewhere described. It contains some 40 houses, possessing in general a handsome appearance for the size of the place, and is the county seat of La Plata County, for which honor Animas City now contends. The number of registered voters in Parrott, an election being held within a month thereafter, was 61; the population of a permanent nature was stated to be 100, and its summer population was given as 400 to 500. While this was undoubtedly possessed in earlier mining days, no such population existed at the time of the visit. Its class of buildings are superior to those of Animas City and included the offices of the county officials, post-office, a store, blacksmith-shop, &c. The accredited population of the place is 125. Both here and at Animas City a weekly mail is received via Silverton all the year round.

Entering the mining regions, the first place worthy of note is the promising town of

SILVERTON,

situated in Baker's Park, of which the town site occupies 360 acres, its altitude being 9,300 feet. It is situated upon a fine level above the river, is well laid out, and is supplied with irrigating ditches and shade-trees.

It contained about 175 buildings of all sorts and descriptions, of brick, frame, and log construction, including eight supply-stores for general merchandise, drug-stores, blacksmith-shops, saw-mill, bakery, and butcher-shops, barber-shops, a number of saloons, and a post-office, and possessed in addition an enterprising weekly newspaper, the La Plata Miner.

Greene's Reduction Works are in the immediate town, and those of Melville & Summerfield a short distance below. It is the county-seat of San Juan County, the offices of which are of course located here. Notwithstanding its lack of roads, everything indicated present and future prosperity. The great mass of incoming supplies and outgoing shipments of bullion are by pack-trains over the range via Cunningham Gulch.

All of its rapid outer-communication is via Lake City, there being a biweekly coach, a private enterprise to that town. To and from Lake City, 4 mails per week, were informed, were each way exchanged, and during the same time there were 3 from Del Norte.

The county officials were again here consulted, and there were found registered for the approaching election in the entire precinct 400 voters, of whom it was estimated that 250 belonged to the town and the balance to the immediate vicinity. The basis of a rude census or an estimate of the population which obtains in the cities and towns of the East is wholly inapplicable in the mining districts. Presuming upon the majority of voters being family men and increasing the number from five to seven times, will there often give an approximate if not an almost accurate result. Here it would be wholly erroneous and great inaccuracy would result. With but few exceptions pro-

spectors and miners in general in a new country, if married men, leave their wives and families behind them and "bach it," to use the provincialism. In short, the newer the country and the more inaccessible, the closer do the voters and the men alone represent the total population. The permanent inhabitants of the town were estimated to be 300, while in summer there were from 300 to 400 floating.

The population to Silverton accredited is, therefore, 700, while that of adjoining mining-camps is placed at 400.

HOWARDSVILLE,

upon the Animas, about five miles above Silverton, is at the mouth of Cunningham Gulch; its altitude being 9,675 feet. It contained 60 houses, cabins, &c., including four stores, a butcher-shop, a brewery, and three saloons. Reduction works of small capacity, belonging to Mr. Edward Inness, are also located here. In the precinct there were registered 100 voters; the permanent population being given as 50, which, with the incoming float of the summer, is increased to 200.

Ascending the river we come upon

EUREKA,

a lively camp on the Animas at the mouth of Eureka Gulch, at the northern end of the depression called Baker's Park, with an altitude of 10,500 feet, containing post-office and stores, and four miles up from Howardsville. Beyond that, at the head of the gulch of the Animas, is

ANIMAS FORKS,

blessed with a post-office and two roads to Lake; its altitude being about 11,300 feet. The first, ascending Cinnamon Gulch, descends into the mining region of Burrows' Park, and follows down the Lake Fork of the Gunnison. The other, a shorter and better route, goes via Mineral City to the Hensen Creek route. The distance by the latter is scarcely over 23 miles, while by the former it exceeds 28 miles. By the latter road, three miles over the range and at the edge of timber line, as it is also situated, lies

MINERAL CITY,

which promises to be the liveliest camp of the three, from the heavy amount of capital that was entering late in the season, and promised an increase for 1878. Like the others, it possesses a post-office, all mails being received from Lake. Its altitude is 11,500 feet.

The summer population of the three places may be said to have been 500 in all.

In the immediate mining district of

BURROWS' PARK

there were said to be 200 persons in all, the chief centers being Tellurium, Sherman, and Argentum, the first named being the oldest and principal place, with a post-office and stores on a larger scale than the others and some 30 or 40 inhabitants.

Down the trail from Mineral City, about eight miles distant, lies

OURAY,

in a magnificent mining country of which it is destined to be the center. The town is beautifully situated in a small basin at the head of the Uncompahgre Park at an altitude of about 8,000 feet, the great valley of the river lying beyond to the north. Here are combined, to a degree nowhere else existing, great deposits of precious metal in the mountains with agricultural wealth below. In the spring it had a population of about 350, a set of smelting works, a sampling establishment, two saw-mills, &c. In the fall the population had doubled, and promises to rapidly increase. Like Silverton, it is badly in need of roads. By the only one it possesses the distance to Lake being called 100 miles, while it is but 28 miles by trail and road from Mineral City. The population accredited to this point and adjoining mining-camps in Poughkeepsie, Bear, Red, and Cañon Gulches was 1,000.

Descending Hensen Creek, *en route* to Lake, is passed

CAPITAL CITY,

at an altitude of 9,500 feet, and as yet but a youthful metropolis. During the season the population increased to 150. Fine mines surround it, and a smelter was erected but not in operation.

LAKE CITY,

at present the metropolis of the San Juan and the leading town of the southwest, is finely situated upon the Lake Fork of the Gunnison, at the mouth of Hensen Creek, with an altitude of 8,625 feet. In March, 1876, there was a population of 300 and about 50 buildings in the town; in March, 1877, it had increased to 1,500 and about 350 buildings, its population at the time of our visit being from 1,800 to 2,000. During the spring there were 300 or 400 idle men in the town in search of work, but being unsuccessful they did not remain. It contained 3 banks, 1 national and 2 private; a number of dry-goods houses, of which 10 were large firms, with an average stock of \$15,000 to \$25,000; some 10 assayers, 9 surveyors, and the usual proportion of lawyers and doctors; 3 bakeries, 3 barber-shops, brick-yards, corrals, and feed-stables; a furniture-house, a planing and a saw-mill, 2 drug-stores, 4 hardware-stores, 2 jewelry establishments, 4 meat-markets, about 20 saloons, and 4 laundries operated by immigrants from the Celestial Empire; 2 churches, 1 Episcopal, the other Presbyterian, indicate its permanent population; there being also two other church organizations with edifices—1 Catholic, the other Methodist. Its great industries are its 3 large reduction works, to be hereafter described, while 4 hotels, 6 restaurants (2 of them rivals and very fine establishments), and 3 breweries do a thriving business. The San Juan being one of the United States land districts, the office is situated here. A hook and ladder company, with Babcock extinguishers, exists, and also a public library and reading-room; while last, but not least, there are 2 bright and spicy weekly newspapers, the Silver World and the San Juan Crescent, with job-printing offices attached. At the post-office there was observed an extensive news-stand with all the popular dailies of New York City and papers of the Pacific coast, with the weeklies and monthly magazines.

To Garland and the railroad there are daily mails and a coach each way, of Barlow & Sanderson's line, the most extensive in the United States it is said. To Silverton the mails were tri-weekly, carried upon horseback, and to the north, down the Lake Fork, the service was also tri-weekly by a buck-board, the medium of fast communication in the mountainous region of the West.

The town line is in the center of the creek, the Lake Fork, and upon the opposite or eastern bank the buildings constitute Wade's Addition. This, with Crookeville to the south and above the town, about the concentration works, will aggregate fully the number given, if not slightly exceed it.

Of all the places mentioned as within the great mineral region, none may be considered as advanced beyond the stage or condition of mining-camps save Lake City, Silverton, and Ouray.

To the southeast, where the Rio Grande emerges from its cañon region, to the great plain of San Luis Valley, lies

DEL NORTE,

on the south bank of the Rio Grande, at an altitude of 7,750 feet.

West Del Norte, where settlements first arose, lost its former business by the erection of a fine business block lower down in the town, near which all the stores and houses gathered; many buildings, therefore, are found deserted or unoccupied in entering the place from the west. There were between 300 and 400 voters registered at the election which had then just been held, the population of the place being 1,500. There are five large wholesale houses—two of dry goods, with a stock of \$80,000 and \$50,000; a large hardware establishment, stock \$40,000 to \$50,000, having a branch store at Lake, and two others carrying amounts of \$25,000 each. In addition thereto are some 30 stores of dry goods, groceries, and of a general nature, doing a small business; 4 meat-markets, 2 drug-stores, 4 large livery establishments, 6 shoe-stores, 2 harness-shops, 2 jewelry establishments, 3 wagon-shops, and 2 tailoring stores were observed. There were 3 hotels, one being a fine brick structure, while 4 restaurants, 10 saloons, 2 billiard-rooms, 2 breweries, a photograph gallery, and 4 blacksmith-shops also exist. The Bank of San Juan, a private and very fine institution, furnishes ample exchange; fire protection existing in a hook and ladder company, with Babcock extinguishers; a fine library and reading-room was found, while the professional men were an assayer, a civil engineer, and the quota of lawyers and doctors. It possesses a very handsome school-house, erected at a cost of \$10,000; a fine church edifice, of stone, 60 by 45 feet, denomination Methodist; an Episcopal one, of frame, 30 by 22 feet; and three other church organizations—Catholic, Presbyterian, and Baptist—neither of which possesses a building; a court-house and jail, 50 by 25 feet, very strong and secure, on which account prisoners are there confined from Lake, Saguache, &c.; brick-yards, with machinery in use, and four sawmills within 20 miles, finding a market here; offices of the United States Land Department and Internal Revenue, and also of the United States timber agent, are at this point. It has a fine weekly newspaper, of extensive circulation, and the oldest in the San Juan, called the San Juan Prospector.

The town-site is very fine and the place well arranged, the streets being wide and

bordered with shade-trees, for which is utilized an irrigating ditch of $1\frac{1}{4}$ miles in length, furnishing the water-supply of the town.

At the time of our visit a telegraph-line from Garland was being erected, and was in operation in December; it was being constructed for a very low figure, the poles being furnished and delivered along the line for seventy cents each.

An organization known as the Del Norte and Alamosa Railroad Company was already formed for the building and operation of a line from Alamosa, the new terminus of the railroad to the town; the length of track being 26 miles. Of its construction being entered upon nothing has been learned at the time of writing; its building, however, will revive the business connections and interests of the place and greatly add to its permanent prosperity.

The following table gives the distances between some of the most interesting and important points visited during the reconnaissance; on account of its relating directly to the centers of population it is here inserted, instead of being included in the treatment of "Lines of communication," to which it properly refers:

Between what points.	Miles.	Remarks.
Garland City to Fort Garland.....	6.5	Railroad terminus at Garland City.
Fort Garland to Stewart's Ferry.....	19.5	} Stewart's, or upper ferry, on the Rio Grande. } Valdez, or lower ferry, formerly Myers's.
Stewart's Ferry to Conejos.....	26.5	
Fort Garland to Chevez Ferry.....	31.5	
Valdez' Ferry to Conejos.....	18	
Conejos to Tierra Amarilla (Las Nutritas) via Ojo Caliente.....	150	
Conejos to Tierra Amarilla (Las Nutritas) via Cueva.....	120	
Conejos to Tierra Amarilla (Las Nutritas) via the Chama route.....	60.7	
Las Nutritas to Los Ojos.....	2	Chama River forded at Los Ojos.
Los Ojos to Rio Navajo.....	33.2	} Upper road to Pagosa.
Rio Navajo to Rio Blanco.....	12.3	
Rio Blanco to Pagosa Springs.....	10.6	
Conejos to Pagosa via Ojo Caliente.....	208	
Conejos to Pagosa via Cueva.....	178	County-road; cut-off.
Conejos to Pagosa via the Chama route.....	114.8	New toll-road; 12 miles incomplete.
Conejos to Pagosa via San Antonio route.....	112.8	New toll-road; constructing.
Conejos to Pagosa via Chama-Navajo route.....	77.4	Proposed United States road; the shortest route West.
Pagosa Springs to the Summit District.....	49	Trail up Rio San Juan.
Pagosa to Rio Nutria (spring near ranch of Colonel Pfeiffer).....	13	} County-road.
Rio Nutria to Rio Piedra.....	12.1	
Rio Piedra to Rio de los Pinos.....	19.9	
Rio de los Pinos to Rio Florida.....	13.6	
Rio Florida to Rio de los Animas.....	5.8	
Animas City to Parrott City.....	19.5	Via toll-road.
Parrott City to East Fork Rio Mancos.....	18.1	Via trail.
Parrott City to West Fork Rio Mancos.....	11.9	} County-road.
East Fork to West Fork Rio Mancos.....	.7	
Thence to Big Bend Rio Dolores (Camp 64, September 23).....	18.7	Trail.
Parrott City to mouth Rio la Plata.....	54	Toll-road.
Animas City to mouth Rio de las Animas.....	58.5	Trial.
Animas City to Hermosa.....	8.6	County-road.
Hermosa, via Grand Cañon of the Animas, to Silverton.....	38.1	Wightman's new toll-road.
Silverton to Howardsville.....	4.7	County-road.
Howardsville to Lake City, via Animas Forks and Burrow's Park.....	36.6	} Toll-roads.
Howardsville to Lake City, via Mineral City and Hensen Creek.....	31	
Howardsville, via old wagon-road, to Carr's.....	16.3	Summit of pass, 12,400 feet.
Howardsville, via Cunningham Gulch and trail over Summit, to Carr's.....	22.7	Pass, 11,900 feet.
Carr's to Alden's Junction or Antelope Springs.....	27	
Alden's to Lake City.....	33.5	Toll-road; pass, 11,100 feet.
Alden's or Antelope Springs to Wagon-Wheel Gap.....	16	} Toll-road down Rio Grande.
Wagon-Wheel Gap to mouth South Fork Rio Grande.....	11.6	
Thence to Del Norte.....	15.8	
Del Norte to the Summit.....	27.8	Toll-road.
Del Norte to Fort Garland.....	60	County-road.
Del Norte to Piedra Pintada.....	15.9	} In San Luis Valley; county-road.
Thence to La Jara post-office on Rio de la Jara.....	18.6	
Thence to Conejos.....	13.5	

CHAPTER V.—MINES AND MINERAL WEALTH.

But little can be told of the difficulties under which a wild and isolated country labors, of the hardships endured by her pioneers and settlers during the transition from a wilderness to that of an established mining region. The trials and sufferings of early explorers in the Rocky Mountains, when bodies of troops, overcome by the severe storms of the winter in pathless forests, narrowly escaped starvation, are already recorded and read like works of fiction. Who shall describe the wonderful adventures and excessive hardships, less worthy of mention but more severe, endured by her early pioneers? Less worthy of portrayal perhaps, in that those who suffered were but on wealth and fortune bent, only selfishly inclined; more severe undoubtedly, since with resources and supplies much less and numbers smaller their path was beset with savages on whose land they were encroaching, and their march became a conflict, a flight from death, and few or none escaped.

Careful investigation has failed to establish who were the actual discoverers in each mining district. Of aspirants thereto there often is no end, and information gleaned is often so beclouded as to be useless.

In the great Pike's Peak excitement, which less than two decades ago started west the tidal wave of emigration so rapidly, one was included to whom is accorded the honor of being the most daring pioneer of the San Juan. To the dauntless perseverance of Baker, more than any other man, the San Juan was indebted for much of the notoriety that gained her immigration and settlement.

Eighteen years ago, at the head of a number, like himself, firm believers in the existence of as fine placers in the San Juan as had been found in olden days in California, he started for this region. Six months later, in the winter of 1850-'61, another and a larger party left Denver in search of the former, of whom no news had ever been heard. The difficulties of travel may be imagined from the statement that fourteen days were required to cross the mountains at the Sangre de Cristo Pass. Deep snows had to be dug away to secure the grazing for the stock, and when that was impossible, trees were cut to obtain browsing to keep them alive. Fort Garland, at its foot, was passed, and through San Luis Valley the party pushed on, after four months of travel finding Baker and his men in the park now bearing his name.

Placer mining alone was then the industry of the country, and prospecting along the river, here and in the Animas Park below, they industriously continued without success.

General disappointment started them back in July. At Garland the outbreak of the civil war was learned, the party separated, and Baker, going to Virginia, entered the service of his State; returning to Colorado seven years later at the head of another party, he again entered the trackless region.

The Gunnison, the Animas, and the La Plata were reached and left behind. Success was lacking, hardships and Indian attacks were frequent, and his party had dwindled to three in all, when Baker himself was shot, it is said, at the mouth of the Colorado Chiquito, another was drowned, and the third barely escaped with his life to tell the story of their sufferings.

Survivors of the original expedition of 1861 reorganized another party, and in 1869 it started from Prescott, Ariz., for the far-distant region. Continued attacks everywhere of treacherous Apaches, and dissatisfaction also, reduced their number from fifty to eight, who finally reached the San Juan and proceeded for the winter to Santa Fé. Leaving there in the following spring this party, increased to twelve, reached Baker's Park in safety, and the Little Giant Mine was soon after discovered.

Again wintering in Santa Fé, the spring of 1871 saw them permanent settlers at Silverton, many others following attracted with the hope of similar luck. The reports of the wealth of the new El Dorado gained credence slowly. So many schemes of a "wild-cat" nature are afloat in a new mining country, so many frauds are perpetrated on the unsuspecting, that capital is wary. It was so with the San Juan.

Without trails to pack out the ore when obtained the mine is useless. With trails complete and the distance great the cost of transportation swallows the profits. It is roads that are essential, always roads; roads for machinery for reducing the ore, roads for freights to cheapen supplies. They are the first thing a new country needs, especially, it should be added, a mineral region, and as a rule the last thing it obtains. A toll-road is a good and permanent investment, and if there exists any absolute necessity therefore it will repay the principal with high interest.

Unfortunately, men do not always pursue their proper vocations, and a road-builder entering a rich mining country, instead of constructing a road, for which he is peculiarly fitted, generally dabbles in mines like the rest of mankind around him, to which, however, like many of them are, he is altogether unsuited.

Mining being a branch of industry, like any manufacturing or commercial business, upon reliable data alone should any dependence be placed. The following table of statistics is therefore furnished, showing the amount of precious metal produced in

the States and Territories west of the Missouri River, including British Columbia, and receipts in San Francisco from the west coast of Mexico, during the year 1877:

California.....	\$18, 174, 716
Nevada.....	51, 580, 290
Utah.....	8, 113, 755
Colorado.....	7, 913, 549
Montana.....	2, 644, 912
Arizona.....	2, 388, 622
Idaho.....	1, 832, 495
Mexico.....	1, 432, 992
Dakota.....	1, 500, 000
Oregon.....	1, 191, 997
British Columbia.....	1, 177, 190
New Mexico.....	379, 010
Washington.....	92, 226
Total.....	98, 421, 754

From the above table it will be seen that Colorado occupies the fourth place in the list of precious-metal regions of the Union, Nevada, California, and Utah only preceding her.

Under the same tremendous impulses of capital, it may be presumed that the time would not be far distant when she would occupy the first or second position. The shrewd, far-seeing operators of the Pacific coast are already unloading, it is said, large quantities of bonanza stock and seeking investments in Colorado.

The table given being based upon known shipments, may be considered as proximate only. It will be safe to place the aggregate production for 1877 at one hundred millions, and that for the present year at one hundred and twenty millions, of which amount Colorado may be placed at ten millions.

In the San Juan itself it was impossible to obtain accurately her production. The country as a whole, in the light of a mining region, is scarcely advanced beyond the state of prospecting.

Mills are wanted everywhere, and thousands of dollars are upon dump-piles for want of a market. The cost of transportation being excessive, only selected ore is taken for shipment to distant points. Moreover, the machinery having been brought in at enormous cost, a high price for ore treatment must be paid. There is therefore but an exceedingly limited market for low grades, such as would yield a high margin over mining in the old districts of Nevada and California.

The value of ore treated by such smelting-works as exist would not, therefore, be an absolute index to the prospective amount of this year's production.

There are numerous points where smelting-works would be fine investments, and if carefully and honestly managed would realize a large amount, if not a moderate fortune, every year for five or ten years to come.

Mining investments in general may be likened to a lottery; the large and handsome prizes are few and far between. But with reduction works it is otherwise. The ore is a staple commodity. Presented to the mill, the smelter carefully samples and ascertains with mathematical accuracy and unflinching regularity its average value. He pays an amount far below its market price, in order to realize the heavy margins for which he has invested his capital. He can therefore suffer no loss, save from the total exhaustion of the ore supply of the surrounding country, which is unlikely to occur. He will therefore enjoy a monopoly for some time to come; and even when competition arrives the output of ore will increase from the discovery of new lodes, so that his investment will still be one of the first class. But, like the building of toll-roads, the sure, safe, and legitimate enterprise is thrown overboard for speculation. That the mill-man will not dabble in one or more mines about him was found, without any exception remembered, the rule.

The San Juan is locally subdivided into mining districts. In speaking, therefore, of mineral wealth as it appeared to an ordinary observer, it will be best to consider each district visited in its practical development.

The precious metal is mined in the form of both silver and gold, the former predominating. Of the latter the value of the placers is inconsiderable, and upon lodes alone should any dependence be placed.

In arriving at the value of a mineral deposit, from a casual examination of specimens of its ore, the most learned geologist, the most experienced assayer, may be at fault. Nothing short of a complete assay will give its definite and precise value and worth.

The extension of this rule is equally true. The value of a mine can never be wholly determined by any specimen. The market price of the ore in general must alone be taken. In brief, the "mill-runs," or prices paid at the smelting-mill or other reduction-works, is the sole standard upon which dependence is to be placed.

In giving the ton-value of the ore it is frequently placed in ounces. This is, correctly speaking, the proper mode, though not always the popular one. At the time of the examination of the mines the value of the standard silver ounce was \$1.20. An increment of one-fifth to the ounce per ton will therefore represent the money value when otherwise denominated.

THE SUMMIT DISTRICT

is some 27 miles southwest of Del Norte, reached from the latter point by a fine toll-road, and lies mainly upon the slopes of South Mountain, a divide between the water of the North and South Forks of the Alamosa.

This is a most remarkable gold district. It may be said to consist chiefly of a single mine; for, while the mountain is covered with stakes, there being in all 2,300 locations upon it, one of them is of immense value, some half a dozen are worth having, and the whole of the rest are not worth \$5 at present.

No well-defined veins or lodes have as yet been found, as, in true fissure formation, the mineral-bearing rock, consisting of "rotten" or decomposed quartz, carrying free gold, the metal being free from impurities and more easily milled than any other gold ore in Colorado.

The principal mine of the district is the Little Annie, other prominent lodes being the Golden Queen, Major, Yellow Jacket, Ida, Golden Star, Summit, and Odin.

The Little Annie having proven very valuable, it was surrounded upon every side with locations, but up to the present time none of these have given positive indications of deposits of the same character and value.

Assays of Little Annie ore have varied from a small amount to many thousands of dollars. The average mill-runs have been \$102 per ton, the best ore being \$150, tailings \$48, the cost of mining and milling being \$12, leaving a large profit to the stockholders or footholders of the mine. The lode was 85 feet below the surface, the pay-streak, so called, being from 20 to 25 feet wide. This is remarkable as being the highest mine in the world, lying at the edge of timber-line and not far below 12,000 feet, the reduction-works in the gulch at the base of the hill being about 11,200 feet above the sea. This was one of the best paying and most economically managed properties found in the San Juan, and can scarcely be surpassed in the whole of Colorado. At the time of the first visit (June 30, 1877) there had been taken to date from the opening of the mill, as we were informed by Mr. C. E. Robbins, the treasurer and chemist of the company, \$105,000, of which \$47,000 had been paid out in dividends, the balance being expended in the plant, including a 10-stamp mill, and items of current expenses. A tramway of over 2,000 feet in length conveys the ore from the dump-pile at the mine to the works below.

In June the following stamp-mills were in operation at the Summit, reducing ore of the Little Annie:

Name of mill.	Number of stamps.	Daily capacity.
		<i>Tons.</i>
Little Annie.....	10	8
Golden Queen.....	10	8
Golden Star.....	10	12
The Adams-Miller.....	5	4
San Juan.....	30	22

The latter was temporarily suspended, undergoing repairs. In addition thereto was the Bowen Mill, of 24 stamps, idle.

PLACERS.

Presuming, from the existence of the valuable auriferous deposits upon the slopes of South Mountain trending to the north, that valuable bars would be found in the gulch below, the owners of the Little Annie made extensive preparations for placer mining therein. Their anticipations have been more than realized.

A magnificent nugget was shown us, obtained in a "cleaning up" early in August, the rock and mineral weighing 5½ pounds. The weight of the gold was estimated at 20 ounces; the value of the gold ounce with premium then existing being \$20.67, there would result a "find" of over \$400.

Numerous and varied have been the theories as to the geological character of the deposits upon the mountain, but that it partakes of a pocket or limited nature is apparently demonstrated in its surface existence, at least by the results of the bars below. In the various cleanings during the placer operations, nothing was realized, from any part of the stream, except from the portion immediately below the mine.

Wages in June for ordinary hands, \$2.50 per day, and board, 35 men being then at work at the Little Annie property.

This district was also passed in August and revisited in October. In the three and a half months, June to October 12, 3,200 tons had been treated, the total production aggregating \$140,000. The mill of the company, of 10 stamps, being unable to treat all the ore mined, its reduction was let by contracts varying from \$8 to \$10; loss to company thereby during the season estimated at \$20,000.

In the examinations of this mine there was noticeable, in an unusual degree, a perfect system of economy in all the details of the business. The tramway referred to, on which the car at each trip transported to the works below a load of 2½ tons of ore, was built in heavy snows and storms, at a cost of but \$1.50 per foot. Later during the summer the wages of the hands, which had been \$2 in June, were reduced to \$1.50, and a tunnel of 100 feet in length, running into the southern face of the mine, was contracted for at \$7.50 per linear foot. Tunnel construction elsewhere in the San Juan varied from \$15 to \$30, according to locality.

The Ida Mine had several hundred tons upon the dump; assays rich, up to \$5,000, but reduction process unsuccessful, the gold escaping the quicksilver and the amalgam yielding only iron. The San Juan, consolidated, has failed entirely, and the panning-mill had been dismantled and the machinery removed in October.

No mills were in operation at this latter date, save the Little Annie and Queen, working in all 23 men on ore of the Little Annie.

The Odin tunnel was at this time personally examined, there being over 3 feet of snow on the ground. Extent, 48 feet; no results whatever beyond the usual porphyry.

THE DECATUR DISTRICT

lies upon the South Fork of the Alamosa, directly below and to the south of the Summit, and is also gold. When it was personally visited in October, most of the mines, very few in number, were deserted. Several men, however, were present, working their lodes, the gangue carrying iron pyrites.

An arrastra was observed near a collection of abandoned cabins, beside which was an unnecessary large tunnel, being 15 feet by 10 in the clear, of a length of 150 feet, a large dump-pile and a lot of selected ore lying near by. The principal lodes of the district, with their values, as we were informed by miners thereon, are as follows: Star of the West, assaying \$85; Carrie, assaying \$60; 1776 lode, assaying \$50.

The water of several streams flowing into the South Fork hereabout was excessively bitter and disagreeable from the alum tastes imparted by the decomposing pyrites throughout their drainage area. Some ore of the Golden Star lode at Sperry's Mill at the Summit gave a mill-run of \$10 per ton.

In their bearing on the mineral wealth of the San Juan, the mines of this section, as far as observation extended, may be wholly discarded. Nothing thereof indicating their present or prospective value was anywhere learned.

THE ALAMOSA DISTRICT,

also a gold region, what there is of it, lies farther below the Decatur, and along the same river.

The lodes, when examined in October last, were everywhere abandoned. As a general factor in the mining interests of the San Juan, this district may be wholly ignored.

Both the Decatur and Alamosa lie in Conejos County.

The region at the head of the Continental Divide, upon the Summit watershed of the Rio San Juan, has been prospected slightly only, and thus far with but little success.

In August we were shown a specimen of argentiferous galena from a lode discovered, it was said, upon the Upper Navajo.

The regions thus far mentioned are outlying and to the east of the great seat of mineral wealth of the San Juan. To pass directly to outlying points to the west, we reach

THE LA PLATA DISTRICT,

in La Plata County, upon the river of the same name, about and above Parrott City, and the most southerly mining section of the country. Operations in this district date back several years, when a wonderful activity for a while existed. The capitalists investing here, for whom the town was named, were Messrs. Parrott & Co., of San Francisco. Parties in their interest, and to whom they liberally supplied the required capital, reached this locality from the Pacific coast and began prospecting. Finding from a season's operations in sluice-mining that a valuable bar existed along the river, preparations for a thorough hydraulic system were entered upon. Through mismanagement or other causes dissatisfaction ensued, and the supplies of capital ceasing all operations were suspended and the camp was, when visited, thoroughly dead.

Prospecting for the gold-bearing quartz in the mountains above, whence the placers derived their value, was not neglected; the result was the discovery of the expected veins, and in addition thereto valuable lodes of silver. From the specimens therefrom valuable assays in Silverton and Denver, it was said, resulted. They are, however, of a refractory nature, resemble, in certain respects, some ores of the Uncompahgre district, and do not yield to the simplest forms of silver reduction. There exists, moreover, it was said, a suspicion of deposits containing tellurium traces, the North Star lode possessing, as we were informed, such constituents. The telluride ores, as is well known, are all of remarkable richness.

Such are the prospects; the reality, the present, unless changed since last September, is heavily obscured. Prospectors are something like sheep—they are very gregarious. All that were seen or were met were leaving the section, and spoke despondingly of its prospects. The buildings of the town, it may be remarked, are of an unusually fine character for a small mining camp, and it is said to have possessed at one time a summer population of 400 to 500; in September last business, however, was dead and was departing to its younger and more prosperous rival, Animas City. No reduction-works or stamp-mills of any kind were found at the town. This is to be regretted, and is but an illustration of the fact that mismanagement or other causes blighting the prospects of a promising camp will deter capital thereafter for entering for a short time, at least, if not for a long period.

Abundantly and not far distant are found the necessary formations for fluxing, while valuable deposits of coal exist upon the La Plata, as they do in sections to its east.

THE DOLORES DISTRICT.

Prospectors from Parrott City and other points have turned their attention to the slopes at the headwaters of the forks of this river, and a number of lodes have been located, resulting in the organization of subdistricts or small camps lying in La Plata County and in Ouray. The ores are chiefly the carbonates, the mineral being chiefly low grade. Specimens from the district, brought away as part of our general collection, include carbonates containing from 63 to 70 per cent. of lead, and from 136 to 216 ounces of silver, zinc blende and galena, argentiferous galenas of a very low grade, and one with gray copper traces. The district has not advanced beyond the early primary or simple prospecting state, and no excitement was apparent in regard to the prospective fortunes to be realized.

THE SIERRA LA SAL.

This mountain group, as is well known, owes its name to the large saline deposits there existing. Prospecting for the precious metal has been prosecuted there at intervals, and it is reported not without success. Whatever indications have been observed, however, have been at the risk of death from the hostile savages who roam to and fro through this region.

While upon the Rio Mancos, we were presented with specimens of sandstone silver by Mr. John Grigor, who discovered and located a deposit thereof in the Merit district of the Sierra La Sal in Utah. The phenomenal occurrence of the deposition of argentiferous mineral in sedimentary matter is not a novelty to geologists, and to its formation allusion were unnecessary. It is of such interest, however, in a mineralogical aspect, that the section although not visited is deemed worthy of note. It need scarcely be repeated that the sedimentary formations outstretching from the bases of the Sierra La Sal are of Cretaceous age. The specimens are very handsome, from the colors of the chlorides, the blue predominating over the green throughout the stratification of all the specimens obtained; they are both high and low grade, the latter giving a mill run of \$6 to \$8, and the assay of the former equaling \$166.

The inexpensive character of mining operations in such a formation is obvious. An extensive deposit of this nature is reported to have some years since been found in Upper Utah.

THE ANIMAS DISTRICT

is situated in the San Juan County and along the river whose name it bears. Half a mile above the mouth of Cunningham Gulch, opening into the Animas River, is the dividing line, we were informed, between this and Eureka District, which lies to its north. It includes mainly, therefore, the mines in the gulches and creeks, reaching the Animas and Baker's Park and those upon the overlooking mountains, chiefly along Cement and Mineral Creeks, Arastra, Boulder, and Cunningham Gulches, and upon Sultan, Anvil, Green, Hazleton, Galena, and King Solomon Mountains. It is the oldest mining district of the San Juan, containing the Little Giant, whose early discovery resulted in the great emigration to the country. It includes some of the most valuable mines in the valley of the river and within its limits a larger number of lodes

of a high quality of ore have been located, and in part are being worked, than in any other district of the San Juan.

The ores of this section are argentiferous, with the exception of those of the Little Giant and a few other exceptional ones which have been found to contain gold; in general, therefore, they may be said to be of argentiferous galena, with and without gray copper, occasionally chloride of silver, and in several mines the black sulphurets being found.

The number of lodes that contain first-class ore is very large, and as there are over 2,000 lodes registered in the county offices at Silverton, and the prospects of all are, in general, very good, the work involved in an examination of this district may be imagined, the mountains being everywhere covered with apparently an inexhaustible quantity of lodes.

The most prominent mines are the Little Giant (gold), (now called the Golden Giant); Highland Mary, Pride of the West, Philadelphia, Susquehanna, Pelican, Aspen, Green Mountain, Legal Tender, Victor, Little Fanny, North Star, Letter G, Mollie Darling, Pelican, Bull of the Woods, Comstock, Silver Cord, and King Hiram Abiff (gold).

Viewed financially, this section labors under more difficulties than any other of the San Juan. With large bodies of valuable mineral within it, the lack of capital and reduction-works keeps them undeveloped. At no place is there so fine an opening for a banking firm. There exists none in the town, and with the activity of trade the scarcity of currency is severely felt; local checks of various kinds, the shinplasters of war times, and drafts on distant banks being had recourse to.

A general *résumé*, embracing the subdistricts of this section, with their localities, the most advanced mines at the time of visit (last part of September, 1877), and the number of men employed therein steadily during the season, is as follows:

Mineral Creek.—Principal lodes, Tornado and Extension; 8 men upon the former, 3 on the latter.

Sultan Mountain.—Along its base flows Mineral Creek, emptying into the Animas; over twenty lodes, chiefly low grades, with increased smelting facilities, will pay well; at present nothing less than 100-ounce ores are taken to the mill; during 1877 fully 50 men were constantly at work. The Ajax is the nearest to town; the Montezuma Tunnel was in 160 feet, bound for the Ajax ore; various other tunnels prosecuted to considerable depth, the greatest being that of Greene & Co., of a prospecting nature, and in 500 feet.

Anvil Mountain, near Silverton. Several lodes, on which assessments alone have thus far been made, are to be worked during the winter.

Cement Creek.—This creek has a southerly course to Silverton, the stream forking about $6\frac{1}{2}$ miles from town. Up the North Fork, about $2\frac{1}{2}$ miles distant, at the mountain summits, are the Saxon, Alaska, very rich lodes; Adelphi and Acapulco, over 200 ounces, and many others of less value. The other fork leads to the Animas watershed, and is opposite Eureka Gulch. Down both forks are trails to the reduction-works at their junction, and along the north fork the trail over to the Uncompahgre passes. At its head and above the forks, over 20 lodes are being developed, in various stages, from simple assessments to 50-foot drifts on the vein; from each, between one and four tons were being shipped. During the season over 50 men were employed.

Boulder Gulch, distant from Silverton $2\frac{1}{2}$ miles, possesses from 15 to 20 lodes of rich galena ores, from 75 to 100 ounces each. During the season some 25 men were regularly therein.

Hazleton Mountain, distant from Silverton 3 miles, and opposite Boulder Gulch. Most valuable mines are here situated, fully 150 men being at all times there employed, the forces at times being increased to the extent of nearly 400 upon the whole mountain. Its richest mines are the Victor, 10 men; Susquehanna, in 100 feet, 15 men; Aspen, a magnificent one, discovered in 1871, producing nearly 4 tons daily, at a profit of nearly \$2,000 per month, and employing 30 men; and the Mammoth, 4 men. The Victor is a very rich deposit, the pay-streak of the lode being of 4 inches of 1,000 ounces, while the inclosing vein in which it is situated is from 5 to 8 feet wide, averaging 65 ounces. A specimen of the collection belonging to the pay-streak of this mine gave an assay of 1,500 ounces. Next in importance come the Legal Tender, tunnel under way 400 feet, 10 men, and the I X L Tunnel, 300 feet; the Prospector, McGregor, Pelican, Tom Paine, Silver Star, Union, and Gray Eagle Lodes, the latter 6 men. The two most important tunnels of the mountain are the Briggs prospecting, 4 men, and the Ingersoll. The latter has already cut the veins of the Victor and the Susquehanna, and is not far from the Aspen. At 500 feet from the surface this tunnel struck an imperfect vein, or "blind lode," which contained nearly two feet of valuable galena, with gray copper and sulphurets, and at 700 feet the Susquehanna; its total length was over 800 feet, and its out-put averaged fully two tons daily of rich ore, with a possibility of greatly-increased production, if desired. This was, at the time of our visit, the largest tunnel in the entire San Juan. On this and Sultan Mountain, the mines are in general farther advanced than those of the other subdistricts.

Arastra Gulch (also spelled "Atrastro" upon location certificates of several mines)

lies between Hazleton Mountain and King Solomon Mountain and leads into Baker's Park from the south. King Solomon Mountain having been designated in a map recently issued by the topographer of a government surveying party as the high peak to the north of Howardsville, various parties at Silverton and Howardsville were interrogated as to its positive location, all of whom stated that the high peak to the south of Howardsville is locally so known; with relation to gulch boundaries, Arastra Gulch lies upon its western sides, Cunningham upon its eastern. The most prominent mine in Arastra Gulch is the Golden Giant, the Little Giant of old, notorious from early discovery and years of litigation, upon which, however, some 10 men have been working during the season. This remarkable mine is worthy of casual mention on account of the phenomenal deposit of its ore. In general, the ores of one district differ radically from those of another, and so also do mines almost contiguous; the smelter of experience can readily designate from external appearances the mines from whence his shipments come without reference to the invoices.

The main pay-streak of the Golden Giant is very narrow, often but 3 inches in thickness, but well defined, within which run two parallel seams of the chloritic ore known as ripidolite, the dark olive-green masses from .2 to .5 inch in thickness containing free gold and finely granular argentiferous galena, which, like the ripidolite, permeates also the intervening quartz. The assay of a specimen of the collection from this mine exceeds \$5,000; far greater ones, however, have been frequently made at Silverton, several running as high as \$27,000. The first machinery brought into the San Juan was for this mine in 1872; it was at immense expense, the trip from Del Norte, about 90 miles, occupying 58 days! Arastra Basin, where numbers of very promising lodes are situated, gave permanent employment to over 20 men.

Cunningham Gulch is as a whole the farthest developed in the district, within its limits being employed from 100 to 150 men.

Galena Mountain, at whose base flows the Animas, towers above Howardsville, on the east of the gulch. Over twenty lodes were worked there during the season, chiefly low grade, 50 ounces being the average.

Green Mountain is on the east side of the gulch, and south of Galena Mountain, being nearer the Continental Divide, where over 35 men have been continually employed. The principal mines are the Little Fanny, Osceola, R. Blum, and Flat Broke, all owned by a company in which the Neigold Bros. and Rodell are largely interested; the magnificent Pride of the West, and the Philadelphia, 1,000 feet higher and 1,500 feet therefrom, touching its southeast limit, the latter being the chief reliance of Neigold Bros. Above the Philadelphia to the north and near the summit of the mountain is the Royal Bengal Tiger, and 5 other lodes, where gold-bearing quartz was discovered. Farther up the gulch are the Green Mountain and several other promising mines. At the upper end of the gulch are the handsome buildings belonging to the mining property of Mr. Edward Inness of New York City, which will be noticed hereafter.

King Solomon Mountain, on the opposite side of the gulch, possesses a large number of lodes, the most valuable being the Highland Mary, employing in its entire establishment over 50 men, and the North Star, where some 25 were continually at work.

From a point near the Highland Mary Works may be had one of the finest views in the San Juan of the immense extent and well-defined character of its mineral veins. From the side of Green Mountain the various lodes may be seen exposed upon the surface from the bottom of the gulch up, and entirely over the face and summit of King Solomon Mountain opposite, which is over 2,000 feet above the gulch at this point. The whole face of the mountain, it has been found, is covered with a multitude of lodes, forming almost a net-work upon its surface. The general direction, however, of the great mineral belt is to the northwest and southeast.

The subdistricts may be concluded with *Kendall Mountain*, upon which are situated a large number of locations, possessing 20 that were being developed, though scarcely at the time (September 30) beyond the stage of assessment work. While they may develop richer deposits on deeper mining, they could at the time scarcely be considered as averaging over low-grade ores, most of them not making mill runs of over 80 ounces. The mining wages in general paid to workmen about Silverton were found to be \$3 per day and board, or \$3.50 to \$4 on their "finding" themselves.

In order to give a clearer idea of the work and capital involved in the development of a mining district like the Animas or any of its subdistricts, it may not be amiss to mention the preliminary steps that are essential.

In the entire San Juan the discoverer of a vein or lode is allowed a surface area of 1,500 feet along the vein, or 150 upon each side of the vein and perpendicular thereto. The planting of a stake containing the location notice and the designation of its boundaries holds the "mine" for the period of sixty days, by the end of which time a 10-foot shaft must be sunk or a vertical exposure of 10 feet of the vein be made, to prevent its being "jumped," or taken by the first comer. With a month or ninety days from the date of the discovery stake, the location certificate must be filed in the office of the county recorder. The amount of work necessary upon a lode to file this certificate is generally known as the first assessment, a certain amount in accordance with the requirements

of national statutes being annually required to prevent forfeiture. It therefore follows that while a large number of locations may be indicative of promising mineral deposits, that fact alone does not decide the wealth of the district. Without thorough development the richest vein is as valueless as the most worthless prospect hole.

The facilities for reducing the immense quantity of ore mined in the Animas district were found to be as follows:

The smelting-works of George Greene & Co., located at Silverton, have been highly successful, owing to the efficient business management of the proprietors. Their works have, without doubt, greatly aided in the development of the district, and have an assessed value of \$25,000, their probable worth being \$75,000; the original cost, it was stated, having been \$60,000, owing to the great expense of transporting machinery over the range at the time of their erection. They were employing in all 35 men, working night and day shifts, with a daily reduction of 10 tons of ore, which is less than the full capacity of the works, producing therefrom 4 tons of bullion. The bullion, as is generally done, is run into bars of an individual pattern, those of the Greene stamp varying in weight from 70 to 85 pounds each. The bars are then placed upon mules or burros (jackasses), and packed over the range, via Cunningham Gulch, to a point on the Rio Grande road, whence they are conveyed by wagon transportation to the railroad at Garland City. Shipment, therefore, is by freight, to refining-works at Saint Louis or some point in the East. The bullion is silver and lead, the latter paying for the transportation of the precious metal.

The iron and limestone, essential for the flux in the usual roasting process followed, are found near by. No coal being convenient, charcoal is solely used. With the opening of the Wightman road through the Grand Cañon of the Animas, Mr. Greene stated that he could draw his supplies of fuel from the coal-banks of the Florida or the Animas. The working season is seven months in length, during which the expenses attendant upon smelting, wages, and ore supplies involved an outlay averaging \$1,200 daily.

On account of the absence of a good road down the Rio Grande and the expense attendant upon packing, no ore was being purchased at the Greene works which was of a lower grade than 75 ounces. For some time these smelting-works have been in possession of a comparative monopoly of the business. The proprietors were Boston capitalists and own a number of valuable mines in the district.

Melville and Summerville's Reduction Works were noticed upon Mineral Creek, below Silverton. The main building was a fine four-story brick, about 100 feet by 75, with extensive sluicing. The building was idle and not subject to examination.

The building was generally known in Silverton as the "Lightning Amalgamation Works," and on account of their being unsuccessful were apparently public laughing-stock. The estimated cost was given at \$25,000, and, in all probability, considerably exceeded that figure. The intended capacity was 20 tons daily, the ore to be largely or entirely drawn from mines owned by the company upon Sultan Mountain. The process was by desulphurization without fluxing. In the trials made with the sulphurets it was said that while the excessive heat drove off much of the baser constituents, the separation of the sulphur was not wholly complete. In Philadelphia, we were also informed, the same company had in successful operation works of similar nature, and to the great altitude was attributed in part the resulting failure.

Subsequent to our visit, we were informed the works were to be remodeled and put in working order for the season of 1878.

Dow & Waters Reduction Works, located on Cement Creek, at the junction of its forks. These works were being finished and were not yet in operation. Their estimated value completed was \$30,000. The mode of reduction was to be by lixiviation or chlorination, commonly called the "leaching" process, with a reported capacity of 20 tons per day.

The above includes all the various enterprises for operating upon ores below Howardsville. This town, upon the Animas at the mouth of Cunningham Gulch, possesses a small crusher and reverberatory furnace, belonging to Mr. Innes, the proprietor of the Highland Mary.

The Neigold Concentration Works, locally so called, are situated in Cunningham Gulch, not far distant from Howardsville. This property consists of five frame buildings with extensive flumes and connecting sluicing; the structure containing a small crusher and a five-stamp battery for the concentration of ores. These works are the property of the Las Animas Mining and Reduction Company, a stock company about one-half of which is owned by the Messrs. Neigold & Roedell, and the balance by Philadelphia capitalists. In their construction \$22,000 was expended, which would be deemed extravagant were it not for the excessive price of labor and material and the exorbitant cost of machinery, which had to be brought over the range by pack-trains.

The Messrs. Neigold & Roedell possess in addition to the above works large interests in several mineral deposits in the vicinity, of which the most important is the Philadelphia lode. Their property is as a whole valuable, and large profits would be realized to the stockholders if a more energetic management were pursued.

The concentration of ores until great reduction facilities abound must continue to be a very lucrative business in the vicinity of Silverton, with its lack of transportation facilities. If the Messrs. Neigold were to increase the capacity of the works from 5 stamps to 20 or 25 drills they could obtain plenty of custom work, and the ratio of expense would be much less than at present.

The Philadelphia is undoubtedly a most promising mine, the ore being mainly argentiferous galena, with large quantities of tetrahedrite or gray copper, and indications of chlorides of large value.

In the specimens of this mine, belonging to the general collection made, all these constituents could be clearly seen; assays made at Silverton of ore of the chloride nature gave very large values, up to \$10,000. The pay-streak is narrow, being from 6 to 10 inches, while the general mill-runs have been well paying in all cases. Its situation is in itself presumptive evidence thereof, being 1,000 to 1,500 feet above and in the nature of a spur of the Pride of the West. This is further attested by the purchase of the ore at Greene's works, placing it at once in the category of high grades. Instead of being worked by its owners, it was during 1876 leased to four miners, who cleared individually therefrom \$700 by the end of the season, or \$2,800 in all.

The Pride of the West lode, on Green Mountain, on the east side of Cunningham Gulch and some 1,500 feet above the bottom, is one of the richest mines in the district.

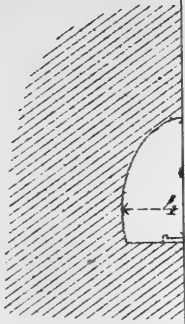
It was discovered in 1874, and owned by five men, has been constantly, but slowly, worked, and in its steady development demonstrated what can be done by perseverance and muscle without capital.

The gangue of the lode is gneiss, and the absolute width of the vein, strongly and clearly defined, within and throughout which paying mineral is found is 35 feet. It contains a pay-streak which averages five feet of *solid* argentiferous galena, with tetrahedrite or gray copper in quantity sufficient to give the ore a high-grade standard.

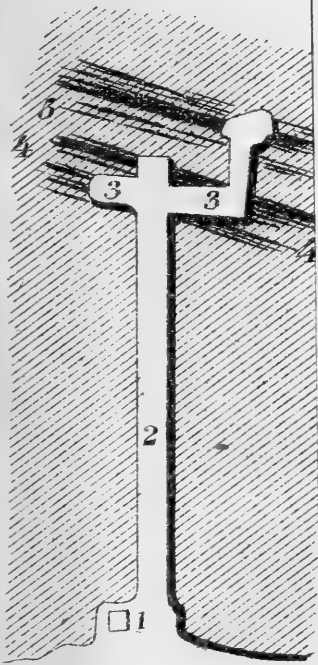
Large amounts of this ore, giving a mill-run of 250 ounces, have been sold at Greene's works. A picked specimen belonging to the collection gave an assay of \$8,000. The adit dimensions were at the most narrow point 6 feet high by 4½ wide; the length of tunnel and drifts was 100 feet, constructed at a cost of \$15 per foot, with mining wages \$3 per day and board, the ore being gotten on the dump for \$5 per ton. Since its discovery in 1874, 200 tons have been removed; 10 tons daily are easily taken out, with a facility for 50 tons were there increased facilities for reduction at Silverton, Greene's works being at all times overcrowded. For ore of 60 ounces at the latter place \$10 was received, and higher prices at schedule rates for that of a greater value. For 60-ounce ore a ready market exists at Lake City, from \$40 to \$50 being obtained. In consequence thereof a considerable quantity of ore of the Aspen and other mines finds its way to the latter point, notwithstanding the great cost of transportation, which varies from \$35 to \$40, or about \$1 per ton per mile. For a quantity of the Pride of the West, shipped to Crooke's works at Lake, \$65 per ton more, it was said, was received than was paid at the Silverton mill. Some 500 pounds of picked ore of this mine gave a mill-run at Crooke's of 910 ounces. Of the great value of the mineral wealth of the Pride of the West some estimate may therefore be formed. The owners had been offered \$100,000 for their mine, but had refused it, their price being \$150,000.

Illustrative of the mining operations here, which may be taken as a sample of a partially developed lode of the San Juan, are three drawings (Figs. 1, 2, and 3, Plate 6), in plan and section, showing relative locations of adit and original point of discovery, of the tunnel, the drifts, vein, and richest pay-streak.

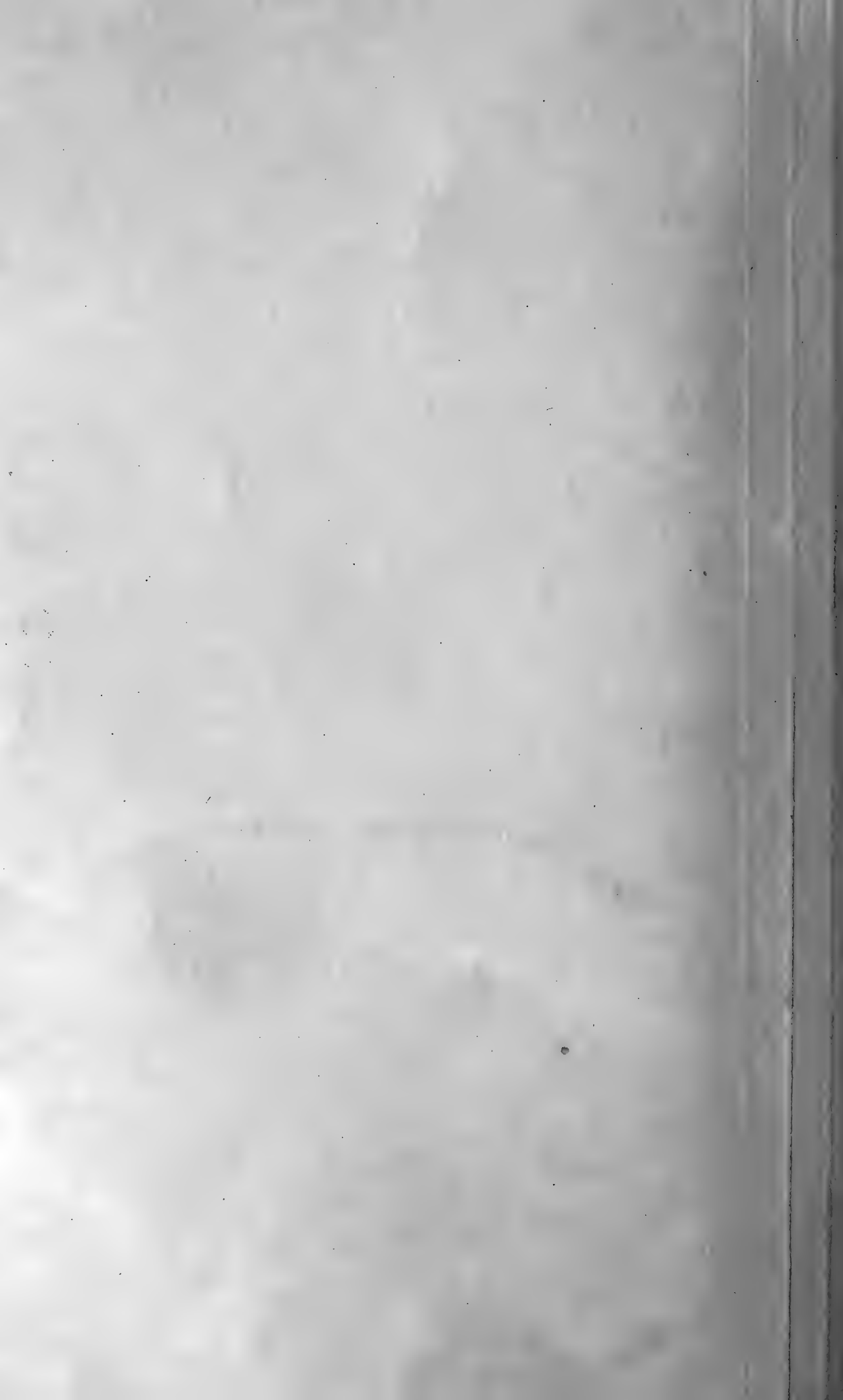
The Highland Mary, lying in the upper part of Cunningham Gulch, is a magnificent property, a group of works below, and handsome buildings, romantically situated farther up upon the mountain-side, the whole the prettiest and most expensive estate belonging to any individual in the entire San Juan. They are part of an extensive property embracing the Highland Mary and other mines, are owned by Mr. Edward Inness, of New York City, and deserve more than passing mention. His investments and capital in works and buildings of various kinds, mining property, roads, &c., mainly lying in the gulch and on King Solomon Mountain, aggregate \$175,000. The only outlay in excess of this anywhere observed in the San Juan was that of a firm in and about Lake City, amounting to \$250,000; it was, however, not an individual enterprise, so that to Mr. Inness must be ascribed the distinction of being the most enterprising and extensive operator in the San Juan. The superintendent of his works, a practical engineer and metallurgist, was Maj. H. D. Whittemore, previous to the civil war in the regular Navy, and subsequently with the Army in the volunteers, but of late years with the Ingersoll Drill Company. The mining property of Mr. Inness, in detail, consists of eighteen locations; there being 400 feet on the Highland Mary proper, 1,500 feet on the Robert Bruce, the western extension of the Highland Mary, the W. H. Nichols being the eastern; 1,500 feet on the Long Tom, 2,000 feet on the Royal Tiger, 1,500 feet on the Mountain Boy, 1,500 feet each on extension No. 1, No. 2, No. 3, No. 4, and No. 5, all located in Cunningham Gulch and on King Solomon Mountain.

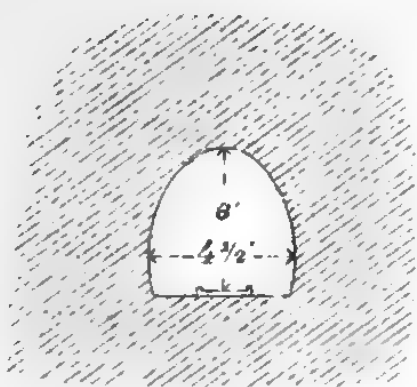


Sec
e
Ac
Pride of th

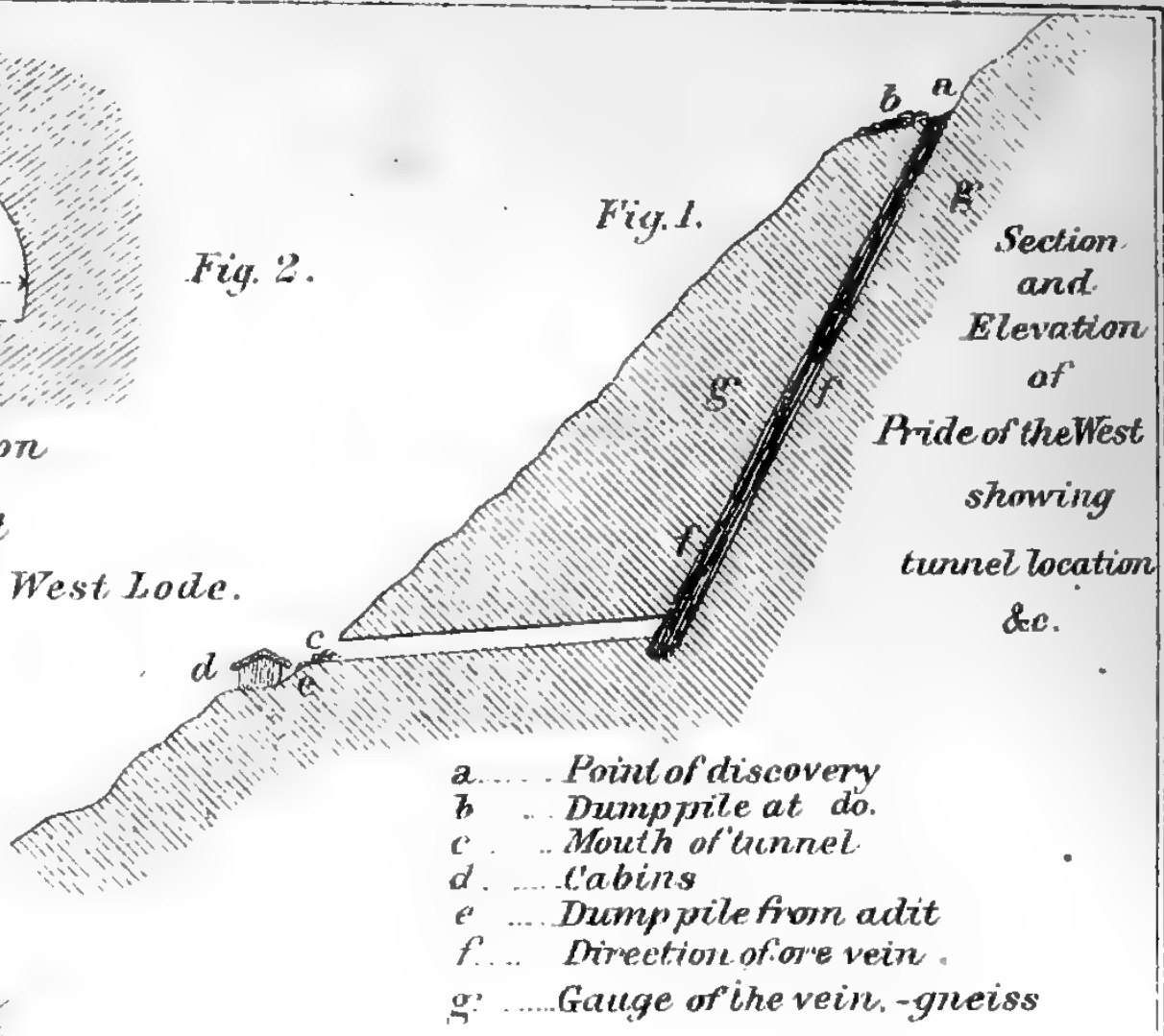


Operations
CUNNINGHAM
GULCH.

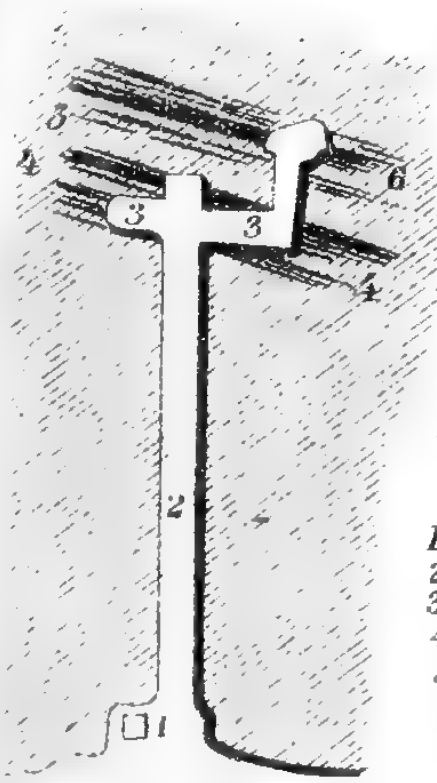




Section of Adit
Pride of the West Lode.



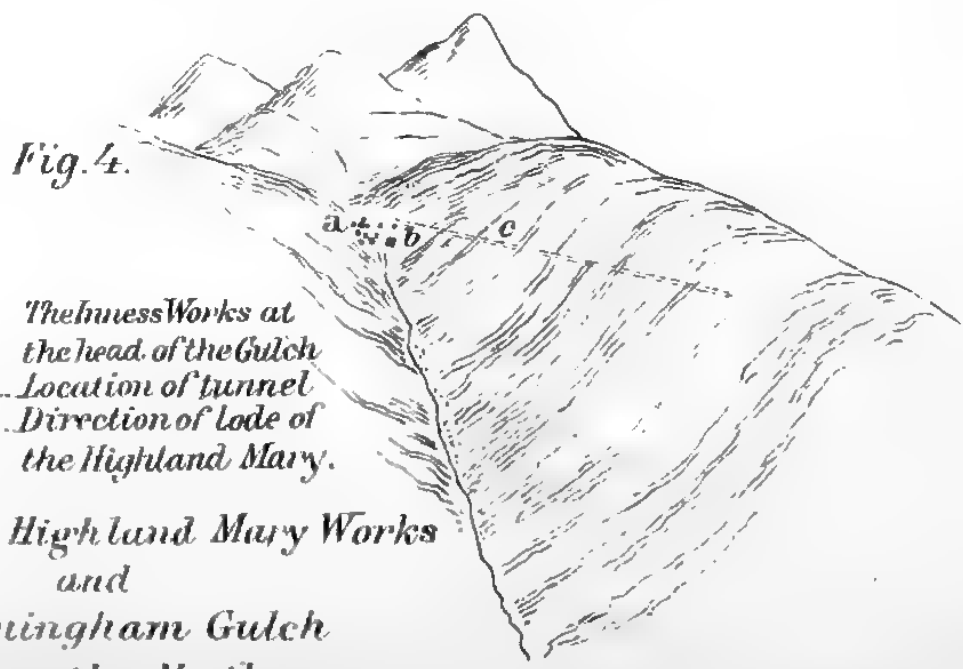
- a..... Point of discovery
- b .. Dump pile at do.
- c .. Mouth of tunnel
- d .. Cabins
- e .. Dump pile from adit
- f... Direction of ore vein
- g..... Gauge of the vein. -gneiss



Plan of
Tunnel and Drifts
on the
Pride of the West Lode.

- 1..Blacksmith shop
- 2..Tunnel with Trail truck
- 3..Drifts
- 4..Main vein ore
- 5.. Heavy streak of 5 feet
- 6.. Rich pay streak of gray copper

Operations in
CUNNINGHAM
GULCH.



- a The Inness Works at the head of the Gulch
- b... Location of tunnel
- c .. Direction of lode of the Highland Mary.

Location of Highland Mary Works
and
Cunningham Gulch
from the North.

[Faint, illegible text, likely bleed-through from the reverse side of the page]

[Faint, illegible text, likely bleed-through from the reverse side of the page]

There was being opened an adit entrance 18 feet by 15, from which a tunnel 10 feet by 10 will be run for 100 feet, giving room for a double T-rail track with switches, 6 cars being in use for removing the *débris*. The work was being advanced by means of six 3-inch Ingersoll drills, the number to be doubled in 1878. The tunnel, which was started from the bottom of the gulch on the Mountain Boy, will cut at 80 feet the Highland Mary and W. H. Nichols, at right angles, when drifts, 8 feet by 8, for a single track, will be run each way to the east and west on both lodes, the main tunnel going south upon the vein of the Mountain Boy. At 500 feet from the adit entrance the tunnel will be 2,000 feet beneath the surface of the mountain above. Attached to the mines were found a total of 14 buildings, as follows:

Engine and compressor building, of stone, 46 feet by 32, walls 2 feet in thickness. When the gulch was entered during the spring (1877) to commence building operations, 22 feet of snow had to be passed over on snow-shoes; where the buildings are located, some distance up from the bottom, it was 7 feet in depth. This had to be dug out and the blasting of 6 feet of rock beneath for firm foundations accomplished. The engine building contains in the main part a 75 horse-power Root sectional boiler and a 60-horse-power Clayton air-compressor, the balance blacksmith-shops. The machinery had been lately put in, and presented as handsome and fine an appearance as could be desired by any engineer. The Clayton duplex compressor was driven by a No. 3 Blake pump, and operated the Ingersoll drills referred to, through pipe and hose, carefully wound with manila rope. This was the only point where an Ingersoll was drilling in the San Juan at that time; working at all angles in quartz and syenitic granite, each drill, managed by two men, bored a 2½-inch hole to the depth of 6 to 8 feet, rating 1½ inches per minute, aggregating 75 feet of linear holes in ten hours, equivalent to the hand-labor of 30 men. All blasts being discharged by the aid of an electro-galvanic battery, the danger from premature explosion was prevented.

The other buildings consisted of the owner's residence, a Swiss chalet, two stories, surrounded by latticed verandas, on a commanding eminence, overlooking the works and the entire gulch; office and superintendent's quarters, refractory, dormitory, dining and cook houses, &c., with stables for the stock, of which there were 12 mules, 8 horses, and a number of burros or jackasses. The number of men employed was 57, said to be their winter force, and in the spring (1878) to be increased to 150 men, on the erection of reduction works for reducing their own ore alone; these, we were informed, would consist of 12 furnaces, with total capacity of 120 tons daily. The price paid by Mr. Inness for the Highland Mary was \$45,000. The ore is an argentiferous galena of high grade, with gray copper, milling up to \$500, some selected ore running to \$5,000 per ton. The vein is 15 feet between gangue walls, and contains a rich pay-streak of 15 to 22 inches.

From the gulch near by this remarkable vein can be easily traced with naked eye up and over the mountain-side. It was stated that a careful test was made of 4 tons of this ore at Greene's works, the pile being crushed, subdivided, and alternate quarters taken and subdivision continued in like manner until the amount had decreased to 2 pounds, which gave a mill-run of \$700 per ton.

Mr. Inness also possesses the Hoffman lode, a location of the past summer (1877), situated 1½ miles south of the Highland Mary; an argentiferous galena of 5 feet with the pay-streak, containing gray copper and some sulphurets of quinces, the general galena ore averaging 100 ounces, the pay-streak running as high as 700 ounces.

The Golden Giant, already mentioned and previously known as the Little Giant, being in the Arastra Gulch, for years in litigation, has been purchased by Mr. Inness entire. From this lode 430 sacks of ore were taken out during the season, averaging 60 pounds per sack, or 25,800 pounds total, which milled nearly \$4,200 per ton. The charter for the Howardsville and Antelope Park toll-road, extending from Howardsville up Cunningham Gulch, over the range and down the Rio Grande to Antelope Springs, was taken out by Mr. Inness in the fall of 1876, and about \$2,000 expended on 5 miles of the road down the gulch from the site of his works; above this a mile cost \$4,000. The intention was to complete the entire road during 1878, the distance from the summit of the range down to the springs being about 40 miles; total cost of finishing and perfecting the entire road estimated at \$30,000. At the time of the visit (October 1, 1877) the expenditures of Mr. Inness aggregated, as already stated, \$175,000.

From an outline sketch, herewith accompanying (Fig. 4 of Cunningham Gulch, Plate 6), an idea may be formed of the deeply eroded character of Cunningham Gulch, and the locations of the mining properties at its upper end.

Within the Animas section, as may be inferred, are situated a larger number of first-class and high-grade silver-mines than are found in any other district of the San Juan. The lack of reduction facilities and good roads has been its drawback.

The supplies of material reaching Silverton are mainly brought by trains of burros, which are valued here at \$25 to \$30 each. Freight by burro-trains from Silverton to Antelope Springs is 2 cents per pound; for return freight 3 cents is charged. These trains are in charge of a driver, receiving from \$60 to \$75 per month; the pack transportation being 150 pounds for a burro, and from 200 to 250 for a mule.

THE NEEDLE DISTRICT

lies within the Needle Mountains, at the headwaters of the Florida, and the Vallecito, or West Fork of the Rio Los Pinos, their western slopes being drained by waters of the Animas. This section had been entirely unexplored by prospectors up to within the last season, not from any lack of desire to enter it, but from the impossibility of accomplishing it, the mountains being wholly inaccessible.

The only trail in the entire region, leading up the Vallecito, was cut early in September by our party in company with a number of prospectors and mining men. In meandering the headwaters of this stream there were everywhere indications of valuable metalliferous deposits. Rich float was observed along the beds of the water-courses, and wide veins of mineral deposits could be distinctly traced and followed with the naked eye upon the mountain-sides. The similarity to Cunningham Gulch was very striking; the veins in their general course lying northwest and southeast, in the same direction as that of the great mineral belt in the vicinity of Silverton.

The prospectors reported an abundance of rich lodes, mainly of silver, with indications of gold. The surface-outcropping, or "blossom rock," made the search for lodes not only an easy task, but also very successful.

The most promising lodes earliest discovered were the Dolly Varden, Clipper, Engineer, Germania, Iron Rod, and Columbia, none of them being developed more than the 10-foot assessment required. The specimens seen, giving fine assays, were of argentiferous galena, chiefly of high grade, with gray copper and sulphurets. The richest lode of the district, as we afterwards learned, was one which assayed several thousand dollars, and was discovered in October by one of the early prospectors, known throughout the camp as "Dirty Jim."

While at the head of one of the streams, float of decomposed quartz was observed similar to the rock of the Little Annie at the Summit. Being followed up and its origin found, although it was left unstaked, the temptation to locate was almost irresistible. We learned later, that after our departure and the existence of a trail was known, a stream of prospectors poured up the Vallecito during the two months intervening till the close of the season, and that numbers of rich "strikes" had been made. This will undoubtedly become, when properly developed, a most valuable district; coal deposits abound on the Florida, close to the Los Pinos, and an agricultural section is not far distant.

THE EUREKA DISTRICT,

adjoining the Animas upon the north, is small in extent, but rich in lodes, and lies along the Animas River, from the dividing line near Howardsville to the divide between the Animas and Uncompahgre Rivers. The most valuable mining properties are found in Eureka, Maggie, and Minnie Gulches.

The towns of the district are Eureka, at the mouth of that gulch and about 9 miles from Silverton, and Animas Forks, located at the junction of the two upper branches of the river, 4 miles farther up; both of these, however, should be properly known as mining camps.

The principal lodes are the Tidal Wave, McKinnie, Crispin, Sunnyside, Yellow Jacket, Golden Fleece, Venus, Emma Dean, American, North Pole, Jackson, Grand Central, Big Giant, Little Abbie, Belcher, Chieftain, Boomerang, Silver Wing, Lily, Golden Eagle, and Great Eastern.

The ores are in general argentiferous galena of high grade, gray copper accompanying; in Burns' Gulch specimens of the Lily and Golden Eagle lodes contained brittle silver in considerable quantities, while in Eureka arsenical ores are found. On Jones' Mountain, not far from this gulch, the Silver Wing, one of the finest mines of the district, contains seven lodes so situated that they will be readily worked by a single tunnel. The owners propose erecting here, during the season of 1878, smelting-works for their own ore.

Selected ore of the Boomerang gave occasional mill runs of \$475.

The Eureka is the most promising gulch in the district, where more work has been done than in any other, although its mines are in all stages of development. The Tegner, with an 80-foot tunnel, a vein of about 10 feet, with a pay streak of nearly 3, gave mill runs of 125 ounces of silver; the Emma Dean, with a 50-foot tunnel, a crevice of 20 feet, and a pay streak of 3, returned a mill run of 168 ounces; and the Crispin, also in Eureka Gulch, with a vein of 9 feet, and a pay streak of about 3, gave a value of 160 ounces.

The facilities for reducing ore have not been equal to the supply, and are mainly at Animas Forks. Here are located the smelters of the Dakota and San Juan Mining Company and the San Juan Smelting Company. The former possesses the usual magnificent water-power, of which an idea may here be formed from the fact that the town lies at the edge of timber line and on the mountain slope, down which the fall of water is the greatest; beyond and down the gulch to the south the descent is much less, although the average to Howardsville, 8 miles distant, is over 200 feet

per mile. This portion of the Animas is very confined, narrowing to the north; the mountains are steep and precipitous, particularly on the east, opposite Eureka, and about the immense trough of the river are numerous evidences of glacial erosion.

At Eureka the outlook for the future was more encouraging. For the reduction of the ores of the gulch, large works, being erected by an Eastern company, were all under way, and expected to be open for business by the beginning of the season of 1878, the process being lixiviation.

In Burns' Gulch, where large quantities of ore were on the various dumps, a concentration mill of about 8 tons capacity was being operated. The proprietors were Messrs. Smyth & Peterson, graduates of the Freyburg mining schools; the concentrated ores were shipped to Saint Louis refining-works, the magnificent motive-power of the water being utilized for their mill.

THE PARK DISTRICT,

so named from its containing Burrows Park, a mountain valley between 10,000 and 11,000 feet in height, adjoins the Eureka on the east. Through this district a road from Animas Forks, via Cinnamon Gulch, passes down the Lake Fork of the Gunnison to Lake City, about 29 miles distant. This road, however, is in such a wretched order that all teams for Lake go from Animas Forks, via the Hensen Creek toll-road, which is in fine order, besides being 6 miles shorter.

The Park District lies mainly in Hillsdale County, and within it are situated some fine properties which are being rapidly developed.

The principal mining points are Sherman, on the Lake Fork, at the mouth of Cottonwood Creek; Argentine, about 6 miles farther up the stream; Tellurium, at the head of Burrows Park, and the American Basin, a huge depression, about $2\frac{1}{2}$ miles long and 1 wide, immediately to the west of Handie's Peak. Several gulches entering the park, also contain some valuable lodes, the most important of which is the Cleveland, coming from the northwest nearly, and below Tellurium.

Among the most promising and best developed lodes are the Hidden Treasure, Major, Vulcan, Mountain Curve, Garden City, Cuba, Little Edith, Lilly, Inez, Cashier, Silver Queen and Del Norte.

The nature of the ores are wholly silver, no gold having as yet been found; they are generally a fine grade galena, with and without gray copper; a few of them carry diorite or antimonial silver, and one or two, indications of pyragyrite or ruby silver.

Their value is that of first-class ore in general, some few running to quite a low grade, but in large quantities. The Hidden Treasure, of the American Basin, gave an assay while we were at Lake of 3,287 ounces; some ore of the Major has sold for a dollar a pound.

Specimen No. 719, of the collection, from the American Basin, gave an assay of 1,000 ounces. The vein is 8 feet between wall rock of the fissure, and contains several pay streaks, of which the finest quality is 8 inches.

Specimen No. 726 was from a lot of the Inez ore, an American Basin mine, which gave a mill run at Lake City of 810 ounces; it contains both native and brittle silver in small quantities. We were present at Van Gieson's Works at Lake City when a sack of 58 pounds of the Vulcan (picked ore, of course) was paid for at the rate of 1,964 ounces per ton. The rest of the lodes mentioned, except the Del Norte, are of fine grade, yielding from 60 and 75 ounces to 150 to 250 ounces, the Cuba, a ruby silver pay streak, having mill runs from 100 to 300 ounces. Upon the Del Norte, about half a mile below Tellurium, \$7,000 has been expended in development; tunnel in over 100 feet; about 1,000 tons already out, all of low grade, perhaps 46 ounces per ton.

In the shape of milling facilities, two works for the concentration of ores were to be erected and opened for the season of 1878. At Argentine, one of a daily capacity of 10 tons was to be built by Messrs. Welsh & Son; at Tellurium, the other, with facilities 50 per cent. greater, or 15 tons per day. The latter was to be done by an Illinois Company, known as the Gunnison Silver Mining Company. It possesses a large capital and has under way the most extensive operations in the district. The mill is located on a gentle slope of the mountain, north of the river, and its heavy water-power is derived from a 1,200-foot race bringing the water from the stream.

THE UNCOMPAGRE DISTRICT

lies on the north of the Animas District, Cement Creek being to the southeast, and the north fork of Mineral Creek to the southwest of Read Peak or Mountain, while Red Creek of the Uncompahgre runs down its northern slopes; it lies also northwest of Eureka District Mineral City and Poughkeepsie Gulch being in that direction from Animas Forks.

It lies, moreover, upon the Pacific slopes of the mountains, its mines being in the gulches of Poughkeepsie, Red, Bear, and Cañon Creeks, which dash down in most horrible and frightful cañons, eroded from the massive mountains circling their heads,

their bottoms choked with *débris*, and very often inaccessible. Words are inadequate to describe the appearance of these cañons from above. Each looks like a perfect wreck of matter, or an exploded world piled below in strange confusion; the fiercely red peaks about lending a brilliant contrast to the long stretches of timber and the valley far below and beyond. The wealth of mineral deposited here by nature was apparently proportioned to its inaccessibility. Mines are most numerous in the Animas; capital has aided them at Lake most largely, but in the Uncompahgre Mountains nature made them richest.

Mineral City is its town, nearest Eureka District, being on a fine toll-road, 3 miles over the range from Eureka, and about 20 miles from Lake City, by the Hensen Creek road. It is an important mining camp, is at the edge of timber line some 11,500 feet above the sea, and is claimed to be higher up in the heavens than any other town in the United States, if not the loftiest mining camp of any size in the world.

Way down the gulch, on the Uncompahgre River, less than 6 miles by air-line, only $7\frac{1}{2}$ or 8 by trail, but 120 by the wagon-road via Lake City, lies Ouray, the largest town of the district, and rival, perhaps, of Lake City and Silverton in the distant future.

A mineral belt apparently runs to the southwest from about Ouray, including the gulches to the south, and continuing on to Red Mountain, at the head of Cement Creek and the north fork of Mineral Creek. Mines that lie within its course partake, more or less, of its peculiar characteristics, which differ from the Animas and other ores in possessing less galena and more of the sulphurets than other sections. Being of a high grade and easily treated, they are great favorites at works for the general reduction of ore.

In the northern part of the district, close to Ouray, on the west edge of town, and at the mouth of Cañon Creek, is the Fisherman lode, wonderfully rich, containing native and brittle silver, assays being as high as \$30,000. The Trout is an extension thereof, containing gray copper, while the Johnny Bull, close by, carries the same ore as the Fisherman, and is presumed to be one of its spurs. The Ophir, Watson, Three Brothers, Cedar, and Clipper, are also near by; the Sivyver and Union, on Bear Creek, and many others, including the Mother Cline, Alaska, Saxon, Tyrol, Poughkeepsie, Silver Coin, Gipsy Queen, Little Minnie, Out Pat, and Lincoln Boy.

Including in this connection the

MOUNT SNEFFLES DISTRICT,

since lying about and upon the peak from which it takes its name, whence Cañon Creek runs down to the town, at the farthest but 9 miles away, all its interests are inseparably connected with Ouray, and we have in the Uncompahgre Mountain belt the richest deposit of mineral, not only in the San Juan, but in the whole of Colorado. The lodes upon the mountain are as large in number as the wealth they indicate exceeds the general average. The names of fifty could be stated that give promise of immense returns on capital carefully placed. They were in all stages of development in the shape of open cuts, large adits, shafts of 20 and 40 feet, and tunnels up to and over 100 feet.

The mines of the Uncompahgre are very young, so to speak, but they will be developed with great rapidity. Of all, none possessed more local renown than the Wheel of Fortune property, which was certainly a lucky turn for the finders. It was of a very rich grade with ruby silver and indications of gold. While in Lake City, a sale of this property to eastern parties was being negotiated, which was afterwards closed, the price being \$160,000. The Wheel of Fortune had been developed sufficiently to show its immense wealth, there being three levels of 160, 80, and 30 feet, and about 60 feet of shafting, the expense per linear foot running from \$18 to \$25; its vein has a fissure of 4 feet width, with a varying pay streak from 10 to 20 inches. Its Blossom or surface rock assayed 1,200 ounces, and selected specimens 26,200 ounces; mill-runs varied from 200 to 700 ounces; 70 tons purchased at Van Gieson's, at Lake City, averaging 275 ounces. The Monetizer and Mark Twain extensions of the Wheel of Fortune, and the Grand Trunk and Silver Queen lodes, crossing at right angles, were included in the sale of the mine. A batch of 9 lodes on Mount Sneffles for which the patent had not yet been received, were also sold at that time to capitalists of Georgetown, Colo., for \$50,000.

One of the most remarkable mineral deposits, not only in the district, but in the entire San Juan, is that known as the Mineral Farm; it belongs to Mr. A. W. Begale, and is especially worthy of mention. It is reached by the trail from Mineral City down to Ouray, being above and about $1\frac{1}{2}$ miles north of the latter. The "farm" consists of 5 large parallel locations, heavy fissure veins, almost a solid mass some 8 feet below the surface, several hundred feet wide and 1,500 long, with a thickness not known, the owner's estimate, which is of course valueless, being 1,000 feet. To the uneducated eye, it looks as if some great leak had occurred when Nature was injecting the molten metal from below through the many crevices and fissures prepared for its reception,

and a great mass had escaped before discovery was made. Whatever its geological formation, the owner has secured it by patent and takes most profitable exercise in occasionally getting it out and hauling it to the mill, the ore being a high-grade galena with sulphurets, and assaying from \$200 to \$900.

The facilities for reducing ore throughout the district are totally inadequate and much of the ore is packed to Lake City; the only reduction works about Ouray being a smelter of a capacity of 10 tons a day, a sampling mill also existing. Chlorination works will undoubtedly be soon erected here, but there will always exist plenty of custom for amalgamation works since the ores of brittle silver which frequently occur are not reducible by the process of lixiviation.

This point is pre-eminently the one for the location of works for the reduction of ore. It is in every direction down hill from the mines; water-power is fine, timber is abundant, spar and iron ore for fluxing abound in the mountains within a few miles above town, and a vein of coal, reported as 5 feet thick, lies scarcely over 6 miles distant, whereas coal used at Lake City has to be hauled over 75 miles.

Wholly unlike the situation of the other mining districts considered, agriculture is possible and very closely approaches the town. Less than 3 miles below, the river enters upon the beautiful and extensive valley of the Uncompahgre, and within less than 6, the cultivation of cereals may be pursued with fine success. With its immensely high and rugged mountains, and so abrupt a descent into a low and gentle valley, there exists unusual diversity of landscape scenery, with mineral and agricultural wealth almost meeting in an extraordinary manner. Ouray and the districts of which it is the center, possess more flattering prospects for the future than elsewhere were observed. The region to the north is the land of the Ute, but must in the near future be in part wrested from him, as was the San Juan proper but a few years ago. Our treaty stipulations, rarely kept inviolate, will not avail. The land is too valuable to remain unsettled.

THE GALENA DISTRICT

lies to the east of the last treated, touching it in the southeastern part of the Uncompahgre, and is but a part of the Lake Fork and the Uncompahgre Mountains, being in part the mineral belt drained by Hensen Creek. Its eastern line is the western boundary of the Lake District.

Of the most valuable lodes of this section, the nature of whose ore will be at once known from the name of the district itself, the Dolly Varden, Silver Chord, Ocean Wave, and Boston, are some of those farthest advanced. At timber line, beyond the source of Hensen Creek, is Mineral City, also called Mineral Point, already mentioned, between 20 and 21 miles from Lake City, while a little less than half way lies Capitol City, a promising mining camp.

Beyond the Ute and Ule the mines of the Crooke's, and 2 miles down from Capitol is the Ocean Wave, largely owned in Kansas City, a very valuable lode and finely developed, there being over 600 feet of tunneling, shafting, and connecting winzes. The value of this mine may be estimated from the fact that they sold 32 tons of ore, first-class or selected rock, to the Messrs. Crooke for reduction at the rate of 218 ounces.

Near Capitol City numbers of rich strikes had been made, and there existed a lively camp of fully 150. The lode attracting most attention was the Silver Chord, about a mile from town. In a vein of 4 feet there is a magnificent pay streak of 16 inches of mineral interspersed with native silver; ore running nearly 600 ounces silver was met in large bodies; some of the specimens taken out were magnificent. They were flecked throughout the narrow seam or streak with native silver, while the rest of the vein held high-grade galena, with gray copper and brittle silver. The owners asserted that they were not picked, which was not at all credible; but be that as it may, they were the handsomest specimens of silver-bearing rock we have ever seen anywhere.

Mineral City, aptly named in part, a metropolis as yet in embryo, of some 250 persons, was found the center of rich mines and valuable interests, some very heavy companies operating here. At Lake City tunneling contracts can be easily gotten at \$15 per foot, while at this point they entail an expense of \$20 to \$25. A Milwaukee company owns 22 mines near by, every one patented. Capt. E. W. Burrows, after whom the park of that name was called, possessing numbers of mines there, has very large interests near Mineral, 20 mines in all, from simple locations to the most advanced condition, which was a 95-foot tunnel on the Boston. The fissures are well defined, as far as developed, and show the average high-grade ores of the section.

A New York company, F. J. Pratt, superintendent, was the most extensive in its operations. Upon the Boston, near by, \$10,000 had been expended in development, and they were beginning upon a tunnel site to penetrate Mineral Point Mountain, for the intersection of 27 fine lodes. The contract for 1,000 feet of the tunnel was closed at the time of our visit for \$21 per foot, a remarkably low figure for the length.

On Copper Mountain, near the head of Hensen Creek, is the Dolly Varden, belonging to Mr. Van Geison, of Del Norte and Lake City. As people do in a mining country when they want their mine developed, are uncertain about its value, and don't like the

risk, he leased it to a miner to work it, pay all expenses, and receive four-fifths of the ore. The miner got out a little over 11 tons of ore, and taking it to the proprietor's mill at Lake City, received an amount which defrayed all his expenses and left him \$4,000 ahead. It has produced the highest average of any mine in the district, mill-runs varying, as we were informed at the works, from 365 to 810 ounces; the total average of the eleven tons was 440 ounces, the last run being of old ore from the dump, which lowered the previous average of 600 ounces. For 500 feet opened, the lode has shown the same pay streak of 10 to 15 inches. It is, therefore, a most valuable property.

Most of the ore of this district is taken to Lake for reduction. Smelting works with a capacity of 10 tons daily were erected at Capitol City, but were not found in operation. The proprietor had too many creditors, we were informed.

From the Galena one naturally gravitates down Hensen Creek to the

LAKE DISTRICT,

which possesses the metropolis of the southwest, and being the most accessible on account of its good roads, is very naturally the seat of larger capital than any other district of the San Juan. It borders on Galena upon the west, the Park District on the southwest, and lies wholly in Hinsdale County. Its richest and most prominent lodes are Hotchkiss, Ute, Ule, Belle of the West, Belle of the East, Silver Coin, J. J. Crooke, Plutarch, Pride of America, Red Rover, Cora, Pacific, Big Casino, Mayflower, East Boston, Little Chief, Mountain Lion, Atlantic, Plantation, and California.

By the register of the United States land-office at Lake City we were informed that there were recorded in this district 5,000 mining locations. Comparatively few, however, of this immense number are in an advanced condition, most of them resting on assessments.

The mines in general are of argentiferous galena, with gray copper; to a less extent the black sulphurets are seen, while in a single case both silver and gold occur. This remarkable exception to the usual mines of Lake is the Hotchkiss lode, in which valuable traces of sylvanite, with other telluride ores, occur the assays being extraordinarily high, running to \$40,000. It is one of the best developed mines in the district, belonging to the Crookes. It may, however, be considered as pocketty in its nature, the rich deposits not being continuous, nor lying in a positive and well defined fissure-vein.

The Belle of the West, but $2\frac{1}{2}$ miles from Lake, is a fine characteristic lode, discovered in 1875. The vein, a true fissure, varying from 3 to 5 feet, possesses a pay streak of 9 to 18 inches width, the constituents of the ore being argentiferous galena, with gray copper, black sulphurets also occurring. Hundreds of tons have been taken from the mine, its production being over 50 per month; its assays have been as high as \$1,200 while the mill runs, the real test of enduring worth, were from \$6,250, the lowest, to \$390. Over and above expenses, it was stated to have made a return to the owners on their investment, of 25 to 66 per cent per annum.

Upon Hensen Creek are the Ute and Ule, belonging to the Crookes, of which the former is the most valuable, and, as might be expected from their immense capital, in an advanced state of development, being, in this respect, at the time, the leading mine of the San Juan. They lie upon a slope of one of the Uncompahgre Mountains, on Hensen Creek, about 4 miles from town, and were purchased by the Crookes in August, 1876, for \$120,000. They began development with the Ute. This lode properly should be Ouray, as it was named by the original locator, after the renowned chieftain of the Indian tribes not far distant, the orthography of whose name he could not correctly manage.

The Ule has a tunnel of 200 feet, with drifts at its end in either direction upon the vein. Finding that its ore, the pay streak of which was 18 inches, did not develop as expected, being rather mediocre compared with the Ute, work was abandoned and attention turned to the latter which possesses a pay streak of fully 3 feet, with high-grade ore containing gray copper.

In the visit to the Ute, there were noted 7 tunnels and 3 large shafts, with levels and connecting winzes. At the close of the previous season (1876), shafts 2 and 3 showed 4 feet of solid mineral; in some places the vein was "pinched" or more narrow, but this average was still about the same, with an increased depth. The ore of shaft No. 1 was first class, milling 80 to 400 ounces. Mr. Simons, the efficient superintendent, with eleven years' experience in the mines of Central City, stated that during his management, ten months previous to October, 1877, there had been taken from the lode 1,600 tons of ore, and that the whole body removed from the mine aggregated "400 fathoms," that term being applicable to the vein area. The resulting amount would be 14,400 square feet of the vein's thickness, equal to 2,000 tons of ore, from their own weight averages, for while the pound weight of a foot cube of quartz is 168, tetrahedrite or gray copper 300, and galena 468 pounds, the mineral is of unequal distribution. In passing through the entire mine, not without some difficulty, by the way, a hole in one

of the winzes being too small for the "fat man" of our party, there were, moreover, seen about 1,000 tons more, broken and awaiting facilities for removal and hoisting. The deepest shaft was 125 feet, and throughout there were about 500 feet of level traversed. Outside near the various adits were 20 miners' cabins and stables for stock; 40 men were employed, wages being as usual \$3 per day and board; cost of tunneling from \$20 to \$25 per foot. These are Lake's representative and handsomest lodes; but mines are not her stronghold; in reduction facilities she stands pre-eminent, and of all, the Crookes' establishment is the chief. In fact the Crookes have made Lake City what she is, the undoubted metropolis of the San Juan and the center of her trade, their total investment being given on the best authority as over \$250,000.

The reduction works of the district, all located in Lake City, are three in number, and in the order of their capacity are Crookes', the Ocean Wave, and Van Gieson's. There is also a separate and small establishment, not far from Van Gieson's for the sampling of ore.

Crookes' Concentration Works, as they are generally called, are located on the Lake Fork of the Gunnison at Crookeville, about a mile from Lake City proper, on the road from the southeast, and commanding a view of the town. There are four in the firm, father and sons, eastern men, and proprietors of the large smelting and refining works in New York City. Being all thoroughly practical men, they have been eminently successful. They located their establishment here as the most accessible point within the mining region; theirs was the first to come, others followed them, capital gathered to the same point, and Lake City, destined to remain the leading place of South-west Colorado, is the result. To their works there is in general no admittance; with the enforced exclusion of the general public, and newspaper men in particular, rumors are afloat of mysterious processes in metallurgy that are kept from curious eyes, like the Swansea over the sea. Not so. The Crookes are thoroughly business men, and came to attend to it. With their magnificent machinery and its great success, their business became so great that intruders were in the way, and so they are excluded. Moreover there were from 300 to 400 idle men in town in the spring (1877), all allured by statements far and wide as to the silver mines found everywhere. They all went to Crooke, sr., for work and told the same story in general. A newspaper man he therefore abhors, as they informed me, from the "false statements about the paradise of San Juan," and the prospectus of one of the western railroads has as strong an effect upon him as a red rag to a mad bull. Their water power is one of the falls of 33 feet in the stream. It is utilized with a 26-inch Leffel turbine wheel and is equivalent to 75-horse power. Their concentration works, the general name of their establishment, consist of concentration works proper, smelting works, chlorination works, and a stamp-mill.

In 1876, they began building, and at the end of that season had expended \$50,000. The main building, erected for concentration, was 96 by 32 feet and 65 feet high. There were six floors, and all of them filled with machinery from top to bottom. Blake crushers, Krom concentrators, and numerous screens, hoppers, and dryers used in concentration were everywhere, in seemingly endless confusion, dazing the beholder. It seemed like another Machinery Hall on a small scale; to essay an accurate description of their works without being an expert metallurgist or a mechanical engineer would be as futile as to attempt to portray the terrible nature of the cañons of the Uncompahgre or the ruggedness of the summits of the Needle Mountains.

The coarse ore is received above, on the sixth floor, as it comes from the mines; it comes out below, an absolutely impalpable powder, perfectly free from dust or rock, fine mineral alone. In the shape of bullion, it is shipped to their refineries in New York. The concentration department was enlarged 50 by 40 feet, during the season of 1877, with similar machinery, in the shape of Blake crushers, Krom concentrators, &c., until its capacity has reached 75 tons daily.

The smelting-works contain four reverberatory furnaces, two sweaters, and two roasters, with another furnace building. The whole is a large building in four compartments, or perhaps, more properly, four buildings combined, 96 by 75 feet. These four furnaces, and the one erecting, have a capacity of 6 to 8 tons daily. They, however, never charge over a ton, and ordinarily but 1,800 pounds each. Huge piles of hogs-heads of tin scraps and turnings used in fluxing were in the yards, and droppings were noticed for miles along the road over which they had come. The chlorination works are of the usual order, 75 by 50 feet; the chlorides are shipped to New York City for refinement. The stamp mill was 75 by 50 feet, and contained 15 stamps.

The blast furnace, a Fraser & Chalmers, was erected during the season of 1877; capacity, 25 tons daily. In the yards were noticed large stacks of ore in desulphurization beds. It is possible that an approximate idea of the enormous quantity of machinery in the shape of Blake crushers, Cornish rolls, Frue vanners, Krom concentrators, &c., may be gathered from the fact that from the railroad they transported 30 tons, which cost them by slow freight 4½ cents per pound. Additions being made were still incomplete, and when finished, the several classes of works under their management will form the largest and most complete establishment in the State, and will be the only

one in Colorado where all the various processes for the treatment of ores are used. An idea of the capital necessary for so extensive operations may be formed from the fact that the single item of labor alone was \$1,000 per day; some 400 tons of base bullion were shipped to the East, it was said, during the season of 1877. This establishment was, when seen, excelled by but one in Colorado, the Boston and Colorado, better known, probably, as Hill's Works, at Black Hawk, where were handled during 1876, \$2,225,000, the estimate for the season of 1877 being \$225,000 more.

The Ocean Wave Smelting Works are located at the lower or northern end of town, Mr. Bernard being the superintendent, with Professor West, formerly of Hill's Works, a practical metallurgist, in charge of the machinery. The works are of the ordinary roasting and smelting nature, with Blake crushers, Cornish rolls, &c. Water-power is obtained from the river; iron ore and calcspar, for fluxing, come respectively from deposits along Hensen Creek and the Gunnison. They give employment in all to 40 men and have a capacity of 20 tons daily. This building had just been completed. At the time of our visit the company had on hand some 450 tons of ore, and were receiving plenty of custom work. The works are first-class in every respect and buy and treat ores of 20 ounces and upward.

Van Gieson's Lixiviation Works, where ores are treated by the chlorination or leaching process, are situated on Hensen Creek, which passes through the town on its way to the Gunnison.

A brief allusion to the interior of this establishment and its treatment of ores may not be wholly devoid of interest, inasmuch as it was highly spoken of and may be regarded as a type of this class of reduction works, which are rapidly increasing in favor. It is the most economical of all modes, securing 95 per cent of the precious metal, or 15 per cent more than is generally obtained by amalgamation, all kinds of ore being subject to its treatment, save those of heavy galena or in excess of 20 per cent.

In its operation water-power from Hensen Creek is utilized, the engine being a 45-horse power, Langford & Co., Black Hawk. Foundations, solid masonry; stack 60 feet high; size of main building 110 by 40 feet containing as subdivisions:

1. Ore receiving room, 40 by 20 feet. Ore purchased is piled in labeled lots; price for ore from the same mine of course varies.

2. Crushing room, 40 by 40 feet; contains Hendrie's ball pulverizers, Dodge crushers, elevator with endless chain and cups. This is also utilized as a drying room; the floor, being of iron, upon which the ore is spread, is heated by furnaces below.

3. Sampling room, contains a Barclay sampler similar to those at Hill's works at Black Hawk, at Georgetown, and elsewhere seen; ground ore of various values is thoroughly incorporated and sample produced of general character and value. From this resultant assays are made, furnished to the seller and prices paid accordingly.

4. Engine room, 40 by 24 feet, is adjoining on same floor, one of Langford & Co.'s, cost \$5,200. Force pump also here, for fire protection, throwing a stream through a 3-inch hose.

5. Cooling room, 40 by 18 feet and 14 feet below the above level, where the roasted ores are cooled; a force pump, Knowles' patent, used therefor.

6. Furnace room, 40 by 20 feet, contains 4 reverberatory furnaces; ores crushed above conveyed in pipes, are submitted to the usual roasting process.

7. Leaching room, situated below the above, containing four circular vats, diameter 9 feet, depth 5, in which the roasted ore crushed and solutions are mixed; hence sluiceways carry tailings to the Gunnison.

8. Chemical rooms, in the same general division but at a lower level; they are two in number and 40 feet by 12 by 14. The first contains two precipitating vats, where mixture is precipitated and clear solution is removed by a force pump to be utilized again; the second contains four tanks for base metals, as copper, iron, lead, &c., of which the copper only is saved. In the first room stirrers, similar to a steamer's screw, revolve horizontally, producing the sulphide of silver, which conveyed to an adjoining room, is desulphurized in a powerful furnace. It is then taken to an adjoining building containing the assay department, and also crucibles, melting furnaces &c., where it is molded into bricks, in which shape it is shipped to refining works in New York City.

Original cost of work, in 1876, \$45,000; in addition thereto \$15,000 to \$20,000 expended during season of 1877, in enlargement &c., capacity having been nearly doubled on the first run being successful; at present reducing 7 to 8 tons daily, and weekly amounts paid out aggregating \$4,000 to \$5,000.

Mr. Houghton, the superintendent, has a reputation for fine management, the first two months showing a product of \$33,000; two weeks' work yielded 7 bricks, which, 925 fine, were worth \$11,000, and the entire first lot of 200 tons reduced in five weeks returned 16 bricks with a weight of 21,431 ounces whose fineness and value, at the proportionate rate of the standard silver ounce, was \$1.07 or about \$22,800 in all.

Ores holding 40 ounces and upward were purchased for cash, and the average value, we were informed, of all ores milled at the works was a little over 130 ounces. It was their intention to increase their works during 1878, to double the present capacity.

This was the last of the mining districts of the San Juan personally visited. Of the indications and the prospects of the two others, nothing can be said save of a hearsay nature; both, however, properly belong to the mineral territory of the San Juan. Nearest and most notorious is

THE SAN MIGUEL DISTRICT,

lying west of the Animas and Uncompahgre where they meet on Mineral Creek, and including the San Miguel and its forks, and the mountains at their headwaters. It indicates both silver and gold, the placers being reported as very valuable.

At Silverton and other points specimens were seen, which were reported to be from mines on the Howard's Fork of the San Miguel; they were of argentiferous galena and also sulphurets, values given of 30 to 150 ounces of latter, and averages of 120 and 130 ounces for the former. Machinery has gone in, mining camps are said to be springing up, and sales of promising placers have been announced. As to the value of the latter there may well be some doubt; although they were, by some, highly spoken of, by others they were not. At the First National Bank at Lake City, we were shown by the president a vial of dust, some 20 ounces in all; larger quantities and nuggets the size of a pea were exhibited by returning prospectors; Silverton had no bank of any kind, Lake City had three, one national and one private, and would therefore receive the gold dust of the San Miguel. The fact, therefore, that such incomings are but at irregular times and not the inpouring of a steady stream, when many men had gone in to work the placers, might serve to demonstrate the non-reliability of the stream-beds for large amounts of the precious mineral.

THE ELK MOUNTAIN DISTRICT

comprises the range of that name, in the northeastern part of Gunnison county, west of the continental divide, completely encircled by waters of the Gunnison and tributaries of the Grand.

Wagon-roads exist, to the east to South Park, perhaps 70 miles, to reduction works, a branch of Hill's at Black Hawk, two divides, one the Continental, intervening. Southwest to Lake City, the distance is about 10 miles farther, with easier grades, down the Gunnison and up the Lake Fork. In a government report these mountains are called a "geological wonder." They are of great height, and are said, moreover, to be a "treasure house of mineral wealth." Specimens of the ore were seen at Lake City and Del Norte, and were of fine appearance. The veins were said to be, in general, very wide and true fissures. Several hundred lodes had been located and partly worked during the season gone by, one of which, called the "Whopper," with a pay streak said to be fully 6 feet, had gotten a mill-run at Lake of 200 ounces. From the lofty lay of the valleys, they are, moreover, claimed to be readily accessible, and coal in abundance, of fine coking properties, is said to be in proximity.

GENERAL SUMMARY.

A commonplace description of all the districts of the San Juan has been attempted, in accordance with that part of the instructions for the field which called for an account of "the prospects of the mines on the Las Animas, and the number of men at work, the mills at work, number and condition, and if there seems to be much to indicate a permanent and active business. All of these will be of value, in addition to a careful estimate and actual count of the men in the district"; furthermore, to carry the reconnaissance to the "heads of the Animas and across the divide to the so-called 'Uncompahgre' district, if there be time, and it is reported there are many men in that vicinity"; and, touching the region known as the "Lake District," to devote some time to the statistical examination thereof.

Examinations in detail of portions of the Lower San Juan, and instructions considered more pressing and urgent, so limited the time that but a passing and most hasty visit could be made to the districts mentioned, the entire day being occupied in marching or visits to divers points, leaving notes to be recorded at night. Statistical information touching the mining camps and towns of the entire region is included in the chapter relating to population. For valuable aid and information furnished, we desire to tender our thanks to Messrs. Robbins of the Summit, Hefferman of Parrott City, Greene, Whittemore and Hudson of Silverton, and Doughty, Olney, Woods, and Houghton of Lake. Men who will endure an interview deserve to be publicly thanked therefor.

It was intended to have prepared a map of the various mining sections, defining their situation and indicating the nature of the mineral deposit. It being found, however, impossible to wholly obtain the exact boundary-line of all the districts from some of the county officials and the surveyor-general of the State, the project was abandoned.

Of the localities passed through, Silverton and Lake are the best developed and undoubtedly the richest mineral-bearing regions, including in the latter the Uncompahgre. The mountains about Silverton, Cunningham Gulch, &c., are more massive than at Lake; tremendous, precipitous crags, which from appearance would yield more than Lake under the same impulse of capital.

In the country as a whole there are no placers; placers are but will-o'-the-wisps, and upon the deep-seated lodes alone must reliance be placed.

Silver is the standard product of the mines, and is found in general in fissure veins well defined with surface outcroppings, commonly called the "blossom rock," which was noted as frequently of chlorine and carboniferous formation. They can be often-times traced with the naked eye, readily with a glass, over the mountain-side for miles. The geological structures are in primary and secondary states; the precious metal is sometimes found native, as in the rich specimens of the Galma district, but ordinarily as ore, in various states and mineralogical conditions, being combined with pyrites of copper, noticeably about the Dolores, pyrites of iron, galena, chlorine, antimonial lead and zinc blende or its sulphuret; rich, free ores occur, azurite or blue carbonate of copper, tetrahedrite or gray copper, sulphurets or silver glance, including both sternbergite of iron and stromeyerite, of copper constituency, discrasite or antimonial silver and stephanite or brittle sulphuret of silver.

The quartz and gangue are sometimes rich in mineral (commonly known as the "vein" by prospectors and others), while the true veins or streaks (ordinarily spoken of as "pay-streaks") often, and in general do, carry more; occasionally native, specular or dross silver, being dentiform, capillary, and disseminated, but seldom massive, the luster being glimmering, fracture hackey and fine; with galena the diminution of cleavage-planes and the approach to lustrous, sparkling particles is hailed with delight by prospectors as indicating a higher proportion of argentiferous mineral. The narrow rich veins, or pay-streaks, to adhere to the popular usage of the word, yield so small a quantity that for a highly profitable mine dependence must often be, and in general is, placed upon large amounts of well paying gangue. The oldest and richest mines of the country, as in Nevada, &c., are low grade but in immense quantities.

Although the fissures of the Uncompahgre, &c., have been pronounced to be of but comparatively shallow depth by a distinguished mining geologist, not extending below the great bands of breccia that may be often at a distance seen encircling a mountain, increased depth has, in all cases, been well repaid. As yet, however, deep mining is almost a novelty in Colorado, and in the San Juan development has not advanced beyond the primary stage; the only deep and largely developed lodes are at Georgetown (silver) and Central City (gold), in both localities expenditure therefor being well rewarded.

CHAPTER VI.—BOTANY.

Prefatory.

A botanical collection, as well as all work relating to natural history, being wholly subordinate to the main objects of the reconnaissance, could necessarily be little more than of a meager character.

Even if a collector should possess the requisite knowledge of this extensive branch of natural science, the study of a lifetime, and the thorough proficiency in collecting which is only acquired through long and arduous devotion to the theory and practice combined, ample time must be at his disposal to enable him to prosecute his labors in the field with but a single end in view.

The absence of all these essential conditions will therefore be remembered in the examination of the results attained, and that the time given thereto was that usually devoted by others to rest and recreation after the day's march, and in general near or after dark, the specimens being ordinarily gathered on the way.

Not with the expectation of finding any new forms, but simply to aid botanical investigators in defining range-limits of certain flora, was the collection made.

For its classification, gratis, we desire to express our sincere gratitude to Professor Gray, the distinguished botanist.

Aware of the heavy demands upon his time in many ways, the vast amount of general botanical research upon which he is engaged, and which no other American can accomplish, and particularly on account of the knowledge of his having in charge, in conjunction with his eminent English co-laborer, Sir Joseph Hooker, extensive explorations and reports upon the Rocky Mountain flora for one of the surveys of the national government, the request for such labor was not made without misgiving.

For his promptness and kindness, and the devotion of time and unrewarded attention to the collection, we desire to express our grateful thanks. The classification will be found hereafter as Section I.

Mr. T. S. Brandegee, civil engineer, of Cañon City, Colo., a well-known investigator, and the only botanist, as we were informed by Professor Gray, who is practically

familiar with the flora of Colorado west of the Rocky Mountains, and particularly of the San Juan region, has kindly furnished, at our request, some botanical notes of great value, which follow the classification of Professor Gray. Not being personally a man of means, and all the work of the reconnaissance having to be done without any appropriation, his contribution was made as a personal favor, and we therefore desire to tender him our sincere thanks.

SECTION I.—CLASSIFICATION OF PROFESSOR GRAY.

Letter of transmittal.

HERBARIUM OF HARVARD UNIVERSITY,
BOTANIC GARDEN, CAMBRIDGE, MASS.,

June 23, 1878.

LIEUTENANT: I inclose you herewith a list of the plants sent me in April last, collected by you in your reconnaissance of the San Juan region of Colorado, &c., in 1877, and classified at your request.

Sincerely yours,

ASA GRAY.

Lieutenant McCauley, U. S. A.,
Fort Leavenworth, Kans.

CLASSIFICATION OF THE BOTANICAL COLLECTION MADE DURING THE
SAN JUAN RECONNAISSANCE OF 1877, IN COLORADO AND NEW MEXICO.

BY PROF. ASA GRAY.

[Species which are not in Porter's and Coulter's Synopsis of the Flora of Colorado are in *italics*. For convenience of reference the species are enumerated in the order of that work.]

RANUNCULACEÆ.

Clematis ligusticifolia, Nutt.

Thalictrum Fendleri, Engelm. (156).

Upper Chama, &c.

Ranunculus nivalis, L. (29, 33).

Ranunculus affinis, R. Br.

Ranunculus cymbalaria, Pursh.

Caltha leptosepala, DC. (25, 89, 88, 109, 515, 500, 365, 367).

Trollius laxus, Salisb. (36, 28, 62, 116, 117, 112).

Aquilegia cærulea, Torr. * (154, 155, 194, 196, 154, 311, 272-278, 287, 292, 197, 205, 206, 207, 209, 211).

Delphinium scopulorum, Gray (124, 140, 193, 238, 389).

Aconitum nasutum, Fisch. (498).

BERBERIDACEÆ.

Berberis Aquifolium, repens, Lindl. (1282), leaves.

Observed abundantly on the upper regions of nearly all rivers meandered, August and September.

FUMARIACEÆ.

Corydalis Caseana, Gray† (1116 and 1132 of the collection).

Also observed, August, 1877, when encamped near Bonn's Cabin, in a small park at the head of the upper cañon of the Rio San Juan, the altitude of the camp being 9,860 feet.

* A very abundant and beautiful flower, commonly known as the "Mountain Columbine," habitat all regions from 7,000 to 12,300 feet, June to September, preferring rocky localities. Remarkably handsome specimens were observed in the Needle Mountains or Quartzite Crags, and gathered at an altitude, above timber-line, at some 12,300 feet. It ranges higher in the Lower San Juan than on Gray's Peak, where it was gathered in August, 1876.

† Proc. Am. Acad. x, 69. This striking species was described from specimens collected in the Sierra Nevada, California, and it has recently been found by Mr. Cusick as far north as Union County, Oregon. I myself collected it in the Wahsatch Mountains, Utah, at the head of the American Fork Cañon, in August, 1877. Mr. Brandegee collected it in 1875 in the San Juan region, between Rio Piedra and Los Pinos, at the elevation of 10,000 feet, and it is now found in the mountains about the Rio Blanco, at nearly the same elevation.

CRUCIFERÆ.

Aralis Drummondii, Gray.

Cardanime cordifolia, Gray (1213, 151).

Rio Chama, altitude 8,500 feet.

Draba alpina, L.

Draba streptocarpa, Gray (7, 27).

Observed very abundantly, 7,000 to 12,000 feet, Summit District, &c.

Sisymbrium canescens, Nutt., var.

Erysimum asperum, DC. (208, 191), and var. *pumilum* (250).

Weeminuche Pass, 10,500 feet, and other points near headwaters of Los Pinos and Piedra.

Lepidium intermedium, Gray.

Lepidium alyssoides, Gray (1234, 1235).

Abundantly observed on upper Rio Blanco, 8,000 feet, in August.

Lepidium montanum, Nutt.

CAPPARIDACEÆ.

Cleome integrifolia, Torr. & Gray.

CARYOPHYLLACEÆ.

Silene acaulis, L.

Stellaria longipes, Goldie.

Stellaria borealis, Bigel.

Arenaria Fendleri, Gray.

Arenaria biflora, Wahl.

Arenaria lateriflora, L.

Arenaria saxosa, Gray (135, 136, 137, 138).

Observed abundant along Upper Rio Los Pinos, 10,000 to 10,600 feet, in July.

PORTULACACEÆ.

Claytonia arctica, var. *megarhiza*, Gray (305).

Needle Mountains, 11,500 to 12,800 feet.

Claytonia Chamissonis, Esch.

HYPERICACEÆ.

Hypericum Scouleri, Hook. (362, 499).

Observed along Rio Piedra and tributaries, 8,000 to 9,000 feet, July and August.

MALVACEÆ.

Sidalcea malvæflora, Gray (1221, 266, 267).

Observed along Rio Conejos, Navajo, &c., July and August, 7,800 to 9,000 feet.

Sidalcea candida, Gray (186, 184).

Headwaters Los Pinos Creek and Chama waters, in July, altitude 8,500 to 9,500 feet.

Malvastrum coccineum, Gray (75).

LINACEÆ.

Linum perenne, L., var. (*L. Lewisii*, Pursh) (1, 263, 290, 480).

Large areas covered with this plant observed along Rio Conejos, Upper Los Pinos Creek, Rio Blanco, &c., July, 7,000 to 9,000 feet.

GERANIACEÆ.

Geranium Richardsonii, Fisch. & Meyer (43, 126, 127, 237).

Observed abundant along Rio Piedra and tributaries, July, about 800 feet.

Geranium Fremontii, Torr. (1246).

Upper Rio Blanco, &c., 8,000 to 9,000 feet.

SAPINDACEÆ.

Acer glabrum, Torr.

Nigundo aceroides, Moench.

ANACARDIACEÆ.

Rhus glabra, L.

Rhus aromatica, var. *trilobata*, Gray (1283).

LEGUMINOSÆ.

Thermopsis montana, Nutt. (150, 148).

Along Rio Conejos, &c., July, 8,000 feet.

Lupinus argenteus, var. *decumbens*, Watson (132).

Very numerous in same locality.

Lupinus pusillus, Pursh.

Trifolium dasyphyllum, Torr. & Gray.

Trifolium Parryi, Gray (192).

Upper Rio Los Pinos, &c., 10,000 to 11,000 feet, July and August.

Trifolium Kingii, Watson (65, 66, 114).

Observed along Upper La Jara, Alamosa, &c., June and July, 9,000 to 10,000 feet.

Astragalus Mortoni, Nutt.

Astragalus adsurgens, Pall.

Astragalus alpinus, L. (11).

Oxytropis Lamberti, Pursh (86, 87?, 118-121).

Numerous along the Trinchera, &c., June, 7,200 feet.

Oxytropis splendens, Dougl. (85).

Vicia Americana, Muhl. (199, 203, 214, 218, 219).

Frequent along Las Nutritas and other creeks, also along dry stream beds, July, 7,000 to 7,500 feet.

Lathyrus ornatus, Nutt.

Lathyrus linearis, Nutt.

Lathyrus polymorphus, Nutt.

Lathyrus palustris, L.

ROSACEÆ.

Rubus Nutkanas, Mocino (1244, 433).

Reported "rarely," Parry; * observed along Weeminuche Creek, July, 8,000 to 9,000, and Upper Rio Navajo, in August, at 9,000 feet; both occasions noted as very *abundant* on the mountain slopes near by.

Geum macrophyllum, Willd.

Geum triflorum, Pursh (195, 198, 212).

Along Weeminuche Pass and other points on Upper Rio Los Pinos, &c., 10,000 feet.

Geum Rossii, Seringe (310).

Taken in its lofty habitat, September, in Needle Mountains, 11,000 to 12,800 feet.

Fallugia paradoxa, Torr.

Sibbaldia procumbens, L.

Potentilla Pennsylvanica, L., var.

Potentilla Hippiana, Lehm.

Potentilla effusa, Dougl. (1227).

Upper Rio Navajo, August, 7,500 feet.

Potentilla gracilis, Dougl. (128, 261).

Taken July and August, similar altitudes, Upper Chama and Weeminuche Creek, 8,500 feet.

Potentilla nivea, L. (23, 26, 32).

Potentilla fruticosa, L. (269, 464).

Rio Conejos, July, 7,900 feet, and Rio Los Pinos and Rio Piedra, &c., to 10,500 feet, August.

Potentilla Anserina, L. (69).

Rosa blanda, Ait. (40, 52, 236, 231).

Fragaria vesca, L.

SAXIFRAGACEÆ.

Saxifraga cernua, L.

Saxifraga bronchialis, L.

Saxifraga punctata, L.

Saxifraga nivalis, L.

Parnassia parviflora, DC.

Ribes cereum, Dougl.

Ribes aauenum, Pursh.

CRASSULACEÆ.

Sedum Rhodiola, L. (248, 358, 402).

ONAGRACEÆ.

Epilobium tetragonum, L.

Epilobium angustifolium, L. (143).

Frequently observed, particularly in valley of Weeminuche Creek, July, 8,000 to 9,000 feet.

Oenothera biennis, L.

Oenothera coronopifolia, Torr. & Gray.

Oenothera albicaulis, Nutt.

Gaura coccinea, Nutt.

LOASACEÆ.

Mentzelia multiflora, Nutt.

Mentzelia aurea, Nutt.

CACTACEÆ.

Cereus gonacanthus, Engelm., &c.

Opuntia Missouriensis, DC.

Abundant in many forms, particularly along Lower Rio Los Pinos, &c.

CORNACEÆ.

Cornus pubescens, Nutt.

UMBELLIFERÆ.

Cicuta maculata, L. (182).

Cymopterus alpinus, Gray.

Ligusticum scopularum, Gray (242).

Along the Chama, July, 8,000 feet, and elsewhere, similar altitude.

Heracleum lanatum, Michx.

CAPRIFOLIACEÆ.

Lonicera involucrata, Banks (503, 528).

Abundant along upper road to Pagosa, near Rio Navajo, Blanco, &c., 7,500 feet.
Symphoricarpos occidentalis, R. Br.

RUBIACEÆ.

Galium boreale, L. (1217, 1220, 550, 201, 232, 233, 483, 529, 281, 288, 418, 417, 439, 413, 426).

Very common; noted everywhere, Rio Navajo, Blanco, Los Pinos, &c., July and August, 7,000 to 10,600 feet.

Galium triflorum, Michx.

VALERIANACEÆ.

Valeriana sylvatica, Richards (93, 98).

Valeriana edulis, Nutt. (224).

Upper Rio Los Pinos, Weeminuche Pass, &c., July and August, 7,000 to 10,000 feet.

COMPOSITÆ.

Liatris scariosa, Willd. (1222).

Very numerous along Rio Navajo, &c., August, 8,800 feet.

Brickellia grandiflora, Nutt.

Aster adscendens, Lindl.

Aster lævis, L.

Aster falcatus, L.

Aster glaucus, Torr. & Gray.

Aster Coloradensis, Gray (228, 229, 231).

Along Rio Piedra and tributaries, Rio Los Pinos, &c., July, 8,000 to 10,000 feet.

Aster (Macharathera) canescens, Pursh (1249, 1219).

Rarely observed; none gathered save along Rio Navajo, August, 7,400 to 8,900 feet.

Erigeron compositum, Pursh.

Erigeron grandiflorum, Hook., var. *elatus*, Gray.

Erigeron uniflorum, L. (226).

Rio Los Pinos, July, 10,100 feet.

Erigeron macranthum, Nutt. (361).

Rio Piedra, &c., July, 8,000 feet.

Erigeron divergens, Torr. & Gray.

Solidago Virga-aurea, L., var.

Solidago Missouriensis, Nutt.

Solidago Canadensis, L. (1245).

Frequently observed along Upper Navajo, August, 7,000 to 8,000 feet.

Bigelovia graveolens, Gray.

Bigelovia Douglasii, Gray.

Aplopappus Parryi, Gray.

Chrysopsis villosa, Nutt.

Lepachys columnaris, Torr. & Gray (1271).

Observed along Upper Navajo in August, and elsewhere abundant.

Helianthus petiolaris, Nutt.

Gymnolomia multiflora, Gray.

Villanova chrysanthemoides, Gray.

Chaenactis Douglasii, Hook. & Arn.

Actinella grandiflora, Gray.

Actinella leptoclada, Gray.

Helenium Hoopesii, Gray (359, 364).

Rio Piedra, Weeminuche, &c., August, 8,000 to 9,000 feet.

Achillea millefolium, L. (239, 265, 390).

Along the Conejos, Chama, and dry streams, July, 7,300 to 8,000 feet.

Artemisia dracunculoides, Pursh (1250, 284).

Along Rio Chama, Navajo, &c., August, 7,400 to 9,000 feet, and elsewhere.

Artemisia tridentata, Pursh.

Very abundant.

Artemisia Ludoviciana, Nutt. (256, 279, 281, 427).

Along Rio Chama, July, 8,500 to 9,000; Rio Blanco, 9,000, &c.

Artemisia scopulorum, Gray (382, 395).

Weeminuche Pass, Rio Los Pinos, &c., July, 10,000 to 11,000 feet.

Artemisia frigida, Willd.

Anaphalis margaritacea (1247).

Upper Rio Navajo, 8,000 to 8,500 feet, August; not elsewhere observed.

Antennaria alpina, Gaertn. (556).

Upper Piedra and Los Pinos, July, 9,000 to 10,500 feet.

Antennaria dioica, Gaertn. (1253).

Upper Rio Navajo, August, 8,000 to 9,000 feet; frequently observed.

Senecio lugens, Richards.

Senecio aureus, L., and (264) var. *borealis*, Gray (82, 84, 90).

Along Rio Conejos, July, 7,900 feet.

Senecio eremophilus, Richards.

Tetradymia canescens, DC.

Cnicus undulatus, Nutt.

Crepis runcinata, Torr. & Gray.

Troximon glaucum, Nutt. (255, 356?).

Along the Upper Rio Los Pinos, July, 10,000 feet.

Troximon aurantiacum, Hook. (338, 396, 392, 391).

Observed along Upper Piedra, July; gathered on Upper Vallecito, in Needle Mountains, September, 11,000 to 11,500 feet.

CAMPANULACEÆ.

Campanula rotundifolia, L. (131, 125).

Observed along the Weeminuche; elsewhere gathered, July, 7,500 to 8,000 feet.

Campanula Scheuchzeri, Vill.

ERICACEÆ.

Arctostaphylos Uva-Ursi, Spreng.

PRIMULACEÆ.

Primula Parryi, Gray (68, 67, 64, 145).

Along Rio Conejos, &c., June, 8,000 feet; common.

Androsace septentrionalis, L. (134).

Upper Rio Los Pinos, July, 9,000 to 10,000 feet.

Dodecatheon Meadia, L. (115, 158, 157).

Very common along Chama waters, July, 8,000 to 9,000 feet.

SCROPHULARIACEÆ.

Pentstemon barbatus, Nutt., var. *Torreyi*, Gray.

Pentstemon glaber, Pursh.

Pentstemon cæruleus, Nutt.

Pentstemon acuminatus, Dougl.

Pentstemon secundiflorus, Benth.

Pentstemon ambiguus, Torr.

Pentstemon humilis, Nutt.

Pentstemon glaucus, Graham, var. *stenosepalus*, Gray (346), &c.

Frequently observed on Vallecito, &c., streams, Needle Mountains, September, 10,000 to 12,000 feet.

Pentstemon Hallii, Gray, (223, 231 bis, 384, 406, 401, 403).

Common on Upper Rio Los Pinos, July, 9,000 to 10,500 feet.

Pentstemon confertus, Dougl.

Chionophila Jamesii, Benth.

Mimulus luteus, L. (268).

Along Rio Conejos, July, 7,900 feet, &c.

Synthyris alpina, Gray (15, 17).

Veronica alpina, L. (329).

Near headwaters Rio Los Pinos and Vallecito, Needle Mountains, September, 10,000 to 12,000 feet.

Veronica serpyllifolia, L. (230, 507, 508, 512-514, 534-536).

Weeminuche Pass and Upper Rio Los Pinos, July, 9,000 to 10,500 feet.

Castilleia linariæfolia, Benth.

Castilleia parviflora, Brug.

Castilleia integra, Gray.

Castilleia pallida, var. *septentrionalis*, Gray (180, 183, 304, 225, 220, 283, 285, &c.).

Abundant; along Upper Chama, July, 8,500 feet; upper waters of Los Pinos, Vallecito, and throughout Needle Mountains, July, August, and September, 9,000 to 12,000 feet.

Castilleia miniata, Dougl.

Orthocarpus luteus, Nutt.

Pedicularis grœnlandica, Retz. (385).

Upper Rio Los Pinos, 10,000 feet, and elsewhere.

Pedicularis racemosa, Dougl.

Pedicularis crenulata, Benth.

Pedicularis scopulorum, Gray.

Pedicularis Parryi, Gray.

LABIATÆ.

Monarda fistulosa, L. (1228, 501).

Along Rio Navajo, on wagon-road and upper waters, 7,000 to 9,000 feet.

Monarda aristata, Nutt.

Lophanthus urticæfolius, Benth.

Brunella vulgaris, L.

Stachys palustris, L., var. (240).

Observed along Rio Chama, July, 7,900 feet; and elsewhere.

BORRAGINACEÆ.

Lithospermium multiflorum, Torr. (369).

Watershed of Rio Piedra, &c., July, 7,400 feet.

Mertensia Sibirica, Don. (76?, 80?, 153).

Frequently observed; from Rio Chama, &c., July, 9,000 feet, (168).

Mertensia oblongifolia, Don.?

Mertensia lanceolata, DC.

Eritrichium nanum, var. *aretioides*, Herder. (17, 20, 24).

Eritrichium glomeratum, DC.

Echinospermum Redowskii, Lehm.

HYDROPHYLLACEÆ.

Phacelia circinata, Jacq.

Phacelia sericea, Gray, (247, 249, 253, 254).

Upper Rio Los Pinos streams, July, 9,000 to 11,000 feet.

POLEMONIACEÆ.

Phlox cæspitosa, Nutt. (21, 60).

Collomia longiflora, Gray.

Collomia aggregata, Porter, (2, 3, 61, 129, 438, 185, 187, 243, 280, 376, 493).

Specimens taken in July: Upper Los Pinos Creek, 8,500 feet; Rio Chama, 8,000; Rio Piedra and tributaries, 7,000 to 8,500 feet.

Gilia pinnatifida, Nutt.

Polemonium confertum, and var. *mellitum*, Gray. (30, 31, 46, 54, 56, 71, 77).

Polemonium humile, Willd. (38, 45, 60).

Needle Mountains and elsewhere, August and September, 10,000 to 12,000 feet.

Polemonium foliosissimum, Gray.

GENTIANACEÆ.

Gentiana Parryi, Engelm.

Frasera speciosa, Dougl. (152).

Along Upper Rio Chama, &c., July, 9,000 feet.

APOCYNACEÆ.

Apocynum androsæmifolium, L.

Apocynum cannabinum, L.

NYCTAGINACEÆ.

Oxybaphus angustifolius, Sweet.

POLYGONACEÆ.

Eriogonum alatum, Torr.

Eriogonum Jamesii, Benth.

Eriogonum flavum, Nutt.

Eriogonum umbellatum, Torr.

Eriogonum racemosum, Nutt. (12, 15, 440, 447).

Rio Blanco and Rio Navajo, July and August, 8,000 to 9,500 feet.

Polygonum viviparum, L. (336).

From Upper Vallecito, Needle Mountains, September, 11,500 feet.

Polygonum Bistorta, L. (130, 210, 213, 227, 330, 436).

Frequently observed; many specimens taken on upper waters of Rio Piedra, Rio Los Pinos, and the Vallecito, July to September, 8,000 to 12,000 feet.

CHENOPODIACEÆ.

Blitum virgatum, L. (1286).

ELEAGNACEÆ.

Shepherdia argentea, Nutt.

SANTALACEÆ.

Comandra pallida, no flowers (258, 291).

Specimens from Upper Los Pinos Creek and South Fork Rio Chama, July, 8,000 to 8,500 feet.

URTICACEÆ.

Humulus Lupulus, L.

BETULACEÆ.

Betula occidentalis, Hook.

SALICACEÆ.

Salix depressa, L., var. *rostrata*, Anders.

TYPHACEÆ.

Typha latifolia, L.

ORCHIDACEÆ.

Spiranthes Romanzoffiana, Cham. (1270).

MELANTHACEÆ.

Vexatrum Californicum, Durand (557).

Gathered on Upper Weeminuche Creek, July, 8,200 feet.

LILIACEÆ.

Zygadenus glaucus, Nutt.

Streptopus amplexifolius, DC.

Smilacina racemosa, Dest. (178, 177).

Upper waters Rio Chama, July, 9,000 feet, &c.

Smilacina stellata, Dest. (18, 79, 81).

Allium reticulatum, Fraser (202, &c.).

Along Lower Rio Chama, New Mexico, July, 7,000 feet.

Calochortus Gunnisoni, Watson (504 or 509).

Along Upper Piedra and Los Piños waters, July, 9,000 to 10,500 feet.

Yucca angustifolia, Pursh.

Very common at suitable elevations and on all lower streams.

JUNCACEÆ.

Juncus Mertensianus, Burg.

Luzula spadicea var. *parviflora*, Ledebour (319 or 320).

Upper Vallecito streams, Needle Mountains, September, 11,000 to 12,500 feet.

CYPERACEÆ.

Carex Jamesii, Torr.

Carex atrata, L.

Carex lanuginosa, Michx.

Carex utriculata, Bortt.

Carex viridula, Michx.

GRAMINEÆ.

Phleum alpinum, L.

Vilfa airoides, Trin.

Calamagrostis Canadensis, Beauv.

Eriocoma cuspidata, Nutt.

Stipa viridula, Trin.

Aristida purpurea, Nutt.

Spartina gracilis, Trin.

Bouteloua oligostachya, Torr. (1265).

Specimens from Upper Navajo, August, 8,000 to 9,000 feet.

Bouteloua hirsuta, Lag.

Buchloe dactyloides, Engelm.

Munroa squarrosa, Torr.

Koeleria cristata, Pers.

rizopyrum spicatum, Hook

Poa alpina, L.

Upper Blanco, Piedra, Los Pinos, &c., July and August, 10,000 to 11,000 feet.

Poa Andina, Nutt.

Festuca ovina, L., var.

Bromus Kalmii, Gray.

Bromus ciliatus, L.

Triticum canicum, L.

Triticum repens, L. (1262).

Specimens from Rio Navajo, August, altitude 7,400 feet.

Triticum strigosum, Steud.

Hordeum jubatum, L.

Elymus Canadensis, L.

Elymus Sitanion, Schult.

Trisetum subspicatum, Beauv.

Aira cæspitosa, L.

Setaria Italica, Kunth.

Andropogon scoparius, Michx.

EQUISETACEÆ.

Equisetum arvense, L.

Frequent; specimens from Rio Chama, July, 8,500 feet, &c.

FILICES.

Pteris aquilina, L.

Cystopteris fragilis, Bernh.

Abundant along Rio Piedra and tributaries, Rio los Pinos and Vallecito, July, August, and September; 8,200 to 12,100 feet.

Woodsia Oregona, Eaton?

SECTION II.—NOTES OF MR. BRANDEGEE.

Letter of transmittal.

ENGINEER CORPS, ATCHISON, TOPEKA AND SANTA FÉ RAILROAD,
Pleasant Valley, Grand Cañon Arkansas River, Colorado, July 1, 1878.

DEAR SIR: I send you inclosed a few notes from personal observations on the botany of the portion of Colorado commonly known as the San Juan region.

Being at present in the field, where I have been for some time, they represent only what my memory can recall; they are, therefore, somewhat meager, and due allowances should in consequence be made.

I am, yours, very truly,

T. S. BRANDEGEE.

Lieutenant MCCAULEY, *Third Artillery,*
In charge San Juan Reconnaissance, Fort Leavenworth, Kans.

NOTES UPON THE BOTANY OF THE SAN JUAN REGION OF COLORADO.

BY T. S. BRANDEGEE, Civil Engineer, of Cañon City, Colorado.

The alpine flora, or the flora above timber-line, is nearly the same as that of the alpine ranges and peaks of Northern Colorado. None of the predominating Colorado alpine flowers are missing, and the few which have been found only among the San Juan peaks are not abundant enough to change its general appearance. *Silene acaulis*, L., *Arenaria artica*, Stev., and *Phlox caespitosa*, Nutt., so well known in the Northern Colorado Mountains as "flowering moss," grow in large clumps, and their abundant, pretty flowers assist in transforming the snow-clad summits of winter into the flower-gardens of July. The little brooks, the sources of the San Juan and Rio Grande Rivers, are almost hidden by *Mertensias* and *Senecios*, while *Castilleia*, *Pedicularis*, *Trollius*, *Actinella*, *Erigeron*, *Caltha*, &c., are as showy and common as in the better known regions of Northern and Central Colorado.

Altitudes between 12,000 and 8,000 feet are the habitats of most of the species of *Coniferae* which cover the slopes of the Rocky Mountains. This region in the San Juan country is generally covered by large forests of the different species of spruce and pine, often intermingled with large aspens.

Especially upon the western slope grow magnificent forests of grand trees, mainly *Abies Engelmanni*, with some very large representatives of *A. subalpina*, Eng. *Pinus ponderosa*, Doug., the pine which furnishes most of Colorado lumber, is abundant, and upon the western slopes forms large forests of fine trees. *Abies concolor* is not abundant, as in the Sierra Sangre de Cristo and southward.

Throughout this timber belt, upon the eastern slope, *Aquilegia Canadensis*, L., seems to almost entirely take the place of *A. carulea*, Torr., and *Calypso borealis*, Salisb., with *Erythronium grandiflorum*, Pursh, are strikingly abundant. *Arenaria saxosa*, Gray, which, however, comes over into the Arkansas Valley, and *Berberis Fendleri*, Gray, are the only plants common and showy enough to remind one of the southern latitude. Upon the western slope, *Corydalis Caseana*, Gray, growing among the forests of *Abies Engelmanni*, is the first plant of a more western flora that strikes the attention. *Gilia aggregata*, Spreng., and *Pentstemon glaber*, Pursh, grow upon the parks with *Lupinus argenteus*, Pursh, and *Actinella Richardsonii*, Nutt.; *Calochortus Gunnisoni*, Watson, *Rudbeckia laciniata*, L., *Helenium Hoopesii*, Gray, *Veratrum album*, L., and other showy plants of Colorado, are common. Upon the western slope, *Pyrus sambucifolia*, Cham. & Schlecht., *Prosartes trachycarpa*, Watson, and *Rubus Nutkanus*, Moç., grow in great profusion.

Below 8,000 feet altitude, especially upon the sandstone formations, there is a great difference between the floras of the eastern and western slopes. That of the eastern differs little from the flora of the Arkansas Valley. A few plants from the south come up to the Rio Grande Valley, but the main flora is the same, and quite different from that of the Platte Valley and Northern Colorado.

The stream-banks of the eastern slope of the San Juan region are bordered with groves of cottonwood, thickets of *Salix longifolia*, Muhl., var., *Rosa blanda*, Ait., *Clematis ligusticifolia*, Nutt., *Bigelovia*, and at lower altitudes with quantities of *Baccharis salicina*, T. & G.

Upon the western, with these are *Rhamnus Californicus*, Esch., an abundance of *Crotægus coccinea*, L., *Shepherdia argentea*, Nutt., and at lower altitudes *Forestiera Neomexicana*, Gray, makes its appearance. The "plum patches" of *Prunus Chicasa*, Mx. ?, so common in the Arkansas Valley, are not found in the western San Juan region. The alkaline flats and low parks of both slopes produce *Sarcobatus vermiculatus*, Torr.,

with several species of *Atriplex*, but upon the western slope *Artemisia tridentata*, Pursh, often accompanies them, forming almost impenetrable thickets.

A prominent feature of the western slope is the great extent of country covered by the "sage-bush," *A. tridentata*, and nearly impassable, excepting by the trails which run through it. These "sage-bush" plains are not found upon the eastern slope, the so-called "sage-bush" plains being parks with *Sarcobatus*, *Atriplex*, and *Bigelovia*, and other smaller shrubby plants, growing upon them.

The mesa slopes of the west are more thickly covered with shrubs than upon the eastern Rocky Mountain slope. The southern species and those from the Interior Basin are so common, that they form the most striking part of the vegetation. *Cercocarpus parvifolius*, Nutt., and *Amelanchier alnifolia*, T. & G., are found upon both the eastern and western slopes, but upon the western *Amelanchier* is much more abundant. The very common bushes of the western San Juan region are *Purshia tridentata* DC., *Cowania Mexicana*, Don., *Peraphyllum ramosissimum*, Nutt., *Fendlera rupicola*, Eng. & Gray, and *Ephedra trifurca*, Torr.

The Mesa Verde, a large mesa of the western slope, is covered with *Juniperus occidentalis*, Hook., intermingled with some *Pinus edulis*, Eng., and *Juniperus Virginiana*, L.; and upon its western edge *Fraxinus anomala*, Torr., *Glossopetalon spinescens*, Gray, and *Coleogyne ramosissima*, Nutt., are often found.

Yucca angustifolia, Pursh, grows upon both the Atlantic and Pacific slopes, but *Y. baccata*, Torr., is plenty only upon the western slope. The genera *Astragalus* and *Eriogonum* are represented mainly by different species on the two sides of the mountains. *A. lonchocarpus*, T. & G., *E. microthecum*, Nutt., *E. Jamesii*, Benth., *E. umbellatum*, Torr., *E. cernuum*, Nutt., are common upon both slopes.

The conspicuous smaller plants of the western mesas, in place of the common *Pentstemon*s, *Aplopappi*, *Bigelovias*, *Townsendias* of the eastern slope, are *Pentstemon linarioides*, Gray, *Aplopappus Nuttallii*, T. & G., *A. armerioides*, Nutt., *Solidago pumila*, *Bigelovia Wrightii*, Gray, *B. depressa*, Gray, *Hosackia Wrightii*, Gray, *Actinella Torreyana*, Gray, &c. The species of *Loasaceæ*, *Solanaceæ*, and *Nyctaginaceæ*, well represented in the Rio Grande Valley, are equally so in the San Juan Valley.

Until both eastern and western slopes are thoroughly explored, it is only negative evidence that a plant has not been found upon either slope, but what is known makes it certain that there is a decided change from the flora of the eastern slope on the Los Pinos, Animas, La Plata, Mancos, and Dolores Rivers.

CHAPTER VII.—ENTOMOLOGY:

PREFATORY.

Touching the botanical collection mentioned in the previous chapter, the precursory remarks there made are also applicable here.

While the time essential for any comparatively full representation of the insect-fauna was not available, an attempt was made to obtain as large a number as possible of the *Articulata* to aid investigators in defining the range-limits of their specialties; particular attention being paid to the *Lepidoptera*, *Coleoptera*, *Neuroptera*, and the *Acrididæ* of the *Orthoptera*.

Traveling mainly with pack-train, some of the collections were unfortunately lost through accidents in the field and *in transit*, including a valuable collection of *Neuroptera*, which Dr. H. Hagen, the eminent naturalist in charge of the Museum of Comparative Zoology of Harvard University, Cambridge, Mass., had promised to classify and report upon.

The collection of *Orthoptera* was expressed to Prof. Cyrus Thomas, of the United States Entomological Commission, whose classification and report, as Section I, will be found hereafter. For his kindness and the unrewarded time and labor devoted thereto we desire to express our sincere thanks.

The largest and most difficult collection of any specialty, several hundred *Lepidoptera*, comprising both *Rhopalocera* and *Heterocera*, were sent for classification and report to Prof. Herman Strecker, of Reading, Pa., whose private collection, numbering over 60,000, is the largest in the world. In addition thereto over 600 specimens of a general collection of *Articulata* were expressed to Mr. Strecker for the same purposes. Both classification and report, involving an immense amount of time and labor, have been promised gratis, and we desire to tender him our thanks therefor. At the time of leaving the office to take the field, it had not yet been received, but its completion is promised at an early day, and in time for publication.

SECTION 1.

ORTHOPTERA.

BY PROF. CYRUS THOMAS.

Letter of transmittal.

WASHINGTON, July 8, 1878.

DEAR SIR: The collection of *Orthoptera* which you have submitted to me for examination and determination, although small, is quite interesting and valuable, and will aid the United States Entomological Commission in fixing the southern limit of the range of *Caloptenus spretus*.

Although containing nothing positively new to science, it is of great importance in determining the range of species, color, &c.; its chief value consisting in showing the characteristics of the orthopteral fauna of the region in which the collection was made, Northern and Northwestern New Mexico and Southern Colorado. I think I could locate the collection from the specimens alone.

From its examination one fact appears to be brought out, viz, that as we move south along the Rocky Mountain range, especially after passing south and beyond South Park, in Colorado, the effect of the altitude on the specimens becomes less marked.

From the list of species given in the annexed report, it will be seen that no specimens of *Caloptenus spretus* were captured, from which I infer that the section visited was entirely free from this pest. As the species was abundant from British America to Texas during the season the collection was made, we may reasonably conclude—what I have long suspected to be the case—that its southern limit along the east flank of the mountain is about the southern line of Colorado.

I am a little surprised at finding no specimens of *Tropidolophus formosus* in the collection. I am inclined now to believe this species has a very limited range.

Want of time has prevented me from studying the collection with the care I would like to. The following report is herewith forwarded to you for such use as you may desire to make of it.

Yours, very respectfully,

CYRUS THOMAS.

Lieut. C. A. H. McCauley, U. S. A.,
Fort Leavenworth, Kans.

REPORT.**ACRIDIDÆ.****TRUXALINI.****1. OXYCORYPHUS OCCIPITALIS, Thos.**Syn.—*Stenobothrus occipitalis*, Thos., Syn. Acrid. N. Am. 81.

One female in color, hind femora wanting. From this specimen I am able to add the following to the original description: Head, antennæ, and lower margin of the pronotum dull ashy-purple color; a green stripe on each side, starting at the eye, extends backward along the upper part of the side of the pronotum and the lower margin of the elytron to about the middle of the latter. In this specimen the discal dots are fused into a median dark stripe. The disk of the pronotum rusty-yellow. (No. 86.)*

2. STENOBOTHRUS COLORADUS, Thos.

This species is so well marked that it is easy to distinguish it even in the pupa state. The dark lateral lines are, in this pupa, shining black, and can be traced upon the disk of the reversed wing-pads; there is a dark line margined each side by yellow, running from the lower end of the eye along the lower margin of the pronotum; the rest of the head and pronotum dull yellow. (No. 1.) One pupa, dry. (No. 6.)

*NOTE.—The appended statement by Lieutenant McCauley will explain these figures.

3. STENOBOTHRUS CURTIPENNIS, Harr.

Syn.—*Locusta curtipennis*, Harr., Cat. Ins. Mass. 56.
Chloea curtipennis, Harr., Rep. 3d ed. 184.
Stenobothrus longipennis, Scudd., Bost. Jour. Nat. Hist. 1862, vol. vii, 457.

At various points.

4. STENOBOTHRUS MACULIPENNIS, (No. 86.)

ÆDIPODINI.

5. TRAGOCEPHALA VIRIDIFASCIATA, Harr.

In the Rio Conejos Valley numbers were observed.

6. TRAGOCEPHALA PACIFICA?, Thos.

Tragocephala pacifica, Thos., Syn. Acrid. N. Am. 161.

From camps along the Rio Conejos and Rio Chama, July, 1877. Elevations 7,000 to 9,000 feet; abundant. ♀ probably *viridifasciata*, but possibly *pacifica*, as the disk of the pronotum is distinctly granulated; the median carina in the foveola of the vertex is distinct, extending into the sulcus of the frontal costa. No. 10, 98–109 inclusive.

7. TOMONOTUS SULPHUREUS, ♂.

Colors very strong (the dark portion of the wings apparently larger in proportion to the yellow than usual?). 63–65; 64 ♀.

8. TOMONOTUS TENEBROSUS, Scudd., ♂.

Syn.—*Ædipoda tenebrosa*, Scudd., Hayden's Geol. Surv. Neb. 251.
Tomonotus pseudo-neietanus, Thos., Proc. Acad. Nat. Sci. Phila. 1870, 80.
Tomonotus tenebrosus, Thos., Syn. Acrid. N. Am. 107.
Arphia sanguinaria?, Stål, Recen. Orth. 119.
Arphia tenebrosa, Scudd., Bul. U. S. Geol. Surv. 1876.
Arphia simplex?, Scudd., Proc. Bost. Soc. Nat. Hist. xvii, 1874, 5.
Arphia conspersa?, Scudd., Proc. Bost. Soc. Nat. Hist. xvii, 1874, 5.
Arphia luteola?, Scudd., Proc. Bost. Soc. Nat. Hist. xvii, 1874, 5.

There is really but little difference between this species and *T. sulphurea* except the color of the wings, and *T. carinata* of Scudder appears to form a connecting link. 66. (95–60 & 77–57 ♀.) (81 ♂.)

9. ARPHIA NEGLECTA.

Syn.—*Ædipoda neglecta*, Thos., Proc. Acad. Nat. Sci. Phila. 1870, 276.
Arphia neglecta, Scudd., Bul. U. S. Geol. Surv. 1871, 46. (No. 12.)

10. CIRCOTETTIX UNDULATA.

Syn.—*Ædipoda undulata*, Thos., Geol. Surv. Terr. 1871, 46. (Nos. 62 & 73.)

11. MESTOBREGMA PLATTEI, ♀.

Syn.—*Ædipoda plattei*, Thos., Syn. Acrid. 123

The specimens being in color show the wings to be a bright yellow at the base; the dash-band is very distinct black, and occupying about $\frac{1}{3}$ of the length of the wings.

12. MESTOBREGMA KIOWA, Thos., ♂.

Syn.—*Ædipoda Kiowa*, Thos., Geol. Surv. Terr. 1871, 461.
Psinidia Kiowa, Thos., U. S. Geog. Surv. West 100th Merid. vol. iv, 885.

Two or three specimens. These specimens enable me to make the following addition to the description as given in my "Synopsis of North American Acrididæ." The median carina of the pronotum may properly be described as somewhat prominent, the wings pale lemon-yellow at the immediate base, the remaining portion of the wings being transparent with dark nerves and nervules. It would probably have been better to have made the specific name *platteana*. (No. 72.) Do. ♀.—Usually a broad flesh-colored band extends obliquely across the face from the middle of the clypeus upward and backward across the cheek toward the occiput. A black stripe runs obliquely downward and forward from the lower and hinder margin of each eye to the middle of the lower part of the face, where those from the opposite sides meet. The vertex above this is a dull flesh-color. 88–58. Do. ♀, (84–57), (93–59).

13. SPHARANGEMON COLLARE, Scudd.

Syn.—*Ædipoda collaris*, Scudd. Hayden's Geol. Surv. Neb. 250.
Spharangemon collare, Scudd., Proc. Bost. Nat. Hist. xvii, 1874, 5.

14. *ÆDIPODA CAROLINA*, (7), (96-60), (96-74).

15. *HIPPISCUS CORALLIPES*, Hald., ♂.

Syn.—*Ædipoda corallipes*, Thos., Syn. Acrid.

Rather small specimens. One specimen that approaches somewhat near to *Æ. montana*. (12.) Do. ? ♀.—Badly damaged (16, 47).

ACRIDINI.

16. *PEZOTETIX DODGEI*, Thos.

Syn.—*Caloptenus Dodgei*, Thos., Can. Ent. 1871, 168.

Several specimens, males and females, some of which approach so near to my *Pez. unicolor* that it is impossible to distinguish the two. (Nos. 20, 46, 48, 35, 24, &c.)

17. *PEZOTETIX ALBA*, Dodge.

The only specimen in the collection is without antennæ or posterior legs, and varies somewhat from Mr. Dodge's description, yet I am satisfied belongs to that species. It is of an ashy-green color, and the stripe on the side of the pronotum is black. (79.)

18. *HESPEROTETIX VIRIDIS*, Thos.

Syn.—*Caloptenus viridis*, Thos., Geol. Surv. Terr. 1871, 450.
Ommatolampis viridis, Thos., Synop. 156.

This varies from the original description in being very short-winged, the elytra not more than one-third the abdomen.

19. *CALOPTENUS FEMUR-RUBRUM*, De Geer.

Specimens vary somewhat from the type in the marking of the elytra, and the slight variation of the cerci of the male. (No. 92.)

20. *CALOPTENUS ATLANIS*, Riley. (69.)

21. *CALOPTENUS OCCIDENTALIS*, Thos. (90.)

22. *CALOPTENUS BIVITTATUS*, Say.

A number of specimens from different sections, some of more than ordinary size and others are unusually small.

LOCUSTIDÆ.

23. *SCUDDERIA CURVICAUDA*, De Geer.

One specimen from Camp 55, female. (No. 75.)

24. *ANABRUS PURPURASCENS*, Uhler.

A number of specimens, mostly females, from various sections; some of these so closely resemble *A. simplex* that were it not for the locality I should place them in that species. (Nos. 110-108 and 120-122.)

25. *ANABRUS COLORADUS*, Thos.

A very distinctly marked specimen. (From Lot 11.) No. 119.

MEMORANDA.

ENTOMOLOGY.

Special collection.

ORTHOPTERA.

(Dry and in alcohol.)

Made during the San Juan reconnaissance in Southwestern Colorado and Northern New Mexico.

1877.

Lieut. C. A. H. McCauley, Third Artillery, in charge.

Nos.	Collector.	Date.	Locality.	Elevation.	Remarks.
1-12	McCauley.	July 22	Pagosa Hot Springs, San Juan River, Colorado.	7,084 feet.....	
13	....do	July 27	Weeminuche Creek, tributary to Rio Piedra, Colorado.	.....
14	....do	Aug. 7	Lower Rio Blanco, Colorado, near wagon-road.	.....
15	....do	Aug. 14	Upper part Rio Blanco, Colorado.	.....
16	....do	Aug. 29	Upper part of Rio de los Pinos, Colorado.	.....
17-22	....do	Aug. 31	Valley Vallecito Creek, above its mouth.	.....
23-48	....do	Sept. 1-3	Upper part of Vallecito Creek, Colorado, between camps 51 and 52.	.....
49-61	....do	Sept. 4	Near Lake Columbine, above or near headwaters of West Fork of Vallecito Cr'k, in the Needle of Quartzite Mountains, Colorado.	Above 12,000 feet..	} Needle or Quartzite Mountains, Colorado, upper regions.
62-64	....do	Sept. 12	Rio Florida, Colorado, crossing of upper wagon-road.	.....
65	....do	Sept. 3	West Fork of Vallecito Creek, Colorado, upper part.	.....
66	....do	Aug. 20	Pagosa Springs, Colorado.	.....
67-69	....do	Aug. 23	Rio Piedra, Colorado, at bridge on upper road.	.....
70-72	....do	Aug. 25	Rio de los Pinos, Colorado, camp at bridge on upper road.	.....
73-74	....do	Aug. 27	Park on Rio de los Pinos, Colorado, at mouth of Vallecito.	.....
75	....do	Sept. 11	Rio Florida, Colorado, camp 55, at upper-road crossing.	.....
76	....do	Sept. 14	Cañon, upper waters Rio Blanco, Colorado.	.....
77-86	....do	Sept. 15	Camp 57, on the Lower Florida, Colorado.	.....
87-92	....do	Sept. 16	Camp 58, on Rio de las Animas, Colorado, near mouth of the Florida.	.....
93-94	....do	Sept. 17	Lower Rio de las Animas, New Mexico, near mouth.	.....
95-97	....do	Sept. 18	Camp 60, Rio de las Animas, Colorado, near camp 58.	.....

NOTE.—The above specimens are all dry.

SPECIMENS IN ALCOHOL.

98-109	McCauley.	July...	Camps along the Rio Conejos and Rio Chama, all in Colorado.	7,000 to 9,000 feet..	
110-119	....do	July and August.	Pagosa Springs, Colorado	7,084 feet.....	} Numbers also in the valleys of the San Juan and Navajo, 7,000 to 10,000 ft.
120-122	....do	Aug. 25 to Sept. 6	Along Rio de los Pinos and Vallecito, Colorado.	7,000 to 9,000 feet..	

NOTES ON THE ORTHOPTERA.

- No. 1. Numerous at and about Pagosa Springs.
 Nos. 2, 3, 4, 5, and 6. Same.
 No. 7. This species of the Acrydii was abundant on some of the grassy bottom-lands along the rivers in parts of July and August, and was particularly useful in supplying the morning table, being highly prized by the large-sized speckled trout (*S. fontinalis*) of the rivers. It is peculiarly aggravating to a lover of sport to find that his fine Scotch or English flies are, for a few weeks of the season at least, but of little value, and that the ordinary "cattle boy" can have almost as good "luck" with sometimes a manufactured hook and home-made appliances, capturing his bait near the river-bank, as he with his imported and costly rods and fishing-tackle. With the passage of the hottest summer days, the trout lose their liking therefor, and artificial flies, as a novelty, can be strongly brought into play with general good results.
 Nos. 8, 9, 10, 11, and 12. Same note as to No. 1.
 No. 15. Numerous in the valley of this and the Navajo, and also on Weeminuche Creek, a large tributary of the Piedra. They were more frequently observed in the early morning than at any other time. As we rode along the trail, through the high-grassed valley, with the morning sun scarcely over the mountain tops, they could be seen upon every side, dropping on the approach of the train from their look-out stations upon a blade of grass.
 No. 16. Numbers observed. Altitude, 9,000 feet. All the large trout (*S. fontinalis*) were at this time in this altitude or vicinity, being taken plentifully every evening, and all of good size, with this and other large orthoptera as a bait. 1,200 feet down, near Camp 45, all trout were small.
 Nos. 17 and 18. Plentiful.
 No. 19. Species similar to No. 16. Lost in transit.
 No. 20. Very numerous in this valley.
 No. 21. Specimen similar to No. 20. Lost in transit.
 No. 23. Same as No. 20.
 No. 24. Same as No. 20.
 Nos. 23-48. Were taken along a stream tributary to the Vallecito, at an altitude of 10,000 feet. The region was a mass of quartzite rocks, strewn everywhere along the track of the water, up which we had to hug our way to find a foothold, cutting the trail as we went. Coming upon a small patch of high grass on a "bench" by the river, an isolated spot amid rocks and fallen timber, the place was so covered with almost a cloud of orthoptera that it was a subject of remark by every one.
 Nos. 49-61. These specimens were taken on top slopes and grassy places of the crags above Camp 52, the highest camping place but one occupied during the entire trip. They are interesting from the fact of their occupying an altitude of over 12,000 feet, and some nearly or quite 13,000 feet. This was a considerable height above timber-line and in the region of the strictly Alpine flora.
 No. 64. None of these were taken in the lofty elevations where were those numbered 49-61.
 No. 67. Frequently seen in this vicinity.
 No. 74. Seen often during marches along the Rio de los Pinos and Rio Florida.
 No. 75. Observed also along the San Juan and Los Pinos Rivers.
 No. 76. This specimen was similar to No. 74. Lost in transit.
 No. 77. Plentiful in bottom-land near the River Rio Grande.
 No. 79. Numerous on plain or mesa bench above the River Florida, in the immediate vicinity of the water.
 Nos. 80, 81, 82, and 83. Same remarks as above.
 No. 86. More observed here than at any other point along the river.
 No. 87. Abundant in the most fertile localities along this river and others traversed during the last month, as the Rio Piedra, De los Pinos, &c. The peculiar color of the wings of this species of the Acrydii makes it easily distinguishable and perhaps more readily observed on the march than any other.
 No. 97. Very numerous in the bottom-lands along this part of the river valley.

SECTION II.

LEPIDOPTERA.

BY PROF. HERMAN STRECKER.

Letter of transmittal.

READING, PA., August 9, 1878.

SIR: I transmit herewith a classified list of the *Hymenoptera*, *Lepidoptera*, and *Coleoptera* collected by you in Southwestern Colorado and the adjoining border of New Mexico during the San Juan reconnaissance made under your charge in 1877. With a few exceptions, which I have designated, the examples are all from Colorado.

A few reptiles were sent to me along with the collection of insects, these I have identified and classified at the end of this paper.

The collection of *Lepidoptera* is very rich, including a number of rare and new species; prominent among the former are the aberrant ♀ examples of *Argynnis Nokomis*, the beautiful *Melitæa Alma*, the second known example, and *Hemileuca Juno*, the only examples of which previously known were taken by Dr. Palmer on the borders of Arizona, and are now in the museum of the Department of Agriculture.

The *Heteroceres* were rich in new species, there being no less than eleven, most of them being more or less conspicuous for beauty, these I have figured on the accompanying plates; prominent among them is the superb *Ctenucha Sanguinaria*, the most splendid of its genus yet found in North America.

Among the *Coleoptera* are some rare species, but none new.

In the *Hymenoptera* are several rare and one new species, the latter a *Smicra*, which I have herein described.

For aid in determining the *Hymenoptera* I give thanks to Mr. Chas. A. Blake and E. T. Cresson, for the *Coleoptera* to Mr. A. S. Fuller, and for the *Reptilia* to Mr. John Ryder.

Very respectfully, yours, truly,

HERMAN STRECKER.

Lieut. CHAS. A. H. MCCAULEY, U. S. A.,

In charge of the San Juan Reconnaissance, Fort Leavenworth, Kans.

REPORT.

HYMENOPTERA.

TENTHREDINIDÆ.

UROCERUS.

Urocerus Flavicornis, Fab. ♀.
(*Sirex Bizonatus* Steph.)

APIDÆ.

APATHUS.

Apathus Elatus Fab. ♂.

BOMBUS.

Bombus Ferridus Fab. ♂ ♀ var.
Bombus Ternarius Say.

MEGACHILE.

Megachile Bucephala Smith.

MELISSODES.

Melissodes Trifasciata Cress.

ANTHIDIUM.

Anthidium Formosum Cress.

VESPIDÆ.

VESPA.

Vespa Occidentalis Cress.

POLISTES.

Polistes Sulphurea Sauss.

POMPILIDÆ.

POMPILUS.

Pompilus Æthiops Cress.

ICHNEUMONIDÆ.

ICHNEUMON.

Ichneumon Longulus Cress., ♂.

OPHION.

Ophion Purgatus Say.
Ophion Bilineatus Say.

THYREOPUS.

Thyreopus Vicinus Smith, ♂.

CHALCIDIDÆ.

SMICRA.

Smicra Bimaculata, n. sp.

Black; face prolonged beneath eyes, closely punctured, on each side at base of antennæ a subtriangular, lemon-yellow spot; mandibles castaneous at tips; scape of

antennæ black, finely punctured (flagellum broken off). Prothorax with a minute dorsal carina, on each side of which is a yellowish-brown spot; meso- and meta-thorax coarsely punctured, sparsely clothed with whitish pubescence; tegulæ dark honey-yellow. Wings yellowish hyaline, sub-iridescent. Four anterior legs blackish externally, honey-yellow deepening to castaneous within; tarsi yellowish-brown. Posterior coxæ black; femora lemon-yellow, with an ovate castaneous stain at middle; femoral teeth nine in number, tipped with black; tibiæ blackish, with a yellow spot on each side near base; tarsi pale brown. Abdomen sub-globose, shining, castaneous, paler above on first segment; petiole long, lemon-yellow, with a lateral castaneous streak extending to middle. Length $6\frac{1}{2}$ mm. Hab. Colorado.

FORMICIDÆ.

FORMICA.

Formica Pennsylvanica De Geer, ♂ ♀.

RHOPALOCERA.

Family PAPILIONIDÆ.

Genus PAPILIO Linn.

Papilio Daunus.

Papilio Daunus, BOISDUVAL, Spécies Gén. des Lépidoptères, i, p. 342 (1836).—RIDINGS, Proc. Ent. Soc. Phila. i, p. 278, fig. 2 (1862).—STRECKER, Lep. Rhop.-Het. i, p. 45, t. vi, 1873.—EDWARDS (W. H.), Butt. N. Am. ii, t. 2, *Papilio* (1874).

Three males taken August 17 near the Rio de los Pinos present no difference from those found in other parts of Colorado and New Mexico, which are smaller than those from Mexico and Central America.

It is easily distinguished from its near allies *Rutulus*, *Turnus*, and *Eurymedon* by the narrowness of the black bands of wings and by the three tails to ~~primary~~ *secondary*.

Papilio Rutulus.

Papilio Rutulus, BOISDUVAL, Annales de la Société Entomologique de France, x, 2e série, p. 279 (1852).—MORRIS, Syn. Lep. N. Am. p. 3 (1862).—EDWARDS (HY.), Proc. Cal. Acad. Nat. Sci. v, p. 161 (1873).

One male, much worn, taken July 27 at Weeminuche Creek, head of Tule Valley.

This is the common representative of *P. Turnus* on the Rocky Mountains and Pacific slope, from which it differs in the greater elongation of the wings, in the submarginal row of yellow spots being confluent, and in the absence of the dimorphic black female.

Papilio Zolicaon.

Papilio Rutulus, BOISDUVAL, Annales de la Société Entomologique de France, x, 2e série, p. 281 (1852).—MORRIS, Syn. Lep. N. Am., p. 4 (1862).—STRECKER, Lep. Rhop.-Het. i, p. 46, t. 6 (1873).—EDWARDS (HY.), Proc. Cal. Acad. Nat. Sc. v, p. 163 (1873).—EDWARDS (W. H.) Butt. ii, t. vi, *Pap.* (1875).

Papilio Zolicaon, LUCAS, Rev. Zool. p. 136 (1852).

Papilio Machaon var. *Californica*, MENETRIES, Cat. Mus. Petro. Lep. i, p. 69 (1855).

At Pagosa Springs, July 21, two males.

This is closely allied to *P. Machaon*, one of the most obvious points of difference being in the black pupil of the anal ocellus, which is absent in the latter.

It feeds, in the larval state, on the umbelliferæ, as do also its allies *Machaon* and *Asterius*.

Papilio Asterius.

Papilio Asterius, CRAMER, Papillons Exotiques des Trois Parties du Monde, etc., iv, t. 385 (1782).

Papilio Asterias, FABRICIUS, Mant. Ins. ii, p. 1787; Ent. Syst. iii, p. 6 (1793).

Papilio Ajax, CLERCK, Icones, t. 33 (1764).

Papilio Troilus, DRURY, Ill. Ex. Ent. i, t. 11, f. 2, 3, 5 (1773).

Papilio Polyxenes, FABR., Syst. Ent. p. 444 (1775).

Near the crossing of upper road at the Rio Blanco, July 7, one female.

This example is very large, and bears no traces whatever of the mesial band of yellow spots on either wing.

The species was frequently seen, though this was the only one captured.

It has a wide range, occurring from Newfoundland south to Central America, and from the Atlantic to the Pacific, and is subject to great and remarkable variations.

Genus PARNASSIUS Latr.

Parnassius Delius var. *Smintheus*.

Parnassius Delius var. *Smintheus*, DOUBLEDAY & HEWITSON, Genera of Diurnal Lepidoptera, t. 4 (1847).—EDWARDS (W. H.), Butt. N. Am. i, t. 2-4, *Parnassius* (1872).
Parnassius Sayii, EDWARDS (W. H.), Proc. Ent. Soc. Phil. ii, p. 78 (1863).

Three, two males and one female, on July 4, at the waterfall on San Juan River, not far below Camp 32. Two of these were of the ordinary form, but one male was remarkably aberrant in that the secondaries were entirely destitute of the usual red spots on both surfaces. This remarkable example I have figured on one of the plates which accompanies this report.

This species is found along the Rocky Mountains of North America generally, and in the Old World in the Swiss Alps and Ural and Altai regions. The American lepidopterists have made the most strenuous efforts to prove this a distinct species from the European forms, but the futility of such efforts are palpably shown by comparing the Altai from *Intermedius* Men. with our Colorado examples, so close are the two that no examination, however critical, can discover any difference that would allow specific separation.

Family PIERIDÆ.

Genus NEOPHASIA Behr.

Neophasia Menapia.

Neophasia menapia, FELDER, (*Pieris M.*), Wiener Entomologische Monatschrift, iii, p. 271 (1859); Reise Nov., Lep. ii, p. 181, t. 25 (1865).—EDWARDS (W. H.), Butt. N. Am. i, t. 1, *Pieris* ♂ (1871).—STRECKER, Lepidoptera Rhop. Het. i, p. 14, t. 2, f. 4 ♀ (1873).
Pieris Tau, SCUDDER, Proc. Bost. Soc. Nat. Hist. viii, p. 183 (1861).—MORRIS, Syn. Lep. N. Am. p. 322 (1862).
Pieris Ninonia, BDL., Lep. Cal. in Ann. Soc. Ent. Belgique, xii, p. 38 (1869).

Several of both sexes taken August 11, at the Rio Florida Colorado.

This species was only seen in the southwestern corner of Colorado, toward New Mexico and Arizona; it is the most beautiful and delicate looking of all our *Pieridæ*, and in ornamentation approximates to some Malayan groups. It is found in Utah, Arizona, California, Oregon, and Vancouver's Island.

Mr. Henry Edwards discovered the *Chrysalis* attached to the trunks of pine-trees in Vancouver's Island; the larva is as yet unknown, but it doubtless, as Mr. Edwards suggests, feeds on some species of pines.

The male was first figured in Dr. Felder's great work, the Lepidoptera of the Reise der Novara; subsequently three figures, all males, though curiously given as male and female, were represented in Mr. W. H. Edwards's Butt. of N. Am.; the only figures of the female are those by myself in the Lepidoptera Rhop.—Het. (1873).

Genus PIERIS Schrk.

Pieris Napi.

Pieris Napi, LINN. (*Papilio N.*), Systema Naturæ, ed. x, 1, p. 468, n. 60 (1758); ed. xii, 1, 2, p. 760, n. 77 (1767); Faun. Suec. p. 271 (1761).—STRECKER, Lepidoptera Rhop.—Het. 1, t. 8, p. 61 (1873).
Pieris Venosa, SCUDDER, Proc. Bost. Soc. Nat. Hist. viii, p. 182 (1861).—MORRIS, Syn. p. 320 (1862).
Pieris Nasturtii, BDL., Lep. Cal. in Ann. Soc. Ent. Belgique, p. 38 (1869).

Common along Weeminuche Creek to Rio Piedro; on San Juan River to Pagosa Springs, in the Rio Navajo Valley, at upper part of the river, at Park, in the cañon of the Upper Rio de los Pinos, and at other points along the route, from July 18 to August 28.

This is a species having an immense range, being found in Labrador, British Columbia, Colorado, Utah, &c., California, Oregon, Alaska, Japan, Siberia, and all over Europe (? ex Reg. Pol.). It is subject to many variations, among which are *Oleracea* Harris, *Frigida* Scudder, *Hulda* W. H. Edwards, and *Pallida* Scudder. Owing to the little attention paid by American entomologists to the fauna of other countries, this insect was supposed to be distinct from the European species until I established their identity in 1873.*

Pieris Napi var. *Pallida*.

Pieris Napi var. *Pallida*, SCUDDER, Proceedings Boston Soc. Nat. History, viii, p. 183 (1861).—MORRIS, Syn. Lep. N. Am. p. 321 (1862).—STRECKER, Lepidoptera Rhop.—Het. p. 62, t. 8 (1873).
Pieris Iberidis, BDL., Lep. Cal. in Ann. Soc. Ent. Belgique, xii, p. 39 (1869).
Pieris Castoria, REAKIRT, Proc. Acad. Nat. Sci. Phila. p. 238 (1866).
Pieris Resedæ, BDL., Lep. Cal. in Ann. Soc. Ent. Belgique, xii, p. 39 (1869).

* *Lepidoptera Rhopaloceres and Heteroceres*, I, p. 61-63, 1873.

This is a variety of the preceding, in which the dark scales which accompany the venations of the under surface are wanting, and generally destitute of the dark marks of the other form; the male has sometimes a distinct black spot in the middle of the upper surface of primaries, but is frequently without it. It was observed and taken in considerable numbers in most places along the route.

Pieris Protodice.

Pieris Protodice, BOISDUVAL & LECONTE, Histoire Générale et Iconographie des Lépidoptères et des Chénilles de l'Amérique Septentrionale, p. 45, t. 17 (1833); Species Général, i. p. 543 (1836).—MORRIS, Syn. Lep. N. Am. p. 17 (1862).

This is another species of wide distribution, occurring in the Canadas and in all parts of the United States and Territories from the Atlantic to the Pacific.

The survey captured many examples at Pagosa Springs, along the Rio Piedro, and at other points where it was in abundance, from middle of July to end of August.

Pieris Occidentalis.

Pieris Occidentalis, REAKIRT, Proceedings of the Entomological Society of Philadelphia, vi, p. 133 (1866).

Pieris Calyce W. H. EDWARDS, Trans. Am. Ent. Soc. iii, p. 189 (1870).

A single male was taken July 21 at Pagosa Springs, Colo. Though not as common as *Protodice*, to which it is nearly allied, it is by no means a rare species in Colorado, California, and Oregon; its position is between the preceding and the European Alpine, *Callidice* Esper.

Genus NATHALIS Bdl.

Nathalis Iole.

Nathalis Iole, BOISDUVAL, Species Général des Lépidoptères, i, p. 589 (1836).

Nathalis Felicia, POEY, Mem. Cuba, i, p. 443, t. 18 (1851).

Nathalis Irene, FITCH, 3d Report N. York State Agr. Soc., suppl. p. 485 (1856).

Nathalis Luteolus, REAKIRT, Proc. Ent. Soc. Phila. ii, p. 350 (1863).

One female, August 8, in Rio Navajo Valley, at upper part of the river.

This pretty little insect is found in Texas, Louisiana, Antilles, Colorado, California, Mexico, and Central America.

Nathalis is closely related to the exotic genera *Idmais* Bdl. and *Teracolus* Swains.

Genus COLIAS Fabr.

Colias Philodice.

Colias Philodice, GODART, Encyclopédie Méthodique, ix, p. 100 (1819).—SWAINSON (*Eurymus P.*), Zool. Ill. ii, 2d ser. t. 60 (1831).—BOISDUVAL & LECONTE, Lep. Am. Sept. p. 64, t. 21 (1833).

Papilio Palæno, CRAM., Pap. Exot. i, t. 14 (1875).

Zerene Anthyale, HÜB., Zutr. Ex. Schmett. f. 307, 308 (1823).

Colias Europome, STEPH., Ill. Brit. Ent. Haust. i, p. 10, t. 1 (1828).

Colias Chrysotheme, *Nastes et Santes*, FITCH, Rep. N. York State Agr. Soc. viii, p. 378 (1854).

Colias Eriphyle, W. H. EDWARDS, Trans. Am. Ent. Soc. v, p. 202 (1876).

A number of examples of both sexes, July 21 to September 15, at Pagosa Springs; along Weeminuche Creek to Rio Piedro and at Rio de los Pinos near crossing of the upper road.

The Colorado examples in some instances are exactly like those found east, while others present some differences, being of a more delicate shade of yellow and having the disk of under side of primaries suffused with pale orange. Some are of a more greenish tint on under surface of secondaries. Examples agreeing with these latter occur in British Columbia, and were described by W. H. Edwards as a distinct species under the name *Eriphyle*. One of the reasons he gives for their distinctness was that they invariably have the orange spot of upper surface of secondaries present; two males of the present suite show no trace whatever of these orange spots.

He further says in allusion to Colorado examples: "Mr. Mead brought from Colorado in 1871 a *Colias* very close to this (*Eriphyle*) from Lake Labache, and which in Reakirt's paper on the Butterflies of Colorado (Proc. Ent. Soc. Phil. 1867, p. 14*) is doubtless the one called *Philodice*. The same form was brought from Montana by Dr. E. Coues, when engaged in the boundary-line commission. For the present I shall give no opinion as to these, but they seem to me nearer to *Eriphyle* than to *Philodice*."

The examples of Reakirt's above alluded to passed into my keeping; they are in no wise different from those found in Pennsylvania, &c.; systematists have created by far too many species of our *Coliades*, making of every local variety a different species.

* Should be p. 135, not 14, as Edwards erroneously cited.

Colias var. *Eurytheme*.

Colias var. *Eurytheme*, BOISDUVAL, Annales Société Entomologique de France, 2e série, x, p. 286 (1852).—MORRIS, Syn. Lep. N. Am. p. 29 (1862).—EDWARDS (W. H.), Butt. N. Am. i, t. 3 (1869).

Colias Chrysotheme var., BOISDUVAL, Sp. Gen. i, p. 644 (1836).

Colias Amphidusa, BDL., Ann. Soc. Ent. Fr., 2e sér. x, p. 286 (1852).

Colias Edusa var. *Californiana*, MEN., Cat. Mus. Petr. Lep. i, p. 80 (1855).

This common form, the summer brood of *C. Chrysotheme*, was found in numbers almost everywhere on the route. The larva feeds on buffalo-grass and other species of clover. It not only occurs in Colorado, but all over the Southern and Western States from the Atlantic to the Pacific, and is occasional in Pennsylvania, and even in New York and the Canadas.

Family LYCÆNIDÆ.

Genus THECLA Fabr.

Thecla Crysalus.

Thecla Crysalus, EDWARDS (W. H.), Transactions American Entomological Society, iv, p. 344 (1873).

One male example of this beautiful insect was taken on the Rio Florida. It is found also in Utah and Arizona and probably in New Mexico. It belongs to or near the same group as *T. Quercus* L., to which species it bears some resemblance.

Thecla Melinus.

Thecla Melinus, HÜBNER (*Strymon M.*), Zuträge zur Sammlung Exotischer Schmetterlinge, fig. 121, 122 (1818).

Thecla Hyperici, BOISDUVAL & LECONTE, Lep. Am. Sept. p. 90, t. 28 (1833).—MORRIS, Syn. Lep. N. Am., p. 94 (1862).

Thecla Favonius, BDL. & LEC., Lep. Am. Sept. p. 95, t. 30 (1833).—MORRIS, Syn. Lep. N. Am. p. 95 (1862).

Thecla Humuli, HARRIS, Ins. Inj. Veg. 1st ed. p. 215 (1841); 2d ed. p. 235 (1852); 3d ed. p. 276, t. 4 (1862).

Thecla Pan, HARRIS, Hitch. Report Geol. Min. etc. Mass. p. 590 (1833).

Thecla Silenus, DOUBLEDAY, List British Museum, ii, p. 31 (1847).

Thecla Melinus var. *Pudica*, HY. EDWARDS, Proc. Cal. Acad. Nat. Sci. vii, p. 172 (1826).

One example, a male, July 28, near the Rio Piedro. Found in all parts of the United States and Territories, from Maine to Florida, and from the Atlantic to the Pacific.

Thecla Titus.

Thecla Titus, FABRICIUS (*Hesperia T.*), Entomologia Systematica, iii, 1, p. 297 (1793).

Strymon Mopsus, HÜBNER, Verz. Bek. Schmett. p. 74 (1816); *Chrysophamus M.*, Zutr. Ex Schmett. fig. 135, 136 (1818).

Thecla Mopsus, BOISDUVAL & LECONTE, Lep. Am. Sep. p. 109, t. 34 (1833).—MORRIS, Syn. Lep. N. Am. p. 102 (1862).—HARRIS, Ins. Inj. Veg. 3d ed. p. 278 (1862).

Three, August 25, Rio de los Pinos, near crossing of upper road. Likewise a species of wide range; the larva feeds on various species of *Quercus*.

Genus LYCÆNA Fabr.

Lycæna Acmon.

Lycæna Acmon, DOUBLEDAY & HEWITSON, Genera of Diurnal Lepidoptera, ii, p. 294, t. 76 (1852).—STRECKER, Lep. Rhop.-Het. p. 88 (1874).

Lycæna Antægon, BDL., Ann. Soc. Ent. Fr. 2e sér. x, p. 295 (1852).—MORRIS, Syn. Lep. N. Am. p. 87 (1862).

Taken September 15, in the Lower Florida Valley, above the Indian reservation. This is one of the commonest of the Western species, abounding in Colorado, Utah, California, Oregon, and adjacent Territories, and is found in all parts from May to end of September.

Lycæna Melissa.

Lycæna Melissa, EDWARDS, (W. H.) Transactions American Entomological Society, iv, p. 346 (1873).—STRECKER, Lepidoptera Rhop.-Het. p. 88, t. 10 (1874); Catalogue, p. 93 (1878).—MEAD, Wheeler's Report, v, p. 783, t. 36 (1875).

One male taken; a number seen in July at Pagosa Springs. It resembles very much the preceding, but is larger, and not of as common occurrence.

Lycæna Battoides.

Lycæna Battoides, BEHR., Proceedings California Academy of Natural Sciences, iii, p. 282 (1867).—STRECKER, Lep. Rhop.-Het. p. 87 (1874); Catalogue, p. 94 (1878).

Lycæna Glaucon, EDWARDS, (W. H.), Trans. Am. Ent. Soc. iii, p. 210 (1871).

At Rio Navajo Valley, at upper part of river, August 8, and at Rio de los Pinos, at the park, at mouth of the Vallecito, August 27, several examples, all males, were taken.

This is a rarer species than either of the preceding; it is also found in Nevada and California.

Lycæna Oro.

Lycæna Oro, SCUDDER (*Nomiades O.*), Canadian Entomologist, viii, p. 23 (1876); Buffalo Bulletin, iii, p. 117 (1876).—STRECKER, Syn. Catalogue, p. 96 (1878).
Lycæna Lygdamus, MEAD (nec. Dbldy.), Wheeler's Rept. v, p. 784 (1875).

Two males at Pagosa Springs. This species is closely allied to *Lygdamus* Dbldy., from which, however, it differs in many points, which, when taken collectively, entitles it to specific distinction. It is one of the early species, and the two above were much worn, and were the only ones noticed.

Family DANAIIDÆ.

Genus DANAIS Latr.

Danais Plexippus.

Danais Plexippus, LINNÉ (*Pap. P.*), Systema Naturæ, ed. x, p. 471 (1758); ed. xii, 1, 2, p. 767 (1767); Mus. Lud. Ur. p. 262 (1764).—CRAMER, Papillons Exotiques iii, t. 206, E, F. (1782).—Herbst. Nat. Schmett. vii, p. 19, t. 46, f. 1, 2 (1794).—DEBEAUVOS, Ins. Afr. et Am. p. 172, t. 4, f. 1, a, 1 b (1805).—STRECKER, Syn. Catalogue, p. 105 (1878).
Danaus Plexippus, SAY, Am. Ent. iii, t. 54 (1828).—PEALE, Lep. Am. i, t. 7 (1833).
Papilio Eriippus, CRAMER, Pap. Ex. i, t. 3, A, B (1779).
Papilio Archippus, FABR., Ent. Syst. iii, 1, p. 49 (1793).—ABBOTT & SMITH, Ins. Ga. i, t. 6 (1797).—SHAW & NODDER, Nat. Miss. xxiii, t. 1006 (1790-1813).
Danais Archippus, BDL.-LEC., Lep. Am. Sept. p. 137, t. 40 (1833).—MORRIS, Syn. Lep. N. Am. p. 38 (1862).
Danais Archippe, GODART, Enc. Méth. ix, p. 184 (1819).
Anosia Megalippe, HÜBNER, Sam. Ex. Schmett. ii (1806-1824).
Anosia Menippe, HÜBNER, Verz. Bek. Schmett. p. 16 (1816).
———CATESBY, Nat. Hist. Car. ii, p. 88.

One female, July 8, at Rio Navajo Valley, on upper part of river. One male, July 21, at Pagosa Springs. Many more were seen at various parts of the route.

This insect is not only found in all parts of the United States and Territories and Canada, but also in Mexico, Central and South America, and in Australia and other islands of the Pacific. Its larva, as is well known, feeds on *Asclepias*.

Family NYMPHALIDÆ.

Genus EUPTOIETA Dbldy.

Euptoieta Claudia.

Euptoieta Claudia, CRAMER (*Papilio C.*), Papillons Exotiques, i, t. 69, f. E, F (1779).—STRECKER, Syn. Catalogue, p. 109 (1878).
Papilio Damius, HERBST, Natursyst. Schmett, ix, p. 184, t. 256, f. 1, 2 (1798).
Papilio Clausius, HERBST, Nat. Schmett. ix, p. 189, t. 257 (1798).
Papilio Nigrosignatus, GOEZE, Ent. Beyt. iii, 1, p. 183, n. 87 (1779).
Argynnis Columbina, GODART, Enc. Méth. ix, p. 260 (1819).—BOISDUVAL & LÉCONTE, Lep. Am. Sept. p. 153, t. 44 (1833).—MORRIS, Syn. Lep. N. Am. p. 44 (1862).—GLOVER, Agr. Rept. p. 61 (1854); p. 66, 105, t. ix (1855).

Males and females at Pagosa Springs July 21; somewhat smaller than those from Georgia, Florida, &c.; otherwise not differing materially.

Larva feeds on violets, sedum, passion-flower, and May-apple (*Podophyllum*). It is found throughout the Southern and Western States, in Central America, Chili, Buenos Ayres, and Patagonia.

Genus ARGYNNIS Fabr.

Argynnis Edwardsii var. *Meadii*.

Argynnis Meadii, EDWARDS (W. H.), Transactions American Entomological Society, iv, p. 67 (1872); Butt. N. Am. ii, t. 2, Arg. (1875).
Argynnis Edwardsii var. *Meadii*, STRECKER, Syn. Catalogue, p. 110 (1878).

Examples were taken and seen in some abundance, July 28 to September 1, along Weeminuche Creek to Rio Piedra, and between the Upper Rio Piedra and the Rio Nutrias, and at the upper part of Vallecito Creek at Needle Mountains.

This is a small variation of *Edwardsii* Reak, confined probably to Montana and some parts of Colorado. Independent of the small size, the only difference of any note is the somewhat brighter green of under surface of secondaries.

Argynnis Nokomis.

Argynnis Nokomis, EDWARDS (W. H.), Proc. Academy Natural Sciences of Philadelphia, p. 221 (1862); Butt. N. America, i, t. 4, Arg. (1868).—MEAD, Wheeler's Report, v, p. 751, t. 35 (1875).—STRECKER, Syn. Catalogue, p. 110 (1878).

Two examples, both females, taken September 15, at the Lower Florida River, in the valley above the Indian reservation.

I was greatly surprised to find this splendid insect in the present collection, it having never before been received from Colorado; the single original (male) type was said to have been captured in the Bitter Root Mountains, which divide Montana and Idaho; subsequently the expedition in 1871, under Lieutenant Wheeler, brought in five males and two females from Arizona, and in 1877 Mr. Neumoegen, of New York, received a number of both sexes from a correspondent in inner Arizona.

The present two examples from Colorado differ notably from all those from Arizona in the following particulars: On under surface, the red color of primaries is darker, and covers evenly the whole wing except toward and at the apex; on the secondaries, the whole space interior to the second of the two outer rows of silver spots, which in the Arizona examples is powdered with grayish-green, is deep reddish-brown, nearly of the same color as in the female of *Aphrodite* or the male of *Leto*; they are larger than most of those I have seen from Arizona. On the upper side it presents no differences. I have always contended that *Nokomis* was a pale, abnormal form of *Cybele*, of which we have so many other like instances in other species from the dry salt regions of Utah and Arizona, and those intermediate examples from Colorado, with their dark reddish undersides, seem to strengthen my opinion. I can but regret that no males were captured (unless the following be really its male), as I consider this by far the most interesting insect in the whole collection.

Argynnis Cybele.

- Argynnis Cybele*, FABRICIUS (*Pap. C.*), Systema Entomologica, p. 516 (1775); Ent. Syst. iii, p. 145 (1793).—HERBST, Natursyst. Schmett. ix, p. 178, t. 255 (1798).
Argynnis Cybele, BDL., Lec. Lep. Am. Sept. p. 151, t. 45 (1833).—MORRIS, Syn. Lep. N. Am. p. 42 (1862).—EDWARDS (W. H.), Butt. N. Am. i, t. 2, Arg. (1868).—STRECKER, Syn. Catalogue, p. 111 (1878).
Papilio Daphnis, CRAMER, Pap. Ex. i, t. 57 (1779).

One male at the Rio Blanco, near its headwaters. This expands $2\frac{1}{2}$ inches; the primaries are more elongate and pointed apically than in the Eastern examples, and the two black lines that form the border on upper surface of wings are diffuse, nearly filling the space between them with blackish; the other of the black markings are all narrower; the ground-color above and the under surface generally are precisely as in Eastern examples.

I must confess to considerable astonishment at receiving this insect from Colorado, it being the first example known to have been taken so far west, and I am strongly inclined to the belief that it is the male of the above-described form of *Nokomis*.

Argynnis Atlantis.

- Argynnis Atlantis*, EDWARDS (W. H.), Proceedings of the Academy of Natural Sciences of Philadelphia, p. 54 (1862); Butt. N. Am. i, t. 5, Arg. (1869).—STRECKER, Syn. Catalogue, p. 112 (1878).

A number of examples, male and female, taken July 25, at Weeminuche Pass, head of Rio de los Pinos, and one male, August 1, in the valley of Upper San Juan River. These are all somewhat paler beneath than the more Northern and Eastern examples.

Argynnis Myrina.

- Argynnis Myrina*, CRAMER (*Pap. M.*), Papillons Exotiques, ii, t. 189 (1779).—GODART, Enc. Méth. p. 268, 806, ix (1819).—SAY, American Entomology, iii, t. 46 (1828).—BOISDUVAL & LECONTE, Lep. Am. Sept. p. 155, t. 45 (1833).—KIRBY, Fauna Americana-Boreali, iv, p. 290 (1837).—HARRIS, Insects Inj. Veg. 3d ed. p. 286, f. 112 (1862).—MORRIS, Syn. Lep. N. Am. p. 43 (1862).—STRECKER, Syn. Catalogue, p. 115 (1878).
Papilio Myrinus, HERBST, Natursyst. Schmett. ix, p. 178, t. 255 (1798).

One male taken July 26, at Upper Weeminuche Creek (a tributary of the Rio Piedra) does not differ from those from other parts of the United States and British Columbia.

Argynnis Kriemhild, nov. sp.

Female, size and shape of *A. Epithore* Boisid. On upper surface not quite as dark as in that species, the black markings not as heavy, and there is no dark suffusion at the basal parts; the under surface much paler than in *Bellona*, *Epithore*, or any of the allied species, though of the same style of ornamentation; the broad irregular mesial band and basal spots of secondaries are of a uniform clear, rather pale yellow, and all save the basal spot at costa are edged with a sharp dark brown line; this is the species which I have cited in my catalogue on p. 117 as *Bellona* var., there described from a single example received from Utah. The reception of other examples since from Arizona as well as the present ones from the Rio Florida Colorado, all of which examples are remarkably constant, has led me to the conclusion that this is a form entitled to specific distinction.

Genus MELITÆA Fabr.

Melitæa Pratensis var. *Pallida*.

Melitæa Pallida, EDWARDS (W. H.), Proceedings of the Entomological Society of Philadelphia, ii, p. 505 (1864).—MEAD, Wheeler's Report, v, p. 763 (1875).

Melitæa Pratensis var. *Pallida*, STRECKER, Syn. Catalogue, p. 121 (1878).

Phyciodes Camillus, EDWARDS (W. H.), Trans. Am. Ent. Soc. iii, p. 268 (1871).—MEAD, Wheeler's Rept. p. 764 (1875).

Phyciodes Emissa, EDWARDS (W. H.), Trans. Am. Ent. Soc. iii, p. 269 (1871).

Taken latter part of July and beginning of August at Weeminuche Creek and other localities along the route; it is the Colorado form of the Californian *Pratensis* Behr., and is also found in Utah, Kansas, and Texas.

Melitæa Nycteis.

Melitæa Nycteis, DOUBLEDAY & HEWITSON, Genera of Diurnal Lepidoptera, p. 181, t. 23, f. 3 (1846-1850).—MORRIS, Syn. Lep. N. Am. p. 325 (1862).—STRECKER, Syn. Catalogue, p. 122 (1878).

Melitæa Oenone, SCUDDER, Proc. Essex Inst. iii, p. 166 (1862).

Melitæa Nyctis, BOISDUVAL, Lep. Cat. Ann. Soc. Ent. Belgique, p. 53 (1869).

Melitæa Harrisii, EDWARDS (W. H.), Canadian Entomologist, ii, p. 163 (1870).

Two examples, male and female, taken near the headwaters of the San Juan River, August 2; these, as are all the Colorado examples I have yet seen, are much darker than those from more eastern localities. It is a species found from Canada to Virginia and from the Atlantic westward to the Rocky Mountains.

Melitæa Minuta.

Melitæa Minuta, EDWARDS (W. H.), Proceedings of the Academy of Natural Sciences of Philadelphia, p. 161 (1861).—MORRIS, Syn. Lep. N. Am. p. 325 (1862).—MEAD, Wheeler's Rept. v, p. 761, t. 36 (1875).—STRECKER, Syn. Catalogue, p. 123 (1878).

Melitæa Arachne, EDWARDS (W. H.), Trans. Am. Ent. Soc. ii, p. 372 (1869).—MEAD, Wheeler's Rept. v, p. 760 (1875).

One male, September 15, in the Lower Florida Valley, above the Indian reservation; this beautiful and somewhat rare species belongs to the same group as the European *Cinxia* L. and *Phæbe* Knoch, which latter it much resembles on both surfaces in color and ornamentation.

Melitæa Anicia var. *Nubigena*.

Melitæa Nubigena, BEHR., Proceedings of the California Academy of Natural Sciences, iii, p. 91 (1863).

Melitæa Anicia var. *Nubigena*, STRECKER, Syn. Catalogue, p. 124 (1878).

Several males and females taken July 21 at Pagosa Springs, and observed previously at other places.

Melitæa Alma.

Melitæa Alma, STRECKER, Lepidoptera Rhopaloceres and Heteroceres, i, p. 135, t. 15, f. 1 (1877); Synonymical Catalogue p. 189 (1878).

One male of this beautiful and rare insect was taken at the Rio Florida above the Indian Reservation. It is nearly allied to *Leanira* Bdl., but differs from that species remarkably on the upper surface, in which the black ground-color is replaced by bright fulvous. The type was received from Arizona; it was also a male.

Genus VANESSA Fabr.

Vanessa Antiopa.

Vanessa Antiopa, LINNÉ (*Papilio* A.), Systema Naturæ, ed. x, p. 476 (1758); ed. xii, i, 2, p. 776 (1767).—HÜBNER, Europäische Schmetterlinge, i, f. 79, 80 (1805).—HERBST, Natursyst. Schmetterlinge, vii, p. 96, t. 166 (1794).—GODART (*Vanessa* A.), Enc. Méth. ix, p. 308 (1819).—BOISD. & LEC., Lep. Am. Sept. p. 173 (1833).—HARRIS, Ins. Inj. Veg. 3d ed. p. 296, f. 121, 122 (1862).—MORRIS, Syn. Lep. N. Am. p. 57 (1862).—STRECKER, Syn. Catalogue, p. 133 (1878).

Papilio Morio, LINNÉ, Fauna Suecica, ed. i, p. 232 (1746).

Papilio Pompador, POLLICH, Bemerk. Churpf. Oek. Ges. (1779).

Of this cosmopolitan species one female was captured, September 15, at the Lower Rio Florida. There was no note of any more having been noticed by the expedition.

Genus PYRAMEIS Hüb.

Pyrameis Atalanta.

Pyrameis Atalanta, LINNÉ (*Papilio* A.), Systema Naturæ, ed. x, p. 478 (1758); ed. xii, i, 2, p. 779 (1767); Faun. Suec. p. 279 (1761).—HERBST, Natursyst. Schmett. vii, p. 171, t. 180 (1794).—BOISD. & LEC. (*Vanessa* A.), Lep. Am. Sept. p. 175 (1833).—HARRIS (*Cynthia* A.), Ins. Inj. Veg. 3d ed. p. 294, f. 120 (1862).—MORRIS (*Pyrameis* A.), Syn. Lep. N. Am. p. 58 (1862).—STRECKER, Syn. Catalogue, p. 135 (1878).

Papilio Amiralis, RETZIUS, Gen. et Sp. Ins. 31 (1783).

One male, July 21, at Pagosa Springs. Others were seen here and there on the route.

Pyrameis Huntera.

Pyrameis Huntera, FABRICIUS (*Papilio H.*), Systema Entomologiæ, p. 499 (1775); Sp. Ins. ii, p. 83 (1781); Mant. Ins. ii, p. 45 (1787); Ent. Syst. iii, 1, p. 104 (1793).—HERBST, Natursyst. Schmett. vii, p. 165, t. 178 (1794).—ABBOT & SMITH, Ins. Ga. i, t. 9 (1797).—GODART (*Vanessa H.*), Enc. Méth. ix, p. 324 (1819).—BOISD. & LEC., Lep. Am. Sept. p. 180, t. 48 (1833).—HARRIS (*Cynthia H.*), Ins. Inj. Veg. 3d ed. p. 292, f. 119 (1862).—MORRIS (*Pyrameis H.*), Syn. Lep. N. Am. p. 60 (1862).—STRECKER, Syn. Catalogue, p. 138 (1878).
Papilio Belladonna Virginiana, PETIVER, Gazoph. iv, t. 33, f. 5 (1711).
Papilio Cardui Virginianensis, DRURY, Ill. Ek. Ent. i, t. 5 (1770).
Papilio Iole, CRAMER, Pap. Exot. i, t. 12 (1779).

Two examples taken in September at the Rio de las Animas, near mouth of the Rio Florida, both small, and differing in nothing from those from other parts of North America.

Genus LIMENITIS Fabr.

Limenitis Ephemion.

Limenitis Ephemion, STOLL. (*Papilio E.*), Supplement to Cramer's Papillons Exotiques, p. 121, t. 25, f. 1, 1a (1790).—GODART, Enc. Méth. ix, p. 42 (1819).—HARRIS (*Nymphalis E.*), Ins. Inj. Veg. 3d ed. p. 283 (1862).—STRECKER (*Limenitis E.*), Syn. Catalogue, p. 143 (1878).
Papilio Astryanax, FABRICIUS, Syst. Ent. p. 447 (1775); Sp. Ins. ii, p. 7 (1781); Mant. Ins. ii, p. 4 (1787).
Papilio Ursula, FABRICIUS, Ent. Syst. iii, 1, p. 82 (1793).—ABBOT & SMITH, Ins. Ga. i, t. 10 (1797).—GODART (*Nymphalis U.*), Enc. Méth. ix, p. 380 (1819).—BOISD. & LEC., Lep. Am. Sept. p. 199, t. 53 (1833).—MORRIS, Syn. Lep. N. Am. p. 64 (1862).
Callianira Ephemionæna, HÜBNER, Verz. Bek. Schmett. p. 38 (1816).

One female, September 14, on the Rio Florida. This example was not large, and the under surface, especially of secondaries, was suffused with reddish-yellow to an abnormal extent; but I have seen an example from Guanaxuato, Mexico, partaking of this same peculiarity.

Limenitis Weidemeyerii.

Limenitis Weidemeyerii, EDWARDS (W. H.), Proceedings Academy of Natural Sciences of Philadelphia, p. 162 (1861); Butt. N. Am. i, t. 2, Lim. (1869).—MORRIS, Syn. Lep. N. Am. p. 327 (1862).—MEAD, Wheeler's Rept. v, p. 770, t. 38 (1875).—STRECKER, Syn. Catalogue, p. 145 (1878).

On August 8 three examples were taken in the Rio Navajo Valley, near the upper part of the river, and a number observed during that day's march. These are larger than any I had previously seen from Colorado, in this assimilating to those found in Arizona.

Family SATYRIDÆ.

Genus EREBIA Dalm.

Erebia Tyndarus.

Erebia Tyndarus ESPR. (*Papilio T.*), Schmetterlinge, i, 2, p. 97 (1781).—OCHSENHEIMER, Schmett. Eur. i, 1, p. 299 (1807); *Erebia T.*, Staudinger's Catalogue Eur. p. 25, 1871.—STRECKER, Syn. Catalogue, p. 151 (1878).
Papilio Hærese, BORKHAUSEN, Nat. Schmett. i, p. 94 (1788).
Papilio Cassioides, ESPR., Schmett. Eur. i, 2, t. 103, f. 2, 3 (1790).
Papilio Dromus, FABRICIUS, Ent. Syst. iii, 1, p. 224 (1793).—GODART (*Satyrus D.*), Enc. Méth. ix, p. 528 (1819).—LUCAS, Pap. Eur. p. 85, t. 39 (1834).—HERRICH-SCHÄFFER (*Erebia D.*), Schmett. Eur. i, p. 59, t. 37, f. 169, 170 (1843).
Papilio Tyndarellus, HERBST, Natursyst. Schmett. viii, p. 135, t. 202 (1796).
Papilio Cleo, HÜBNER, Eur. Schmett. i, f. 209-212 (?1796).—GODART, Hist. Nat. Lep. Fr. ii, 17, 5, 6 (1822).
Hipparchia Neleus, FREYER, Neu. Beyt. i, t. 80, f. 3, 4 (1833).
Erebia Callias, EDWARDS (W. H.), Trans. Am. Ent. Soc. iii, p. 274 (1871).—MEAD, Wheeler's Rept. v, p. 775 (1875).

Examples taken July 27 at head of the Tule Valley, and on 31, Pagosa Springs and other points not directly stated.

This species is also found in the Old World in Switzerland, and the mountainous parts of Hungary, Italy, and France; it presents but little variation regardless of locality.

Erebia Epipsodea.

Erebia Epipsodea, BUTLER, Catalogue Satyridæ in the British Museum, p. 80, t. 2, f. 9 (1868).—STRECKER, Syn. Catalogue, p. 151 (1878).
Erebia Rhodia, EDWARDS (W. H.), Trans. Am. Ent. Soc. iii, p. 273 (1871).

July 15, taken at head of South Fork of Rio Chama; July 27, head of Tule Valley; August 1, waterfall on San Juan River; August 23, Rio Piedro, near the bridge on upper road.

There is no doubt but that this is a form of *E. Medusa* Fab., in which view I am sustained by Dr. Staudinger.

Genus CHIONOBAS Bdl.

Chionobas Uhleri.

Chionobas Uhleri, REAKIRT, Proceedings Entomological Society of Philadelphia, vi, p. 143 (1866).—STRECKER, Lepidoptera Rhop.-Het. p. 28, t. 4, f. 5 (1873); Syn. Catalogue, p. 154 (1878).

Several taken July 13 at the Rio Navajo. This is a very variable species, as are many of the *Chionobas*, in the number of ocelli. Of Reakirt's original types now in my possession, one has three on the primaries and four on the secondaries; the other has four on the primaries and five on the secondaries, one of which is quite small, and was overlooked in the original description; I have also other examples with only one spot on primaries and two or three on secondaries. This species is closely allied to *Scoutda* Ev.

Genus SATYRUS Latr.

Satyrus Charon.

Satyrus Charon, EDWARDS (W. H.), Transactions of the American Entomological Society, iv, p. 69 (1872).—STRECKER, Syn. Catalogue, p. 156 (1878).
Cercyonis Oetus, SCUDDER (*nec* BOISDUVAL?), Bulletin of the Buffalo Society of Natural Sciences, ii, p. 242 (1875).

July 15, at Deer Creek, a branch of the Upper Rio Blanco; July 21, Pagosa Springs; July 28, Weeminuche Creek to the Rio Piedro; August 28, park in cañon of the Upper Rio de los Pinos. A large number of this species were taken at the above localities, and were the only *Satyrus* noted by the expedition.

Genus COENONYMPHA Hüb.

Coenonympha Tiphon var. *Ochracea*.

Coenonympha Ochracea, EDWARDS (W. H.), Proceedings of the Academy of Natural Sciences of Philadelphia, p. 163 (1861).—MORRIS, Syn. Lep. N. Am. p. 328 (1862).
Coen. Tiphon var. *Ochracea*, STRECKER, Syn. Catalogue, p. 160 (1878).

Several taken at Pagosa Springs July 21, and others were seen at different places; I have also received it from Montana, New Mexico, Oregon, &c.

There can be no doubt but that this is a variation of *Tiphon* Rott., a species ranging all over Europe and Northern Asia, and of which *Davus* Fabr. is a synonym.

Family HESPERIDÆ.

Genus PAMPHILA.

Pamphila Snowi.

Pamphila Snowi, EDWARDS (W. H.), Canadian Entomologist, ix, p. 29 (1877).—STRECKER, Syn. Catalogue, p. 169 (1878).

Two examples at Pagosa Springs July 21.

A species somewhat allied to the Eastern *Leonardus* Har., but not as large, or as distinctly marked beneath.

Pamphila Napa.

Pamphila Napa, EDWARDS (W. H.), Proc. Entomological Society of Philadelphia, iv, p. 202, t. 1 (1865).
Hesperia Dacotah, EDWARDS (W. H.), Trans. Am. Ent. Soc. iii, p. 277 (1871).

Several males and one female at Pagosa Springs.

Genus ANCYLOXYPHA Feld.

Ancyloxypha Garita var. *Hylax*.

Thymeticus Hylax, EDWARDS (W. H.), Trans. Am. Ent. Society, iii, p. 274 (1871).
Ancyloxypha Garita var. *Hylax*, STRECKER, Syn. Catalogue, p. 175 (1878).

A number taken, July 28, along Weeminuche Creek to the Rio Piedro, also between the Upper Rio Piedro and the Rio Nutrias; it was quite common flying around among the grass in numbers.

Genus PYRGUS.

Pyrgus Syrictus.

Pyrgus Syrictus, FABRICIUS (*Papilio*), Systema Entomologiæ, p. 534 (1775); Sp. Ins. ii, p. 137 (1781); Mant. Ins. ii, p. 90 (1787); Ent. Syst. iii, 1, p. 349 (1793).—DOUBLEDAY & HEWITSON (*Pyrgus S.*), Gen. Diur. Lep. ii, p. 518 (1850-1852).—STRECKER, Syn. Catalogue, p. 176 (1878).

Papilio Orcus, CRAMER, Pap. Ex. iv, t. 334, I. K. L. (1782).

Pyrgus Oileus, WESTWOOD & HUMPHREYS (*nec* LINNE), Brit. Butt. t. 38, f. 14, 15 (1841).

Syrictus Oilus, MORRIS, Syn. Lep. N. Am. p. 121 (1862).

Papilio Tartarus, HÜBNER, Eur. Schmett. f. 716, 717 (1803-1818).

Hesperia Tessellata, SCUDDER, Syst. Rev. Am. Butt. p. 73 (1872).

Syrictus Communis, GROTE, Canadian Entomologist, iv, p. 69 (1872); (*Hesperia C.*), l, c. p. 220 (1872).

This widespread and common species was observed on the route generally. Besides being found in all parts of the United States and Territories; it is common in Mexico, Central America, and most parts of South America, down to Patagonia inclusive.

Genus NISONIADES Hüb.

Nisoniades Persius.

Nisoniades Persius, SCUDDER, Proceedings Essex Institute, iii, p. 170 (1862).

One male at Rio Chama July 7. This is another of those species having a range from the Atlantic to the Pacific.

HETEROCERA.

Family SPHINGIDÆ.

Genus MACROGLOSSA O.

Macroglossa Senta, n. sp.

Male expands $1\frac{1}{2}$ inches; above, the head, thorax, and first two and part of third segment of abdomen heavily clothed with olivaceous hair; beneath the first three segments of abdomen are black; the remaining ones pale sulphur-yellow with black in the middle; anal tuft black; antennæ black.

Beneath, head and body are yellowish-white; legs clothed with yellowish-white hair.

Upper surface, wings hyaline, with the veins dark brown. Primaries, costa blackish; exterior margin of moderate width, widest at apex, scalloped on its inner edge, but not deeply, Indian-red in color, brighter at apex and between the last two cells at and near the inner angle; in the middle this border is sprinkled or suffused with brownish; fringe dark brown; inner margin Indian-red, narrow at and near the inner angle, becoming very broad from middle of inner margin to base.

Secondaries have a narrow exterior margin of dark brown, slightly scalloped inwardly, and showing traces of red toward inner half; abdominal margin broad and reddish, brightest at anal angle.

Under surface, wings: Primaries, costa pale yellowish from base to over or about half its length; terminal half sprinkled heavily with dark brown; exterior margin with the red not as dark as above, but brighter; inner margin also not as dark at its outer half, and pale yellow toward and at base.

Secondaries with basal part, costa, and inner margin pale yellow; exterior margin red; fringes of all wings brown.

One male; Tierra Amarilla, New Mexico, July 10.

This beautiful little species is far more slender and delicate than *Difflinis* or allies, and its position would be between the group of which *Difflinis* B. is typical and the other composed of such species as *Thysbe* F. *Gracilis* Grote, &c. It can be distinguished at a glance from any other known American species.

Family ZYGÆNIDÆ.

Genus CTENUCHA Kirby.

Ctenucha Matthewi.

Scepsis Matthewii, EDWARDS (HY.), Proceedings of the California Academy of Sciences, v, 184 (1873).

August 13, several near the headwaters of the Rio Blanco.

This is closely allied to *Ctenucha Fulvicollis* Hüb., but is of larger size and paler color throughout. It is a species having considerable range, the type from which Mr. Hy. Edwards described it having been taken in Vancouver's Island.

Ctenucha Cressonana.

Ctenucha Cressonana, GROTE. Proceedings Entomological Society of Philadelphia, ii, p. 64, t. 8, f. 5 (1863).—STRETCH, Illustrations of Zyganiidæ and Bombycidæ of N. America, i, p. 28, t. 1, f. 14 (1872).

Several examples taken along Weeminuche Creek to the Rio Piedro and between Upper Rio Piedro and Rio Nutrias July 28.

This species is rare in collections. It is nearly the size and color of the Eastern *C. Virginica* Charp., but has the pale yellow marks or lines on tegulæ and primaries like *C. Venosa* Wlk., excepting that the latter species has one more pale line on primaries toward the apex.

Ctenucha Sanguinaria, n. sp.

Female expands not quite two inches; head bright blood-red or scarlet, shining blue between the eyes; prothorax above same lustrous blue, beneath and at sides

scarlet; thorax also blue, the same color as in *C. Virginica* Charp.; patagiæ edged with scarlet on inner margin; abdomen same blue as thorax; legs blue. Antennæ wanting.

Upper surface, wings: Primaries black, with blue reflections, most noticeable at basal part, which equals in luster the body; secondaries shining blue.

Primaries have the costa the greater part of its length from the base outward edged with scarlet; the submedian nervule, the median nervule with its two middle branches, and the subcostal inferior nervule are also of the same fine scarlet or blood color; fringe white.

Secondaries with white fringe, and without marks, as in other species.

Under surface, color as above, but devoid of all the scarlet lines except that which edges the costa.

Perhaps a better idea of the ornamentation of the primaries of this species can be conveyed to those familiar with the North American fauna were I to state that the arrangement of the scarlet lines is precisely the same as is that of the whitish-yellow ones in *Venosa*. Of this, the most superb of all our species, one example, a female, was taken July 16 at Rio Blanco. The antennæ, as above stated, were wanting, and the secondaries were much torn and broken at the outer half, but the example had been fresh when caught and was not at all rubbed; hence the description and accompanying figure were accomplished without difficulty.

Family BOMBYCIDÆ.

Genus CROCOTA Hübn.

Crocota Fragilis, n. sp.

Expands $1\frac{1}{2}$ inches; head and body ocher color above, inclining to flesh-color below; wings above ocher, a little inclining to pinkish near and at abdominal margin of secondaries; beneath, uniform flesh-color or pinkish.

One example taken July 21 at Pagosa Springs.

This species has the wings narrower and longer in proportion than any other I know of, and throughout it is less robust in appearance.

Genus NEMEOPHILA Stph.

Nemeophila Plantaginis.

Nemeophila Plantaginis, LINNÉ (*Phalœna P.*), Systema Naturæ, ed. x, p. 501 (1758); ed. xii p. 820 (1767); Fauna suecica, 301 (1761).—DUNCAN, Naturalists' Library, Ent. iv, p. 216, t. 21, f. 1 (1836).—STAUDINGER, Catalogue, p. 56 (1871).—STRECKER, Lepidoptera Rhop.-Het. i, p. 79 (1874).

Nemeophila Cœspitis, GROTE & ROBINSON. Trans. American Entomological Society, i, p. 337, t. 6, f. 43 (1868); iv, p. 428 (1873).

Nemeophila Cichorii GROTE & ROBINSON. Trans. Am. Ent. Soc. i, p. 338, t. 6, f. 44 (1868); iv, p. 428 (1873).

Two males near headwaters of San Juan River August 2. One of these is like the common European form; the other assimilates to var. *Matronalis* Fr. in the inner part of secondaries being black. This is an exceedingly variable species. Some examples (var. *Hospita* Sch.), found in Colorado and Europe, have the ground-color of wings white; others, the form common to Europe and Colorado, have the ground-color yellow; another form, so far known only from Europe, have the secondaries scarlet; yet others in which the ground-color is black; this latter form is the following-cited *Eupsychoma Geometrica* Grote.

In the Trans. Am. Ent. Soc. iv, Grote and Robinson redescribed *Plantaginis* as new under the name of *Cœspitis* and *Cichorii*, adding that *Cichorii* would be readily distinguished by the black fringe and clear yellow bands of the upper surface of primaries. The larvæ of these two species are stated to be quite distinct, and to be found on different food-plants. These authors evidently had little if any acquaintance with either the European forms of this species, or with the habits of the larvæ of the Arctians, as the fringes in different European varieties of *Plantaginis* are either yellow, black, or both, and the larvæ of the Arctians, as any tyro knows, will feed on almost any green thing, and in default of vegetable food will even sometimes devour each other.

Nemeophila Plantaginis var. *Geometrica*.

Eupsychoma Geometrica, GROTE, Proceedings Entomological Soc. Philadelphia, iv, p. 318, t. 2, f. 1 (1865).

Eupsychoma Geometroides, GROTE & ROBINSON, List Zyg. and Bombyc. N. Am. p. 7 (1865).

Nemeophila Plantaginis var., STRECKER, Lepidoptera Rhop.-Het. p. 79 (1874).

August 2, one example taken near headwaters of the San Juan River, agrees exactly with the figure in Proc. Ent. Soc., with the exception of having one more small white mark near apex in primaries.

This variety of *Plantaginis* was first placed by Grote in a new genus, *Eupsychoma*, which he made for its reception. This genus he placed in the *Zyganidæ*. To quote

his own words, "a Zygænid genus allied to *Ctenucha* and presenting some analogies in the neuriation to *Eudryas*."

Another closely allied variety was described by Walker in Cat. Het. B. M. iii, p. 626, under the name of *Nemeophila Petrosa*, he not having made the mistake, however, of placing it in a new genus.

Genus ARCTIA Schr.

Arctia Cervinoides.

Arctia Cervinoides STRECKER, Proceedings Academy of Natural Sciences of Philadelphia. p. 151 (1876).

One example, July 15, Upper Rio Blanco, differs from the type in having the secondaries more blackish, and in the white lines of primaries being narrower in part.

This was described from a unique example received from Colorado in 1875. It is nearer to *Quensehii* Payk. and *Cervini* Fall. than to any other known species. I know of no other examples in collections besides the type and the one above alluded to.

Arctia F-pallida, n. sp.

Male expands 1 inch. Head above pinkish, beneath black; thorax above pinkish, with three black stripes, beneath black; abdomen crimson above, with a black dorsal stripe; below black; antennæ black.

Wings, upper surface primaries black, with a large pale flesh-colored mark resembling the letter F; this is formed by a mark extending from base of wing, some distance from and parallel with the inner margin, to nearly two-thirds the length of the wing; from its outer extremity to the costa extends a somewhat bent line of same color and width. Another such line also extends from the first mentioned to costa, about midway between the last-mentioned line and base of wing, these three lines thus forming a very conspicuous and distinct letter F. Secondaries scarlet, with broad blackish margin; a not very conspicuous dark mark extends from base to outer margin about one-third in from abdominal margin; a blackish spot connects with the dark border of costa about one-third the distance from the apex; fringe of abdominal margin scarlet; all other fringe of all wings dark grayish.

One example of this handsome little species captured at the Rio Navajo July 13; it belongs in same group with *Nais* Dru., &c.

Genus SPILOSOMA Stph.

Spilosoma Antigone, n. sp.

Female expands 1½ inches. Head and body entirely pure shining white; antennæ white above, black beneath; legs white, except the coxæ and femora of anterior pair, which are yellow.

All wings same pure shining white as the body; primaries above, with an irregular submarginal row of faint brownish dots; the three or four toward the apex are ones that are noticeable without close inspection; another brown point at the intersection of the median nervule with its two middle branches, this spot or dot is also very faintly visible on the other surface, as is also a discal point on under surface of secondaries.

One female, July 16, main Rio Blanco; one female previously from Georgia.

There are, besides this, four described species of *Spilosoma*, in North America, viz, *Virginica* Fab., *Congrua* Wlk., *Vestalis* Pack., and *Latipennis*, Stretch. From the first of these the present species differs in its immaculate abdomen; from the second, in the absence of black bands on the tarsi and of the "four oblique, very imperfect, and irregular bands composed of pale brown dots"; and from the third and fourth in the anterior coxæ and femora being yellow instead of rose-colored or pink. I thought at first it might be Walker's *Congrua*, as the number of pale dots on primaries is not necessarily specific in this and allied genera (as can be seen by the endless varieties of *Hyphantria Cunea* Dru.), but the absence of black bands on the tarsi and other points stated by Walker have satisfied me of its distinctness.

Genus HEMILEUCA Wlk.

Hemileuca Juno.

Hemileuca Juno, PACKARD, Annual Report of the Peabody Academy of Science for 1871, p. 87 (1872).

Three male examples, at Rio Florida, much worn. Packard says in his description of this species that it is "similar in its form to *H. maia*." The present examples do not agree with his description in this respect, as the wings are narrower than *maia*, are more prolonged apically, are less rounded on exterior margins, and the primaries are much hollowed in on costa. Packard says, "wings uniformly dark-brown." This conveys an erroneous impression of the color, which is the same, only more dense and opaque, as in the darker examples of *maia*, a sort of crape-like or semi-diaphanous black. He

also speaks of "a few white scales beyond the discal spot" on upper surface, and "on hind wings there is a round white patch beyond the discal dot, and another between it and the costa." In the present examples are no traces of anything like these, the secondaries being destitute of all marks and entirely black on both surfaces; but these points are not all specific, as I have examples of *maia* in which the pale band varies from the normal form, and others where it is entirely wanting on the primaries. In some this band covers the greater part of the wing; in others it is reduced to a mere line, or else wanting entirely. But the shape and the color will easily separate *Juno* from *maia*. In *Juno* the color is dense, heavy, and opaque; in *maia* it is filmy, crane-like, semi-transparent, and *maia* is a much heavier built insect. Throughout, *Juno* is closely allied to *Hemileuca Grotei* (Grote & Robinson, in vol. ii, Trans. Am. Ent. Soc. p. 192, t. 2, f. 60, 1868), and if I may judge by the figure, which is apparently a fair one, I would believe that *Juno* and *Grotei* are varieties of one species, the main differences being that the primaries are less elongated in *Grotei*, but this might be sexual, as the figure is of a female, and I have only males of *Juno* for comparison, and in the presence of a narrow white band on secondaries; traces of this latter are, however, visible, as I have mentioned in Packard's types, and its size or even presence is not essentially specific. The pale cross-bands on the abdomen of Grote's figure, I presume, are only the hyaline space formed by the stretching of the sutures between the segments, as the abdomen is enormously elongated.

Genus PSEUDOHASIS Gr.-Rob.

Pseudohasis Hera.

Pseudohasis Hera, HARRIS (*Saturnia H.*). Rep. Insects of Massachusetts, p. 286 (1841).—MORRIS, Syn. Lep. N. Am. p. 221 (1862).—(*Pseudohasis H.*), STRECKER, Lepidoptera Rhop.-Het. i, p. 137, t. 15, f. 10, 11, 12 (1877).

Hemileuca Pica, WLK., Cat. Het. B. M. vi, p. 1318 (1855).—MORRIS (*Saturnia, P.*), Syn. Lep. N. Am. p. 222 (1862).

One male, July 14, at Rio Blanco, near its headwaters; one male, July 28, at Weeminuche Creek, near Rio Piedro; August 1, one male and one female, in valley of Upper San Juan River. These are all of the Colorado form, figured in my work on Lepidoptera, t. 15, f. 11, with pale, creamy-tinted upper wings and rich yellow hind wings. These differ from the Utah form, which has the ground-color of all wings white, and from the Arizona form *P. Nuttalli*, in which the black bands of wings are much less diffuse, and in which the black bands of abdomen are either partly or wholly obsolete. Wherever this species or its varieties occur it is found in great abundance, flying by daylight. The California form *P. Eglanterina* feeds in the larval state on wild rose or brier.

Family NOCTUÆ.

Genus AGROTIS O.

Agrotis Redimacula.

Agrotis Redimacula, MORRISON, Proceedings Acad. Nat. Sciences of Phila. p. 165 (1874).

September 11, several examples at the Rio Florida near upper road. This is a widespread species, near *Tessellata* Harr.; it is found from Maine to Colorado.

Genus HADENA Tr.

Hadena Lignicolora.

Hadena Lignicolora, GUENÉE Noctuelites, i, p. 140 (1852).

Several of this common and widespread species were taken at Weeminuche Creek near to Rio Piedro, also at Pagosa Springs and elsewhere; they are in no wise different from those found elsewhere in the United States.

Hadena Morna, n. sp.

Male expands $1\frac{1}{4}$ inches. Head and thorax cinnamon-colored; abdomen of same color, but paler.

Upper surface primaries same color as head and thorax, darkest from discal spot inward; markings all more or less indistinct; transverse anterior line deeper reddish and double; transverse posterior line apparently single, reniform, indistinct, its lower part on the median nervule filled with a gray or lead-colored spot, which is the only mark of any prominence; exterior margin of wing bordered with a dark shade; fringe same color as the last; secondaries reddish white with broad smoky border exteriorly; fringe pale.

Under surface primaries shining cinnamon-color, paler than above; secondaries same color as above, but devoid of dark border.

One male at Rio Blanco near its headwaters.

Genus LEUCANIA O.

*Leucania Ligata.**Heliophila Ligata*, GROTE, List Noctuidæ, p. 12 (1875).

A number observed and several taken at Pagosa Springs July 31; they are a little larger than the examples from Texas.

Genus HELIOTHIS Tr.

*Heliiothis Meadi.**Tamila Meadi*, GROTE, Bulletin Buffalo Society of Natural Sciences, i, p. 121, t. 3, f. 5 (1874).

One example of this lovely insect taken at Pagosa Springs July 31.

Heliiothis Sulmala, n. sp.

Male expands $1\frac{1}{2}$ inches. Head and body silvery milk-white; wings same white as body; primaries with a sub-basal band strongly bent outward at its middle, a broad marginal band at exterior margin being widest at inner half toward interior margin, this marginal band is divided through its middle from costa to inner margin by a white line; a large kidney-shaped discal spot; this spot as well as all the bands are of an olivaceous or yellowish brown, not very dark and semi-metallic, much the tint of the geometrid *Gorytodes Trilinearia*; the whole arrangement of the bands is much as in *Heliiothis Rivulosa* Guen. and *H. Regia* Streck., excepting that the portion of the wing interior to the sub-basal band has the white ground of rest of wing; fringes pure white; secondaries same white as primaries, with a narrow border to exterior margin and a large lunate discal spot of same color as bands and spot of primaries; fringe pure white. Under surface same white as above; primaries with marginal band much as above, excepting that it becomes obsolete toward the inner angle; a broad band extends from base along costa to the exterior margin; this band in a measure absorbs the discal spot; secondaries immaculate, except the large discal spot; all fringes white.

One male of this elegant insect taken July 31 at Pagosa Springs; a few more observed but not captured.

Family PHALÆNIDÆ.

Genus APLODES Guen.

Aplodes Undinaria, n. sp.

Expands $1\frac{3}{8}$ inches. Head white above, brown between the eyes; palpi white; antennæ white; thorax bright green; tibiæ and tarsi white; femora bright green; abdomen white above and at sides, with a pale green dorsal shade, beneath green.

Wings, upper surface primaries uniform green, like thorax, minutely reticulated with white, the latter only plainly discernible under a lens; two distinct white lines, the first and narrowest extending from interior margin, not very far from the base, across the wing to middle of costa, this line is a little curved or rounded outwardly; the second line is wider and extends from interior margin at two-thirds its distance from base, to the costa some little distance from apex; costa very narrowly edged with white; fringe green, edged outwardly with white.

Secondaries broadly green at inner half of exterior margin, from whence they become paler, and white toward apex, costa, and base; a white line, a continuation of the outer one of primaries, crosses the wing from abdominal margin to costa near or at apex, where it becomes lost; fringes green, edged with white outwardly, as on primaries.

Under surface all wings pale green, merging into white toward inner half; lines of upper side not so conspicuous.

One example, July 13, at the Rio Navajo.

Genus ACIDALIA Tr.

*Acidalia Peralbata.**Acidalia Peralbata*, PACKARD, Fifth Report Peabody Academy of Sciences, p. 70 (1873); U. S. Geo. Survey of Territories, Hayden, x, p. 332, t. 10, f. 48 (1876).

A number of examples taken at West Fork of San Juan River.

Genus FIDONIA Tr.

*Fidonia Acidaliata.**Fidonia Acidaliata*, PACKARD, Sixth Report Peabody Acad. of Sciences, p. 48 (1874).
Loxofidonia Acidaliata, U. S. Geological Survey of the Territories, Hayden, x, p. 224, t. 9, f. 44 (1876).

Two examples, Pagosa Springs. This species bears a strong resemblance to *Zonoma Trilinearia* Bkh., a European species.

Fidonia Stalachtaria, n. sp.

Expands $\frac{3}{4}$ inch. Shape of *F. Fimetaria* G.-R., to which it is closely allied. Head and body powdered with whitish and black scales.

Upper surface wings rich orange color; primaries whitish gray along the inner half of costa. A short dark-brown band extends from middle of costa to the median nervure, where it is narrower than at the costa; half-way between this and exterior margin is another band, which extends from costa, where it is broadest, to inner margin. This last band is in part almost confluent with a broad brown border of exterior margin; between the latter and this band, at and near the costa, is a pale yellowish-white mark narrower than in *Fimetaria*; median nervure brown. Secondaries with a broad brown border to exterior margin; this border incloses a row of almost confluent orange spots, which commences at the anal angle and extends two-thirds in toward the apex; interior to the marginal border, and parallel with it, is a brown mesial line; all fringes pale yellow, alternated with brown terminations of veins.

Under surface, primaries bright orange, except at costa and apex, where the color is pale yellow, the dark lines same as above but paler, and the outer one does not reach to the exterior margin, there being a narrow pale space between. Secondaries pale-brownish with three irregular bands composed of more or less closely connected pale-yellow irregularly shaped spots; also between the innermost of these bands and the base are several more irregular pale yellow marks; there are traces of silver in the spots of under side of secondaries, as in *Fimetaria*, though there is considerable resemblance in the arrangement of all the markings.

Two examples, August 10, at Rio Navajo, near mouth of cañon of its headwaters.

Genus METROCAMPA Latr.

Metrocampa Perlata.

Metrocampa Perlata, GUENÉE, Uranides et Phalénites, i, p. 128 (1857).—WALKER, List. Lep. B. M. Het. xx. p. 157 (1860).

Metrocampa Virida-perlata, PACKARD, Proc. Bost. Soc. Nat. Hist. xvi, p. 38 (1874).

Three examples, July 27, head of Tule Valley, at Weeminuche Creek. August 11, Rio Navajo, at its headwaters and at other points. These are in no way different from Eastern examples; it is found in British Columbia and in all parts of the United States and Territories except in the far South.

Some years since I obtained a large number from S. Labrador; these were all of small size. The largest I ever saw were from California and Pennsylvania; when fresh caught and unsullied this is a most lovely thing to behold, but in a very short time the beautiful pale sea-green shade disappears.

Genus EUGONIA Hüb.

Eugonia Coloradaria.

Eunomos Coloradaria, GROTE, Annals Lyceum of Natural History of New York, viii. t. 16, f. 11 (1867).

Tetracis Coloradaria, PACKARD, U. S. Geo. Sur. Terr. Hayden, x, p. 550, t. 12, f. 47 (1876).

One of this fine species, July 21, at Pagosa Springs. It is easily distinguished from all others of its genus by the two heavy black bands (rather than lines) of primaries.

Genus EUASPILATES Pack.

Euaspilates Spinataria.

Euaspilates Spinataria, PACKARD, Sixth Report Peabody Acad. Sci. p. 45 (1874); U. S. Geo. Sur. Terr. Hayden, x, p. 204, figure (1876).

Two examples were taken; both have the dark lines of primaries much heavier than represented in Packard's figure.

Genus HETEROLOCHA Led.

Heterolocha Edwardsata.

Heterolocha Edwardsata, PACKARD, Proceedings of the Boston Society of Natural History, xiii, p. 383 (1871); U. S. Geo. Sur. Terr. Hayden, x, p. 478, t. 11, f. 48 (1876).

This species was quite abundant; it was taken at the West Fork of the Rio Navajo, near its headwaters; at the Rio Blanco, and at the Rio de los Pinos near the crossing of the upper road; it was in no particular different from California examples.

Genus EURYMENE Dup.

Eurymene Excelsa, n. sp.

Expands $1\frac{1}{4}$ inches. Head and thorax bright orange ocher; abdomen yellowish-white.

Upper surface wings: primaries same color as thorax, and crossed from interior margin to costa by two distinct brownish-gray lines; the first or sub-basal is edged

inwardly, and the second outwardly, with white; the sub-basal is almost straight, the other curves inward a little near the costa; a minute brown discal point or dot; exterior margin edged narrowly or with a mere line, rather, of brown; fringe whitish. Secondaries whitish with faint ochraceous tinge; a minute discal point and a small black mark on abdominal margin one-third in from the anal angle.

Under surface whitish with an ochraceous tinge, the latter most perceptible at costa and exterior margin of primaries; dark lines and discal spots of upper surface repeated, but fainter.

One example of this handsome insect was taken July 14 at Pagosa Springs.

Genus CIDARIA Tr.

Cidaria Truncata.

Geometra Truncata, HUFNAGEL, Tabellen Berliner Magazin, iv, 602, 625 (1769).

Geometra Russata, WIEN, Verz. 113 (1776).

Polyphasia Centumnotata, STEPHENS, Illustrations Brit. Ent. iii, 230 (1829).

Petrophora Truncata, PACKARD, U. S. Geo. Sur. Terr. Hayden, x (1876).

Taken at various points along the route during the month of August. It is found in British Columbia, in all parts of the United States, except the Southern States, as well as in Europe and Siberia.

Cidaria Hastata.

Phalæna Hastata, LINNÉ, Systema Naturæ, ed. x, p. 527 (1758); ed. xii, p. 870 (1767); Fauna Suecica, p. 335 (1761).

Melanippe Gothicata, GUENÉE, Uranides et Phalénites, ii, p. 388 (1857).

One medium-sized example of this exceedingly variable species was taken; it has less black on it than any example I have yet seen, either American or European. It is likewise a species of large range; being found in Labrador and United States, Europe, Siberia, and Alaska.

Genus MARMOPTERYX Pack.

Marmopteryx Formosata, n. sp.

Female expands $1\frac{1}{4}$ inches; head whitish gray, brown between the eyes; thorax and abdomen whitish gray; wings shaped much as in *N. Marmorata* Pack., to which it is allied. Upper surface pure satin white; primaries with an exterior border of pale grayish or fawn, very broad at costa and narrowing gradually to the inner angle; within this border, near apex, is a white mark; interior to the border, extending from the costa to the median nervure, is a narrow shade of the same color as the border. Secondaries immaculate, but the markings of under side faintly appear through them; all fringes pure white, alternated at veins with pale fawn.

Under surface primaries pure silky white, yellow along costa and at apical parts; this yellow striated loosely on costa and densely at apex with scarlet; within the apical patch is a white mark corresponding to that within the fawn-colored exterior margin of upper surface. Secondaries yellow, striated densely with scarlet; a broad pure white mesial band bent at nearly a right angle in the middle, in the space exterior to this band directly opposite the angle formed by the bend in same is a yellow and white space caused by the non-segregation of the striæ; in the middle, about, of the space between the base of wing and the mesial band is a large white spot; the striation from this spot to the abdominal margin and extending to the inner edge of mesial band is blackish purple; the costa near base has a conspicuous white mark; all fringes as on upper surface.

The wings, especially the secondaries, are not near as much prolonged, especially as in *Marmorata* Pack. The ornamentation is in the same style somewhat as in that species, but the coloration, particularly on under side, is far more beautiful; this is certainly the handsomest and most notable of the four species now known.

Two examples were taken at the Rio Florida.

COLEOPTERA.

CARABIDÆ.

Genus CYMINDIS.

Cymindis Brevipennis Zim.

PTEROSTICHUS.

Pterostichus Protractis Lec.

Pterostichus Luczotii DEJ.

SILPHIDÆ.

PELTIS.

Peltis Lapponica Hb.

DERMESTIDÆ.

DERMESTES.

Dermestes Marmoratus Say.

TROGOSITIDÆ.

TENEBRIOIDES.

Tenebrioides Costicalis Mels.

COCCINELLIDÆ.

HIPPODAMIA.

Hippodamia 5-signata Kby.

COCCINELLA.

Coccinella 9-notata Hb.

SCARABÆDÆ.

APHONUS.

Aphonus Pyriformis Lec.

MACRONOXIA.

Macronoxia Decemlineata Say.

DILOTAXIS.

Diplotaxis Haydenii Lec.

BUPRESTIDÆ.

CHALCOPHORA.

Chalcophora Angulicollis Lec.

BUPRESTIS.

Buprestis Rusticorum Kby.

MELANOPHILA.

Melanophila Drummondi Kby.

ELATERIDÆ.

ANELASTES.

Anelastes Druryii Kby.

CORYMBITES.

Corymbites Hieroglyphicus Say.

TELEPHORIDÆ.

CHAULIOGNATHUS.

Chauliognathus Basalis Lec.

CERAMBYCIDÆ.

HOMACTHESIS.

Homacthesis Emarginatus Say.

LEPTURA.

Leptura Cribripennis Lec.

PACHYTA.

Pachyta Liturata Kby.

MONOHAMMUS.

Monohammus Oregonensis Lec.

CHRYSOMELIDÆ.

CHRYSOMELA.

Chrysomela Multipunctata Say.

DISONYCHA.

Disonycha Alternata Illig.

TENEBRIONIDÆ.

ASIDA.

Asida Sordida Lec.*Asida Actuosa* Lec.*Asida Elata* Lec.

ELEODES.

Eleodes Extricata Say.*Eleodes Longicollis* Lec.*Eleodes Sulcipennis* Mann.

MELOIDÆ.

EPICAUTA.

Epicauta Maura Lec.

CANTHARIS.

Cantharis Cyanipennis Say.

CURCULIONIDÆ.

PISSODES.

Pissodes Cortatus Mann.

SCOLYTIDÆ.

DENDROCTONUS.

Dendroctonus Terebrans Lec.

With the collection also were sent to me the following reptiles:

Class BATRACHIA.

Order URODELA.

Suborder CADUCIBRANCHIATA Latr.

Family AMBLYSTOMIDÆ Cope.

Amblystoma Mavortium Bd.

Four larval examples are no doubt of the above species. They (the larvæ) were formerly regarded as a distinct genus under the name of *Siredon*.

Order OPHIDIA.

Suborder ASINEA Müll.

Family COLUBRIDÆ Cope.

Cyclophis Vernalis B. & G. (Green Snake.)
Eutaenia Vagrans B. & G. (Garter Snake.)

Order LACERTILIA Owen.

Suborder PLEURODONDTA Cope.

Family IGUANIDÆ Cope.

Phrynosoma Douglassii Bell. (Horned Toad.)
Sceloporus — ?

This example was too much discolored and too immature to decide with certainty as to the species.

PLATE I.

FIGS. 1, 2. *Parnassius (Delius) var. Smintheus* Dbldy., ab.
FIGS. 3, 4. *Argynnis Nokomis* W. H. Edwards, ab.
FIGS. 5, 6. *Argynnis Kriemhild* Strecker.



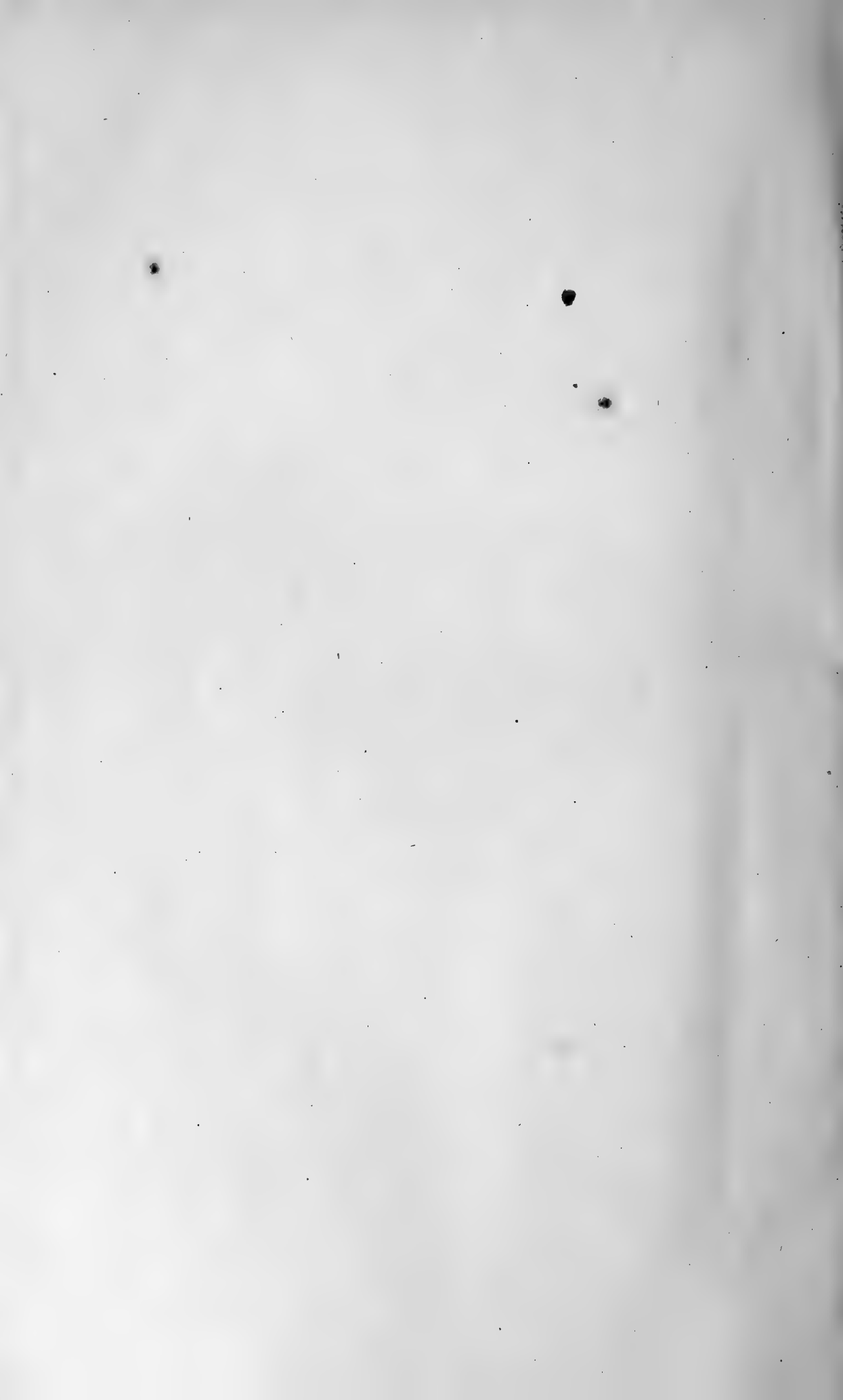
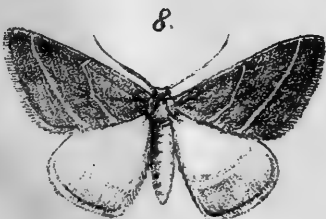
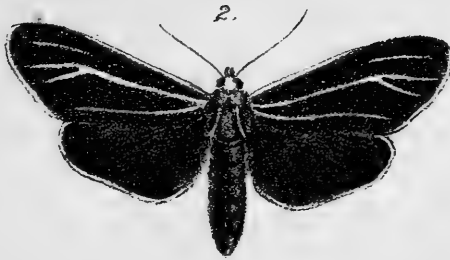


PLATE II.

- FIG. 1. *Macroylossa Senta* Strecker.
FIG. 2. *Ctenucha Sanguinaria* Strecker.
FIG. 3. *Arctia F-pallida* Strecker.
FIG. 4. *Arctia Cervinoides* Strecker.
FIG. 5. *Heliothis Sulmala* Strecker.
FIG. 6. *Fidonia Stalachtaria* Strecker.
FIG. 7. *Cidaria Hastata* Linné, ab.
FIG. 8. *Aplodes Undinaria* Strecker.
FIG. 9. *Eurymene Excelsa* Strecker.









SMITHSONIAN INSTITUTION LIBRARIES



3 9088 00047 8743