BLAKE

PIMA COUNTY
ARIZONA

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ITS MINING DISTRICTS, MINERALS, CLIMATE, AGRICULTURE AND OTHER RESOURCES

PREPARED AT THE REQUEST OF THE
CHAMBER OF COMMERCE
BY
WILLIAM P. BLAKE, Sc. D.
Territorial Geologist.

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CONTENTS.

PIMA COUNTY, ARIZONA

LOCATION, AREA, HISTORY.

Pima, the oldest of the thirteen counties of the Territory of Arizona, was established by the first Territorial Legislature in the year 1864.

It then extended east and west nearly the full length of the Gadsden Purchase, or from the Territory of New Mexico on the east to the Colorado River on the west. Since then, the area of the county has been reduced by the setting off of Cochise County on the east; a part of Yuma County on the west; a part of Pinal on the north and the county of Santa Cruz on the south. But even while so shorn of its initial vast extent it retains the ample area of 9,424 square miles, an area equal to that of the state of Massachusetts and Rhode Island combined.

Pima, including Santa Cruz, borders on the south upon the state of Sonora, Mexico, for nearly 200 miles. The greatest width, north and south, at the bordering county of Cochise is about 80 miles. The map of the county is nearly bisected by the parallel of 32 degrees.

Pima may be regarded as typical Arizona. It is the portion of the territory earliest occupied and most generally known. While the Pilgrim Fathers were settling Massachusetts Bay, the Fathers of the Church were traversing Pimeria Alta, as the region was then known, establishing Missions and preparing the way for civilization. The region was traversed in turn by the expeditions from Mexico in search of gold and turquoises; by the gold-seekers of 1848 and 1849, by the Overland Butterfield stages and lastly by the Southern Pacific railway, which stretches diagonally across the northeast corner of the county.

The great reputation of Arizona for its wonderful temperate and life-giving climate is largely based on the knowledge gained by travelers and residents of Pima County.

TOPOGRAPHY.

The surface is diversified by mountain ranges and broad, plain-like valleys. The mountain ranges extend generally in a northerly and southerly direction with a westward deflection. The chief elevations and broadest mountain chains are at the eastern end of the area. We there find the Santa Catalina mountains, the Rincons, Santa Ritas, Whetstones, Patagonia and minor elevations. West of the Santa Cruz valley, and near the southern boundary, we find the Tumacacari, Arivaca and Oro Blanco mountains, succeeded northerly by the Cerro Colorado, Sierritas, and the Tucson mountains. From these ranges, westward, the elevations become successively less in altitude and importance, while the valleys and the slopes become wider and at lower levels, until beyond the western limits of Pima County the sea-level is reached at the Red Sea of California, the Gulf of Cortez, now more generally known as the Gulf of California.

The highest point in the county is Wrightson's Peak of the Santa Rita mountains, south of Tucson, known familiarly as Old Baldy, its summit 9,432 feet above tide. Mount Hopkins, the neighboring peak, is 8,072 feet, and Josephine Peak is 8,435 feet.

In the Santa Catalinas, Mt. Lemmon reaches an altitude of 9,150 feet. In the Rincons, the peak is 8,465 and Mt. Mica 8,590 feet above the sea.

The Baboquivari Range, west of the Tucson Mountains, is one of the longest or most continuous in Pima County, extending from south of the International Boundary, northward nearly across the county, finding its northern prolongation in the Roskruge Range and the Silver Bell mountains. It receives its name from Baboquivari Peak, the picturesque

and abrupt precipitous cone rising some 7,849 feet above tide, as determined by Professor Forbes of the University of Arizona, the only explorer known to have made the ascent. This peak is a most noted landmark, visible for a hundred miles, or more, in any direction, north, south, east and west.

The Santa Cruz River and the Rillito are the principal streams. The drainage generally is northward to the Gila, and westward toward the great Colorado, the Nile of America. The Santa Cruz extends from Sonora, Mexico, northward towards the Gila, sinking and becoming lost in the plains before reaching Casa Grande. The Rillito rises in the Whetstones and the Santa Ritas and flows westward with considerable volume, for part of the year, and then disappears underground.

The valley of the Santa Cruz at Nogales on the boundary is 3,863 feet above tide; at Tubac about 3,300 feet and between 2,300 and 2,400 feet at Tucson.

The broad valley of Tucson is an expanded portion of the valley of the Santa Cruz River. It has the appearance of being surrounded by mountain ranges on all sides. The region so apparently inclosed by mountains has an approximate breadth of 18 to 30 miles; a length of 60 miles; in the aggregate an area of over 1,000 square miles, with an elevation above tide of 2,300 to 2,400 feet, at Tucson, to 3,500 feet at the upper margin of the detrital slopes which form the valley.

GEOLOGY.

The geologic structure of all the mountain ranges is complex. The rock formations range in age from the most ancient to those of comparatively recent date; from the Archaean to the Tertiary and Quaternary.. It is a most interesting and instructive field for the geologist. Volumes of geologic history are piled away in the hills and lie ready to be read and interpreted.

Gneiss.—In the higher ranges at the eastern part of the county in the Santa Catalinas, and in the Rincon mountains, crystalline gneiss, and mica schists abound, especially on the south side, towards Tucson, while contorted mica-schists crop out on the east side.

Granite.—Massive grey granite with large and picturesque boulders of decomposition give a varied outline to the surface. Near Oracle (in Pinal County) at an elevation of about 4,000 feet, evergreen oaks in groves and singly are distributed park-like over the hills and among the boulders.

Schists.—The Schists are strangely contorted and compressed into zig-zag form, regularly crumpled like the leaves of a book which has suffered violent compression edgeways. The bends are angular, not rounded, and vary in amplitude from an eighth of an inch to twelve inches or more. These schists seem to merge into the gneissic rocks which are so permeated with granite or felspathic nodules as to present tabular rocks, with rounded white protuberances, a birds-eye or "augen-gneiss." It is a formation extensively developed, not only in Pima, but in other parts of Arizona and may be known as the Arizonian schist formation. It underlies the Cambrian strata unconformably and represents very ancient sediments.

Palaeozoic.—The Palaeozoic strata are well-developed in the Santa Catalinas. They are uplifted and rest at the north end upon intruded diorite which has metamorphosed a thick bed of blue limestone and formed white statuary marble, with copper deposits along the contact, as, for example, at Leatherwood's Camp.

Devonian Corals.—Gold occurs in the large quartz lode of the Southern Belle Canyon not far from Coral Ridge, where there are reefs of petrified marine shells and corals in Devonian limestone.

Conglomerate.—Heavy beds of Conglomerate, chiefly of quartz, add to the geologic interest of the region.

Red Sandstone.—Massive strata of red sandstone underlying limestones and quartzite crop along Southern Belle Canyon.

Palaeozoic in Santa Ritas.—The palaeozoic is also well developed in the Santa Rita mountains near Greaterville, where Devonian fossils occur in limestone. Copper deposits of importance are worked at Helvetia and Rosemont near the contact between the quartzite and limestone and granite.

So, also, in the Sierritas, there are important contact deposits of copper ores at the Twin Buttes, at Mineral Hill, Olive Camp and other claims.

Mineral Deposits.—In the Santa Ritas, a region of intrusive diorite is accompanied by many mineral-bearing veins, carrying argentiferous grey copper, and galena. We there find the Salero mines noted in the early annals of mining in the southwest, and several large veins cutting boldly through the diorite and carrying grey copper and silver ores.

The Arizonian schists occur south of Casa Grande and are traversed by gold-bearing quartz veins.

Carboniferous limestones occur at the Vekol (Pinal County) and at the Jack Rabbit, and other claims, south of Casa Grande.

Volcanic.—Massive deposits of volcanic ejecta in the form of tufas and rhyolites flank the Santa Ritas and are the chief formation southwards to Calabasas, Nogales and Sonora.

In the Cababi the prevailing rocks are porphyritic and volcanic.

Lavas of comparatively recent origin extend southeasterly from the Mohawk range nearly across the county. They are also in evidence at many places in the Tucson mountains and especially at Tumamoc and Sentinel Peak, west of Tucson, and south at the Mission.

Tufa.—The lower hills along the Santa Cruz on the west side are generally formed of more or less uplifted tufas, and the higher elevations further west, as in the Tucson moun-

tains, are palaeozoic sandstones, limestones, shales and quartzites.

Coyote mountain is granite with massive beds of quartzite, probably of Cambrian age.

Porphyritic tufas at the north end of the Coyote mountains are remarkable for thick coatings, at the outcrops, of black oxides of manganese.

Massive conglomerates are found farther south near the Baboquivari. Granite and gneiss are found at Sasabi on the boundary, and further west at Quitovaquito, at the boundary line.

Baboquivari Peak, with columnar form and vertical sides, much resembles a volcanic rock or plug.

Mountain Slopes.—The larger part of the area between the mountain ranges is formed of the detrital material brought out from the canyons and arroyos of the mountains by the raging floods which must formerly, in late Tertiary time, have swept out boulders, quartz and sand in enormous quantity, enough to partially fill the valleys and give a distinctive peculiar sloping outline to the topography. (See also under climate.)

THE MINING DISTRICTS OF PIMA COUNTY.

The valley of the Santa Cruz may be regarded as the cradle of mining in the Southwest. This valley extending far to the north, was the chief route by which the earliest explorers from Mexico reached the then little known northern portion of Sonora, styled "Pimeria Alta." Mines were opened right and left, and the ores were melted in crude but effective adobe furnaces, before the acquisition of the region by the United States in 1853, since known as the "Gadsden Purchase."

Mining then commenced in earnest and United States citizens, especially at the Cerro Colorado and at the Salero and the Santa Ritas, near Tubac, now in Santa Cruz County, also at the Patagonia mine (Santa Cruz County), since better known as the Mowry, it having been extensively worked by Sylvester Mowry.

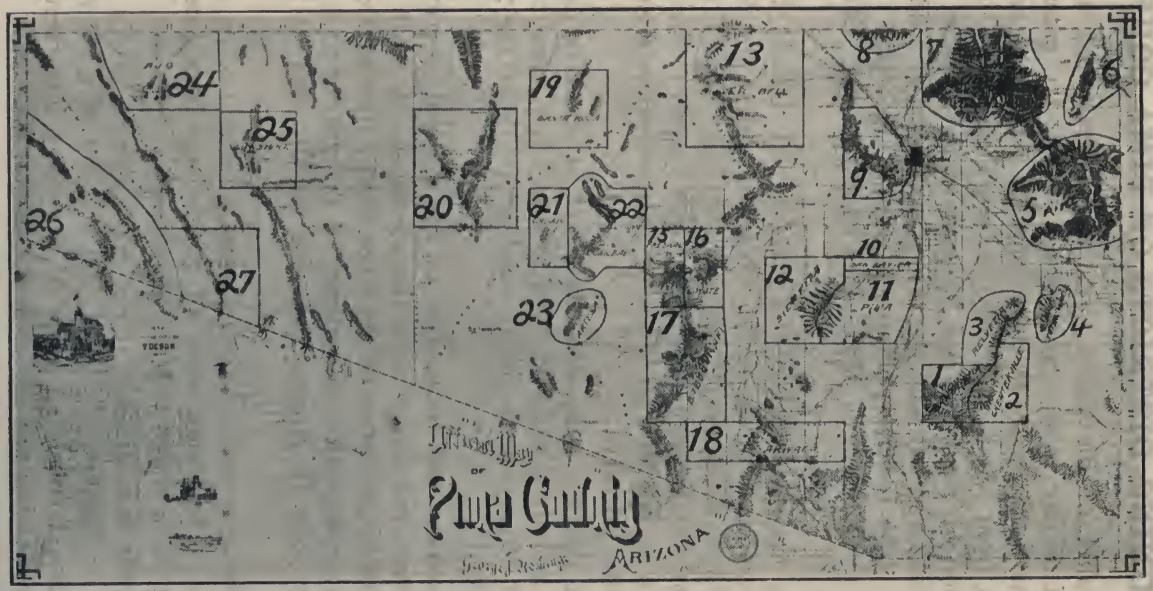
Mining districts were also established at an early date at the Ajo and the Cababi in "Papagueria," the name of the region of Papago settlements, west and south of the Santa Cruz valley.

The position and boundaries of the mineral districts of Pima County are shown upon the accompanying small map, a photographic reduction of the large county map by General Roskruge, upon which the outlines of the district have been drawn by John E. Magee, Esq., for the Chamber of Commerce.

The mining records of Pima County show tens of hundreds of entries of locations, many of which have been patented, but many have lapsed and are abandoned.

Manifestly it is difficult, if not impossible, to give a complete list or directory of claims, and it is not here attempted, but mention is made of some of the more important and best known claims and mines in the several districts.

LIST OF MINING DISTRICTS OF PIMA COUNTY.



1	Santa Rita	6	Redington	11	Pima	16	Coyote	20	Quijotoa	24	Ajo
2	Greaterville	7	Old Hat	12	Sierrita	17	Baboquivari	21	Cababi	25	Gunsight
3	Helvetia	8	Catalina	13	Silver Bell	18	Arivaca	22	Comobabi	26	Quitovaquito
4	Total Wreck	9	Amole	15	Fresnal	19	Santa Rosa	23	Artesa	27	Montezuma
5	Rincon	10	San Xavier								

In the following notices of some of the claims and companies the names are arranged alphabetically.

AMOLE (TUCSON) DISTRICT.

Acme Mining and Reduction Co.—24 unpatented claims. Smelting ores, copper, gold, silver and lead.

Arizona Copper Mining Co.—Twenty-five claims, 14 miles southwest of Tucson; 7 miles to Jaynes Station. Copper, silver and gold.

American Amalgamated Smelting and Mining Co.—Sixteen claims. Copper ore. Six miles to railway.

Bloody Rose Copper Co.—Five full claims, 3 miles west of Tucson. Copper ore.

Buster Brown Co.—Sixteen miles northwest of Tucson. Five claims. Copper and silver ore. Eight miles to Rillito Station and about 12 from the smelter at Imperial.

Copper Queen Lode.—Thirteen acres, 4 miles west of Tucson.

Terquinis Mines.—Twelve copper ore claims, 13 miles northwest of Tucson.

Grand Central Mining Co.—Eight claims, copper, gold, silver and lead ores. Six miles to railroad; 14 from Tucson.

Grand View.—Ten claims, copper ores.

Gould Mining Co.—Twenty-two claims, copper ores. Eighteen miles from Tucson.

Golden Shower Copper Co.—Four claims, 14 miles northwest of Tucson, in the Yuma mine. Four miles from Rillito Station.

New Strike Group.—Fifteen acres patented; 16 claims, zinc ore.

Noquilla Lode.—Sixteen miles west of Tucson, 9 acres patented; ores, silver and lead.

New State Copper Co.—Nine claims, 14 miles from Tucson. Copper and iron ores.

Old Pueblo Copper Co.—Nine claims; copper ores with gold and silver values; five miles from Tucson.

Plomora Group.

Southern Arizona Copper Co.—Six claims..

Silver Moon Mining Co.—Six patented claims, about 35 miles from Tucson; gold and silver ores.

Tucson Comal Copper Co.—Seventy claims. Two thousand acres; ores of copper, gold, silver and lead. The Maimie and Old Pueblo claims about 4 miles west of Tucson; Botello and Iron Dyke about 30 miles southwest of Tucson.

Texas Copper Co.—Three claims, copper ores and large croppings of iron ores. Ten miles to Rillito Station.

Old Yuma Mining Co.—Eight claims, 14 miles northwest of Tucson; 6 miles to railroad. Argentiferous lead ore and gold.

Weir-Pelton Group.—Twenty-two claims; copper ores, 22 miles west of Tucson.

AJO DISTRICT.

The wonderful richness of the copper mines of the Ajo were celebrated throughout northern Mexico before the Gadsden Purchase and were popularly supposed not to have been included in the sale of the country to the United States. The property was located, according to United States law, by a party of American citizens in 1854 and was worked by the Arizona Copper Mining and Trading Company. An attempt by Sonorians to take the mines by force was made in 1855 by a company of cavalry from Altar and Ures, Sonora, Mexico, but the soldiers were repulsed.

Considerable quantities of native copper and of rich red-oxide ore were sent by teams to Yuma, thence down the Colorado to the Gulf, thence to San Francisco for shipment to Swansea, Wales.

Redeswill Reduction Co.—A Boston organization. Seven patented claims and twelve held by location. The properties were formerly held and worked by the late Col. C. C. Bean.

Cornelia Copper Co.—Two hundred and sixty acres patented.

ARIVACA DISTRICT.

Adjoins the Oro Blanco District on the north. It includes the Gigas mountains and a part of the San Luis range.

Some facts regarding its early hisetory were given in former reports of the geologist, and a brief resume may be permitted.

Upon the acquisition of the country under the Gadsden treaty, active exploration of the mineral wealth of Southern Arizona was commenced by citizens of the United States, and the earliest work was chiefly along the valley of the Santa Cruz and its tributaries, the Sopori and the Sonoita.

About the years 1855 and 1857 the best known mineral localities in the Gadsden Purchase were at Arivaca, anciently famous as Aribaca. Sopori, the Arizona mountains, the Santa Rita range, the Cerro Colorado, the Salero, and, further west, the Ajo and the Cababi country.

In the year 1856 an association, or company, was formed in Cincinnati, Ohio, for the purpose of sending out a prospecting party to acquire by purchase, or otherwise, one or more of the deserted mining ranches and mines. Col. Chas. D. Poston, of Elizabethtown, Kentucky, with Mr. Herman Ehrenberg and Mr. Frederick Brunckow, engineers, with a party of gentlemen, were fitted out and, after some time spent in visiting the then deserted camps, established the headquarters of the company at Tubac, opposite the Santa Rita mountains and the northern spur of the Arizona or Arizuma mountains, by which name the range is still known in Sonora, just south of the boundary line. Mines at Salero were secured at that time.

Several miles northeast of the Arivaca rancho and north of Tubac, in the Cerro Colorado, other and important mining localities were found and acquired, among them being the mines later known as the Heintzelman, the Carlos, Cesario and others. These results led to the permanent organization of the company known as the Sonora Exploring and Mining Company, with Major S. P. Heintzelman, formerly, in 1853, in command at Camp Yuma, as president. Capital was obtained from the eastern states, largely from Colonel Samuel Colt, of Connecticut, the manufacturer of the Colt revolver, and machinery was sent out at great cost for the development of the property.

Colonel Poston secured the services of the young metallurgical engineer, Raphael Pumpelly, in addition those of Ehrenberg, Brunckkow and Kustel. For the more complete and satisfactory reduction of the ores, barrel amalgamation by the Frieberg method was introduced. The first bar of silver was produced in 1859.

At the breaking out of the civil war the protecting United States troops were withdrawn and it was no longer possible to work the mines in safety by reason of the presence of bands of murderous savages. The works were closed down. Many tons of valuable silver ore were hidden under the piles of waste and the settlement was abandoned. Messrs. Poston and Pumpelly were the last to leave and made their way almost alone down the Gila to Yuma, and thence across the desert to California and San Francisco.

Further notes upon the workings of the Heintzelman and other mines of that region and of Pima County may be found in the report of Professor Blake, the Territorial Geologist, to Governor N. O. Murphy in 1899, pages 110 to 114.

Cerro-Colorado Mining and Milling Co.—This historic property, known also as the Heintzelman mine, after a long period of inactivity and neglect, was re-opened in 1908. Area then reported: One patented claim, 71 not patented; five mill-

sites—greatest depth 300 feet. The development work is now in charge of Mr. C. U. Udall, who is sinking a deep shaft.

American Wolfram Co.—Eight patented claims; ores of tungsten. Sixty miles southwest of Tucson.

Arivaca Mining Co.—Six claims.

Bradford Tungsten Group.—One hundred and forty-three acres patented. Several claims. Ores of tungsten, chiefly huebnerite.

Centennial Wolfram-Tungsten Group.—Known also as the Bent and Sampson mine. Ten claims and a millsite; ores of tungsten; 60 miles southwest of Tucson.

Eastern Star.—Eight claims; gold. About 75 miles from Tucson.

Irwin Group.—Eight patented claims.

Liberty Mining and Smelting Co.—The old Liberty and Mary E. group, about 60 miles southwest of Tucson, in the district also known as the Silver Hill about 5 miles south and west of the Cerro Colorado. Nineteen claims, noted for high-grade silver-lead ores and considerable shipments.

Oceanic.—Twenty three claims.

Parnell, G. U. and U. Co.—Twelve claims.

New York Group.—Five miles west of Cerro Colorado; eight claims.

BABOQUIVARI DISTRICT.

At the southern end of the range of the same name. It is about 60 miles from Tucson by wagon road which extends northward to Sasabi and El Plomo in Sonora. Ores mostly gold and silver.

Inpites Group.—Six claims; near Last Chance.

Last Chance.—Four miles south of the peak. Nine claims.

Oriental.—Between 15 and 16 acres; 80 miles southwest of Tucson.

CABABI AND COMOBABI.

These two adjoining districts are near the center of the county, about 70 miles west of Tucson by the wagon road. The region was the scene of early historic mining, prospecting and locating. Much work was done there in the decade of the 80's, and high-grade silver and gold ore was developed.

Cababi Consolidated M. Co.—Six patented claims.

Desert Group.—Twelve patented claims, and a valuable deep well, utilized by prospectors and Papagoes. Estate C. P. Huntington.

Duchess Group.—One patented claim.

Empress Group.—Were owned in 1908 by Nettie McCormick, Tucson.

El Cantina and San Tomas.—Two patented claims.

Manhattan Gold Mining and Smelting Co.—Twenty-two claims; gold ores.

Manning, Randolph and Smith.—Five patented claims.

Papago Copper Co.—Fifty claims, one patented; in Comababi District.

Picacho—"Old Picucho."—Noted in the early annals of mining in the southwest for the richness and abundance of its ores of silver which it is stated could be profitably mined and transported far south into Old Mexico for treatment. The great extent of the ore bodies developed near the surface is made evident by the confused net-work of old shafts, inclines and drifts, mostly caved in and not accessible. Deeper workings in 1909 and 1910 have revealed the existence of ore bodies, which it is believed will rival those of the higher levels, and work is now (1910) actively prosecuted.

Richey Group.—Three patented claims; silver, gold and

copper ores.

Santa Rosa M. Co.—(Rochester group.) Nine claims, ores of copper and silver.

EMPIRE.

This district lies southeast of Tucson and centers about the Empire mountains, a short spur of the Santa Rita range. The shipping point is Pantano, about ten miles distant.

Esperanza Group.—Nineteen patented claims.

Empire Mining and Development Company.—Fifteen full claims, one patented; silver, lead and copper ores; eight miles from shipping point.

Total Wreck Mine.—Now (1910) lying idle.

GREATERVILLE.

Adjoins the Helvetia District on the south, and is chiefly known for its extensive gold placer deposits flanking the Santa Rita mountains on the east side. These placers have been extensively worked and prospected. Accessible by wagon road from Tucson, about fifty miles distant. The nearest railway station is Sonoita, on the Guaymas branch of the Southern Pacific.

J. B. Anderson Group.—Placer claims, also vein claims, carrying ores of lead, silver and copper; twelve in number.

Barcelo-Zipt.—One claim; gold and silver ore; twenty-eight miles from Vails Station.

Thos. Deering.—Twelve claims; copper and gold ores.

Empire Valley Mining Company.—Placer claims; 300 acres; H. A. Mann, president.

HELVETIA.

The northern end of the Santa Rita range is within the

lines of the Helvetia District, which adjoins the Greaterville and the Empire Districts. The shipping point for most of the mines in the Helvetia is Vails Station, on the main line of the Southern Pacific. The ores of copper predominate.

Black Horse and Goodenough Group.—Two claims. Shipments have been made of copper ore. Eight miles by wagon road to Vails Station.

Cuprite Mining and Smelting Company.—Eight claims; copper sulphide ore.

Copper Mountain.—Five claims; copper sulphide ore.

J. K. Brown.—Eight claims.

Thos. Deering Group.—Five claims.

Eclipse.—Nineteen acres, patented.

Helvetia Copper Company.—Area is estimated by acres (2,500), half patented. Formerly Hughes property. Ores, copper carbonates and yellow sulphide. At and near contact of limestone and granite. Equipped with 150-ton smelter, now idle (1908-1910). Railway to the Santa Cruz projected.

Iowa Mining and Smelting Company.—Blue Jay group. Twelve claims. Ore shipped to Vails Station, sixteen miles.

Schley and Phelps Group.—Eleven claims; copper ores.

Naragansett.—Eight claims; contact deposit; copper ore.

New York Copper M. and Smelting Company.—Eight claims.

Omega Copper Company.—Two patented claims, from which large shipments have been made.

Rosemont Copper Company.—About 800 acres patented ground. Copper ores. Smelter not in operation. Twenty-two miles to Vails.

Tip Top Mining Company.—Bulldozer group.

MEYER DISTRICT.

In the western part of Pima County, near the Ajo District. It includes the Gunsight range, and a portion of the Growler range.

Arizona R. S. M. Company.—C. C. group; thirteen patented claims.

Bueno Burro Group.—One patented claim. Silver King G. & S. M. Co.

Growler Copper Company.—Copper Hill group. Twenty-eight claims; 500 acres patented ("Growler Mining District"), about sixty miles south of Gila Bend Station.

Keystone Gold and Silver Mining Company.—Southern Belle group. Three patented claims.

Morning Star.—Two patented claims.

Silver Girl and Gunsight.—Two patented claims.

Richey and Dufton Group.—Two claims.

OLD HAT DISTRICT.

In the northeastern corner of the county, and includes the Santa Catalina mountains. Accessible from Tucson by wagon roads and also from the valley of the San Pedro.

Campo Bonito Mining and Milling Company.—Colonel Wm. F. Cody, president.

Copper Range and Arizona.—Fifteen claims and five mill-sites. Five of the claims patented. Represented by F. M. Hartmann, Tucson.

Cole Richey Group.—Three claims. Copper ores.

Esperanza Copper.—Esperanza group, Canada del Oro. Six claims.

Giesman Group.—Also known as *Condon's.* Five claims. Copper ore. At contact of limestone and diorite.

Apache Group (Leatherwood's).—Nine claims. Ores of copper at lime contact.

Pontotoc Mining Company.—Twenty claims. Copper ores.

Pandora Group.—Twenty-three patented claims.

Stratton Group.—Ten claims. Copper ores.

PAPAGO DISTRICT.

South and west of Tucson, adjoining Pima District on the west. Thirty miles by wagon road from Tucson and includes the greater part of the Sierrita range.

Bail and Otis Group.—Ten claims.

Calumet and Arizona M. Co.—Twenty claims.

Lincoln Consolidated M. Co.—Garcia group. West side of the Sierritas; 30 miles southwest of Tucson. Thirty-four claims, and mill and townsite.

Margarita Group.—(J. T. Hughes.) One patented claim and millsite.

Red Carbonate Group.—Nine claims.

Montezuma Group.—(Hughes.) Twenty-three acres patented.

Parcell Grand Consol. M. Co.—Twenty-five miles southwest of Tucson. Three hundred acres patented; 15 claims not patented. Lead, silver, gold and copper. Twin Buttes camp 10 miles distant.

PIMA DISTRICT.

About 35 miles south of Tucson and adjoins the Sierrita. It is reached by the Twin Buttes branch of the railway from Tucson to Calabasas and Nogales.

Armagosa Copper Co.—In 1908 under bond to the Calumet & Arizona M. Co.

Contzen and Murphy, Group Three.—Thirty-three claims in three groups; copper ores.

Guefano Group.—(Pacheco & Richey.) Seven claims; 24 miles from Tucson.

Elkhorn M. Co.—Ten claims; copper.

Marconi Group.—(Roni.) Seven claims. Copper ores.

Mineral Hill Consolidated Copper Co.—Patented ground 850 acres; 24 unpatented claims.

Meyer-Clarke-Rowe Mines Co.—San Xavier group. (A. W. Forbes, Agt.) Seven patented claims. Ores: Silver, lead, copper and zinc. Twenty miles to shipping point at Tucson.

Ninety-nine Group.—(Boston and others.) Twenty-eight miles southwest of Tucson; two miles from Twin Buttes. Nine claims, one millsite.

Old Allison Group.—Between Plumed Knight and the San Xavier. Nineteen claims. Copper ores. Twenty miles to Tucson.

Olive Camp Mining Co.—Wedge group. Twenty-two miles south of Tucson by wagon road. Five claims. Argentiferous galena.

Paymaster Consolidated.—Paymaster group. (Owen.) Fifty-two claims.

Port Arthur Group.—(Cunningham.) Thirty-one claims; copper ores.

Plumed Knight.—(Chilson.) Are patented claims and 13 are not patented. Copper ores.

Roni Read and Baxter Group.—Eleven copper-bearing claims.

Reid Group.—(Baxter, Ellis and Bell.) Thirteen claims. Thirty-two miles south of Tucson. Copper, silver and gold.

Vulcan Group.—(Schaaf.) Four patented claims.

Swastika Copper and Silver Mining Co.—Twenty-four claims; silver and lead.

Silver Spoon Group.—(Adjoins Paymaster.) Six claims.

South San Xavier Copper Co.—(Franklin.) Three claims patented; four not patented.

Twin Buttes Mining and Smelting Co.—Twenty-seven miles southwest of Tucson in Sierrita mountains. Seven claims patented and 55 not patented. Connected with the Southern Pacific railroad by rail.

The four principal claims of the Twin Buttes, are the Senator Morgan, Copper King, Copper Glance and Copper Mill. The ore occurs in well-defined contacts of granite with limestone and in lode-like bodies of garnet, which is the abundant vein-stone. The railway constructed by this company from Tucson, has, with the exception of the branch leading from the valley up to the mines, been disposed of to the Southern Pacific and forms the first portion of the line from Tucson to Calabasas, Nogales and Mexico.

QUIJOTOA DISTRICT.

This district lies west of the Cababi District and the Santa Rosa. It became prominent some twenty years ago as a silver producing camp of great promise. It has within its limits gold placers, without water, but worked in a desultory way by the Papago Indians.

Silver Bullion Group.—Twenty-four acres patented.

Weldon Copper Mining Co.—Thirty claims.

Lovell-Richey-Carpenter Group.—Seven claims; copper ores.

RINCON DISTRICT.

East of Tucson and includes the Rincon range southeast of the Catalina District.

Palo Verde Copper M. Co.—Ten claims, about 9 miles northeast of Vails Station.

Rudge Copper Co.—Nine claims.

Santa Yduvijen Group.—(Lovell, Carpenter and Richey.) One hundred and forty acres.

Virginia Belle—(Bennett, Pantano.)

REED DISTRICT.

Between the Rincon and the Catalinas, about 35 miles from Tucson by the wagon road.

Arizona Apache Copper Mining and Smelting Co.—(Foran-Crisman group.) Twenty-nine claims; copper ores.

Del Monte Group.—Seven claims. Copper ores.

SILVER BELL DISTRICT.

About thirty-five miles northwest of Tucson, covering the Silver Bell mountains at the northern prolongation of the Roskruge range, and formerly known as the Abbie Waterman mountains.

Arcade Group (Decker, Johnson, Fairon).—Sixteen claims. Eight miles from Sasco.

Cole-Glidden Copper Company (Vic Griffith.)—Sixteen claims. Copper ores.

Copper Giant.—Fourteen claims. Ten miles to Sasco smelter.

Cleveland Arizona Mining Company.—El Toro Copper group. Ten claims. One quarter of a mile from the railroad at Silver Bell.

Indiana-Arizona Mining Company.—Abbie Waterman group.

Imperial Copper Company.—About 800 acres patented, twenty-eight claims; balance not patented.

E. B. Gage, president; W. F. Staunton, vice-president and general manager.

This property is connected with the two smelting furnaces at Sasco, on the Southern Pacific railroad, by the branch known as the Arizona Southern railroad, with a trackage of twenty-one miles. The furnaces have a combined capacity of 750 tons daily. The second furnace was started December 1, 1908. (See further under the caption of Smelters.)

In five years' time since work at the mines under the Imperial management began, the lodes of copper ore have opened to a depth of 800 feet by both a vertical and an incline shaft. Tunnels have been cut, roads made, and a town of some 2,000 inhabitants has replaced the solitudes of the desert. More over, the smelting town of Sasco, in the valley, has grown up around the furnace plant and is connected with the mines by a standard gauge railway fourteen miles long and with the trunk line of the Southern Pacific at Red Rock.

The Imperial carries the names of about 800 men on its pay roll. It mines and ships 600 to 750 tons of ore a day, and Sasco produces 1,250,000 pounds of copper a month. It thus ranks with the large copper producers of Arizona and is growing in extent and importance, with a large area of ground yet to be opened.

Mr. Staunton, the general manager, in his report for 1909, says: "The Mammoth mine has continued to be the largest producer during the year both in tonnage and value, the out put having been 89,542 tons.

"The occurrence of ore in this mine, as indeed in all our limestone mines, is associated with the contact of the limestone and an intrusive porphyry, the ore bodies sometimes extending for long distances in the limestone, but generally originating at the contacts. The porphyry has broken the limestone into large, irregular blocks, which have been so displaced by fracture and movement as to make the following of the contact (which is the method employed) difficult."

La Mina Cobre Company—Copper Prince group. Twelve claims. Eight miles from Sasco smelter.

North Silver Bell Group.—(Percy Williams.) Two hundred and fifty acres, adjoining the Imperial on the northeast.

Oxide Copper Company.—Doxology and True Blue group. One hundred and forty claims.

Richardson-Crepin Group.—Claims near Imperial.

Red Rock Copper Company.—Nine patented claims and one millsite.

Silver Hill Consolidated Copper Co.—The properties of this company are in the Silver Hill mountains, about five miles easterly as the bird flies from the mines of the Imperial Copper Co., and 40 miles from Tucson. The range of elevation known today as the Silverbell mountains was formerly known as far back as 1878 as the "Abbie Waterman mountains." The original mining location in these mountains was known as the Abbie Waterman mine. The property was early extensively worked for lead and silver and produced a large quantity of both of these metals. As the work of development proceeded copper ore became the chief product and the mine became known as a copper mine. It is known also as the Paddy Woods mine, and has been extensively developed.

The initial properties upon which the Silver Hill Consolidated Copper company was organized, consisted of the five following claims, to-wit: Metallic Beauty, Majestic, Silver Hill, Silver Hill West Extension and Faison. These are patented mines.

Subsequent to the organization of the company, it was found advisable by the corporation to cause to be located for it, fifteen additional mining claims. These are admirably situated adjacent to and surrounding the above named five patented mines, and the area enclosed in these additional claims is exceedingly promising for the production of copper.

The copper ores occur in connection with strata of limestone and quartzite at or near the contact of these formations with granite. They are also found in fault fissures followiing the planes of disruption of large masses of rock.

MINERALS OF PIMA COUNTY.

Under the title "Mineralogical Sketch of the Silver Mines of Arizona," Mr. Raphael Pumpelly, in 1861, presented a paper to the California Academy of Science, which was published in the proceedings (Vol. II, 1862). A copy was also printed by Mowry in his "Arizona and Sonora," in 1864.

That paper deals chiefly with the minerals and mines of the Cerro Colorado, and of the Santa Ritas as then known. The principal species noted are the argentiferous grey copper, stromeyerite, galenite, blende and native silver, practically the mineral species of the Salero and Tyndall District as known today.

In May, 1907, the writer contributed a list of Pima County minerals to the "Citizen" for its "Mining and Industrial number," which list, with additions and corrections, is here repeated. Reference is also made to the list of Mineral localities of Arizona, published in 1909, as a report to the Governor.

The most abundant and showy mineral species of which Pima County can boast, are doubtless the ores of copper, more especially those resulting from the oxidation of copper sulphides. The mineral cabinets and great museum collections of the world have been enriched by the brilliant crystallizations of azurite, malachite and cuprite from the stopes of the Copper Queen mine at Bisbee, in the adjoining Cochise County. Fortunately for such collections, and for science, the management of the mine under Dr. James Douglas has ever been an appreciative conserver and distributor of the gems of the mine. A fine series may be seen in the Museum of the University.

Other remarkably beautiful cystallizations of the rare mineral known as Wulfenite, the molybdate of lead, have been taken from the Mammoth mine north of Oracle, and from the Old Yuma, specimens of which are also in the Museum.

Amongst other compartively rare species occurring at several places in Pima County, we may mention molybdenite, vanadinite, Des Cloizite and tungstic ochre. The following alphabetical list includes some of the best-known species and localities, but is confessedly imperfect:

Argentite.—Silver sulphide. With the ores of the Eureka, the Alta, Montezuma, Empress of India, Montezuma's Daughter and other silver mines of the Tyndall District, Santa Cruz County. Also, in the ores of Cerro Colorado and Liberty mine.

Argentiferous Grey Copper.—See Tetrahedrite.

Argentiferous Lead Ore.—See Galena.

Azurite.—The blue carbonate of copper. At the Azurite mine; Sierrita; Helvetia, at the Imperial, Silver Bell District, Ajo, and at nearly all the copper mines of Arizona.

Barite.—In complex groups of flattened crystals from the Quijotoa District. At the Imperial Copper Mine, Silver Bell District, in crystals; also at the Santa Catalinas.

Calcite.—A common associate of the ores of lead, of copper and of silver. Abundant as caliche.

Cerussite.—Lead Carbonate. Is generally found in the oxidized croppings of the lead-bearing lodes. At the Paymaster, the Mowry, in Santa Cruz County; at the Flux Mine, Patagonia; World's Fair Mine.

Chalcocite.—At Spencer's Papago Copper Mine, Cababi, District, and at other copper claims.

Cuprite.—Crystallizations of this rich ore of copper were formerly abundant in the ores of copper at the Copper Queen

in Cochise County. A cubic crystal measuring nearly one-half inch on the sides, and translucent of a fine ruby-red color adorned the collection of Mrs. Williams of Bisbee. It was formerly found in large masses with native copper and malachite at the Ajo.

Chalcopyrite.—The most common of the combination of iorn and copper with sulphur, known generally as "yellow copper," is common in the copper claims. It is softer than iron pyrites with which it is very generally associated. Found at the Helvetia Mines; Paymaster Group; in Tucson mountains and the Silver Bell Mines. at Leatherwood, Apache Camp.

Chrysocolla.—Silicate of copper in varying shades of green color is a common associate of other ores of copper in the croppings of the copper-bearing lodes of Pima County.

Des Cloizite.—A compound of zinc and vanadic acid. Occurs at the Old Yuma Mine, near Tucson. This species named for the late Professor Des Cloiseaux, a famous mineralogist of Paris, France.

Epidote.—An alteration mineral allied to garnet and a frequent associate of ores of copper and specular iron. It is abundant at the Morgan Mine, Twin Buttes, and in the shales of Silver Bell District it carries native copper.

Garnet.—Common as a veinstone of copper ore at the Twin Buttes, Imperial and other mines; at Helvetia and in the Mineral Hill District.

Gypsum.—At many localities in Pima and Santa Cruz Counties, especially along the San Pedro River.

Gold.—At Greaterville, in placer deposits, also in veins in the basal granite conglomerate of the Santa Ritas, and in shaly limestone. In the placers of Horseshoe Basin, and generally in association with copper ores in small quantity. In quartz veins at Oro Blanco, Arivaca and Salero in Tyndall District. "White-Gold," in Oro Blanco District and Canada

de Oro. At the Southern Belle, Old Hat District, Catalina mountains.

Galena or Galenite.—A widely distributed mineral, generally silver-bearing and known as argentiferous lead. Old Yuma mine, near Tucson; Liberty mine, Cerro Colorado. Also in Tyndall District; Eureka, Mabel and other mines; Paymaster mines, Sierritas; at the Mowry mines, Santa Cruz County; World's Fair mine, Flux mine, Patagonia; at the Vekol (Pinal) and other mines west and south of Tucson.

Huebnerite.—A tungstate of manganese, used specially for making tungsten steel and for hardening steel. Occurs abundantly in quartz lodes in and near Gigas mountains (Arivaca District). Also in the Whetstone mountains and the Dragoons, in Cochise County.

Hematite.—Occurs massive and foliated at several copper mines and especially in the Montosa copper mines and in the foliated form associated with copper and with zinc-blende at the Pluto and at the Isabella and other claims.

Lead Sulphide.—See Galena. For lead-carbonate see Cerussite.

Manganite.—An ore of manganese frequently associated with lead and silver ores, especially in the lodes traversing diorite in the Tyndall District, Santa Cruz County. It is there earthy and amorphous mingled with other oxides and is derived from pink manganese spar; one of the veinstones. At the Coyote mountains, manganese oxide forms a thick superficial coating on porphyritic rocks.

Magnetite.—Common as croppings of copper deposits, especially in Santa Cruz County, Tyndall District, near to the Montosa, and in Josephine Canyon at the Vulcan, in a large bed associated with copper ore and suitable for flux. At the Twin Buttes and other copper mines in Pima County.

Molybdic Ochre.—At McCleary's molybdenite mines, Santa Ritas.

Molybdenite.—Molybdenum sulphide, at McCleary's mines, Santa Ritas, in quartz gangue.

Native Silver.—World's Fair mine, near Patagonia, Santa Cruz County; Eureka mine and the Alta, Salero, Tyndall District.

Native Copper.—Paymaster mines; in epidote, Silver Bell District. At the Ajo.

Scheelite.—(Tungstate of lime.) Occurs in the Maudina claim, Old Hat District, Santa Catalinas.

Specular Iron.—This species, known also as hematite and micaceous iron ore ,is a frequent associate of copper ore croppings, often in the position of gossan overlying the copper ore. Occurs in large beds associated with magnetite in Tyndall District, Santa Cruz County. See Hematite.

Sphalerite.—Sulphide of zinc. At the Montana mine, Santa Cruz County, at the Helvetia and other mines in Pima County.

Stibnite.—Sulphide of antimony, occurs sparingly in connection with some of the lead ores.

Stromeyerite.—An ore of copper of high grade and rich in silver. Constitution mine, Tyndall District, Santa Cruz County; also at the Montezuma group, same district; Heintzelman mine, Cerro Colorado.

Tenorite.—Black oxide of copper, is usually found in small quantities in the midst of rich secondary copper ores in the croppings of the larger copper lodes.

Tetrahedrite.—In the veins traversing diorite in the Tyndall District, Salero. In the World's Fair mine, near Patagonia. At the mines of the Cerro Colordo; also in the Cababi District. In cyrstals at mine of Clark & Petersen.

Tungsten.—See Huebnerite.

Vanadinite.—Old Yuma mine, north of Tucson.

Wolframite.—See Huebnerite.

Zinc Ores.—See Sphalerite.

BUILDING STONE, MARBLE AND OTHER MATERIALS.

There are many places in Pima County, from one end to the other, where excellent building stone can be cheaply quarried.

Tufa.—Near Tucson there are two or more quarries where a light-colored gray or nearly white tufa is obtained for building. It is a strong and durable stone, breaks with a conchidal fracture without rift, and has been effectively used for one of the larger buildings at the University and for a two-story dwelling. It is used also for coping and trimmings.

For rough foundations, coping and cellar walls, a heavier, darker-colored lava-rock is obtained at Tumamoc Hills and at Sentinel Peak, opposite Tucson.

Marble.—The Tucson mountains, west of the city, yield a fine-grained, very dark-colored, almost black marble. White statuary marble may be had near Giesman's Camp, in the Catalinas.

A variegated marble of great promise occurs near the Total Wreck mines, in the Empire District.

Santa Rita Marble, Granite and Mining Company.—This company has opened quarries of marble and granite in the Santa Ritas, and exhibits a fine series of samples in the office of the Chamber of Commerce. One of the samples is nearly dense black and takes a high polish. Other samples are blue-gray, suitable for mantels and monuments.

Red Freestone may be had in the Southern Belle canyon, and quartzite in abundance.

Brick and Tile Clay of excellent quality occurs near Pantano, on the line of the Southern Pacific railroad.

Brick.—The manufacture of a superior quality of brick has been started by Q. Monier, using a peculiar feldsparthic tufa which, after grinding and moistening, is compressed in

molds and then burned to a very dense and hard brick of superior form and quality, with a variety of pleasing colors. This product is a most desirable accession to the variety of building materials obtained in Tucson.

Gypsum.—This can be obtained in quantity near Tucson.

Limestone.—Rock suitable for burning to caustic lime is obtained in the Tucson mountains and in the Sierritas, Santa Ritas, Catalina and the Rincons. Good lime for mortar can be had from the Caliche, so abundantly spread through the soil about Tucson.

SMELTING WORKS.

The ruins of ancient adobe furnaces and the mounds of scattered slag piles in various places in Pima County, especially along the Santa Cruz valley, record the industry of the metallurgists of the seventeenth and the early part of the eighteenth centuries. Such evidences are most notable where the lead-silver ores of the old Patagonia mine were treated; also at the Tumacacori Mission, near Tubac, where Salero ores were treated, and also at the Cerro Colorado.

The furnaces were built on the pattern of the Mexican vasa, practically a combination of a reverberatory and a shaft furnace, and were adapted to the treatment of comparatively small quantities of high-grade silver ores in mixture with silver-bearing lead ores. The resulting metallic lead, rich in silver, was cupelled with the formation of lithage and pure silver. Charcoal was used for fuel. Similar furnaces of small size might be used today with profit in some localities where crude oil can be obtained for fuel.

Furnaces for copper smelting have been established at several places at different dates. One was maintained for years a few miles north of Tucson, as a custom smelter, supplied largely by the ores from the Old Boot mine, Silver Bell District. A furnace was also kept running for a long time

at the mine. A smelter at the old Apache mine in the Catalinas was run for a time and produced considerable matte from the rich surface ores but at great expense for fuel. It was moved to the Isabella mine in the Santa Ritas, where Capt. Burgess produced several shipments of black copper, but was obliged to shut down by a complete change in the character of the ore, as depth was obtained. These results emphasize the importance, or necessity of having a proper mixture of ores for the furnace charges, such a mixture as is rarely found in one mine or locality.

With the acquisition of the Old Boot and other copper bearing claims at Silver Bell, the Imperial Copper Company organized the Southern Arizona Smelting Company, with Mr. E. B. Gage as president; W. F. Staunton, vice-president and general manager, and Mr. Meade Goodloe, superintendent. A 400-ton smelting furnace was erected at Sasco on the Southern Pacific railroad, about 14 miles distant, and was connected by rail with the mines.

The first furnace was erected there under the immediate supervision of Prof. Meade Goodloe in the winter of the years 1907-1908, and was started in the month of February, 1908. During the year, it averaged 366 tons of charge.

A second furnace, increasing the total capacity of the works to 750 tons per day, was started December 1, 1908, and in March, 1909, the production had been increased to 1,500,000 pounds of copper per month. During the last seven months of 1909 the two furnaces averaged 371 tons of ore each per day, exclusive of flue dust, counter slag or other material entering for a second time. The material smelted consisted of Imperial ore, 240,833 tons; custom ore, 3,140 tons; iron flux, 1,567 tons; a total of 245,540 tons.

Liberal inducements in smelting rates have been offered for custom ores, resulting in shipments to the extent of 3,140 tons.

The furnaces have made matte of good converting grade,

averaging near to 40 per cent copper. Skilled, judicious management and the increased scale of operations have resulted in a marked reduction in the net cost per ton, the average for 1909 being $4.91, covering mining, transportation, smelting and converting. The average for the three months ending September 30th was as low as $3.55 per ton. General Manager Staunton, from whose report these figures are taken, directs attention to the fact that on this basis with copper at 13 cents per pound in New York, netting approximately 11 2-5 cents in the bank, a recovery of slightly less than 40 pounds per ton of ore, or 2 per cent only, is necessary to cover all operating expenses.

In addition to the extensive smelting works at Sasco, where the ores from the Imperial mine and some custom ores are smelted, as already noted, it is proposed to have a plant nearer to Tucson. The many copper-bearing properties near this, and along the Santa Cruz valley are being made easily accessible by the construction of the railway from Tucson to Calabasas and Nogales, thus connecting with the newly developed railway system of the Western Mexican States.

The desirability of a custom smelter near to Tucson has long been noted and discussed.

In a communication to the Tucson Chamber of Commerce, March 19, 1910, Capain C. F. Roberts, superintendent of the Esperanza and the Chesterfield mines, outlines a plan for the consolidation of effort of the leading producing mines about Tucson for the construction and maintenance of a smelter plant. He enumerates the Esperanza, the Chesterfield, the Omega, the Helvetia and the Twin Buttes properties as capable of furnishing an adequate supply of ore for a 300-ton smelter, rating the Helvetia as good for 200 tons a day, the Omega 100 tons, and the Twin Buttes 100 tons, leaving in addition large reserves at the mines. Other mines, especially the Old San Xavier mine, and the claims of Mineral Hill, are named as important adjuncts in the ore supply.

It has been proposed by others to erect a smelter at the Gould mines in the Tucson mountains, where it is claimed that the ore is sufficiently abundant.

The smelting works at Sasco, where the copper ores of the Imperial Mines Co. are treated, has the advantage of a favorable natural mixture of ores and of being on the main line of the Southern Pacific railway and is known also as a custom smelter.

In any projects for the establishment of a smeltery it is essential to consider not only the quantity of the ore-supply, but its nature, as regards proper smelting mixtures; the accessibility of suitable fluxes, the fuel supply and the facilities for transportation.

AGRICULTURE AND STOCK RANGES.

The character of the vegetation of Pima may impart a better idea of the climate than any description.

Southern Arizona, particularly large portions of Pima County, is the home of the vine, the fig and the pomegranate. Palms and pepper trees abound, and orange and lemon trees may be grown in favorable situations.

The bottom lands of the Santa Cruz and of the Rillito yield large crops of alfalfa and grain and supply the market at Tucson with fresh vegetables throughout the year.

The extreme fertility of the soil of these valleys is generally known. Although the ranches and farms of the Santa Cruz have been worked for many generations and without fertilizing in any form there is no lessening of fertility and yield.

In the report of the Governor of Arizona for 1899, page 205, we read:

"The Santa Cruz valley, which extends from south to north across the entire county, was undoubtedly the first seat of agriculture in Arizona. The old settlements of Huëbabi, Tu-

macacori, Tubac, Tucson and San Francisco maintained a considerable population and supplied the Spanish military posts with provisions by agriculture in the earliest dawn of civilization on the American Continent and the descendants of those early producers, augmented by recent settlers, still carry on successful agriculture at all these points and at many new places until agriculture has become an important industry. For more than three hundred and fifty years, ever since the Spaniards first set foot in the Santa Cruz valley, crops have been produced every month in the year with irrigation and without a particle of fertilizer being used and still the soil is rich and abundantly productive, and is annually growing richer from irrigation. Two crops are raised on the same land each year."

The same authority says:

"Twenty per cent of the land of Pima County can be successfully irrigated and reclaimed by a system of ditches and drainage pipes and reservoirs for water storage at a reasonable outlay. * * * Wheat, barley, oats, alfalfa, corn, sorghum, tobacco, potatoes, peas, beans, beets, all kinds of vegetables, fruit, etc., can be produced on these lands."

The Canoa Rancho.—In the Santa Cruz valley, about thirty-five miles south of Tucson, is a tract of land two and one-half miles wide and eleven miles long, originally a Spanish land grant but fully confirmed by the United States, and now under development by Milwaukee capitalists. This tract of over 2700 square miles, along the richest portion of the valley and under one ownership, has much agricultural importance. A large portion of the tract is covered with heavy mesquite wood which will find an appreciative market for domestic fuel in Tucson.

Rillito Lands.—The bottom lands of the Rillito near Tucson are famed for their fertility and productiveness. They are much prized and utilized by market gardeners, who largely supply Tucson with fresh vegetables winter and summer.

Cattle Industry.—Pima County has always been famous for the abundance and quality of its beef cattle. The nutritious and high flavored wild grasses of the mountain slopes impart a sweetness and flavor to the beef unattainable by fattening with alfalfa. The large herds of horses that formerly ranged over the plains of Pima have to a great extent disappeared and left the pasturage to horned stock. In some parts of the valleys in Papagueria the native grasses in favorable seasons grow luxuriantly and so thickly that they may be advantageously cut for hay.

Angora Goats.—Several herds, one in Tyndall District (Santa Cruz County), prove the adaptation of the region to the goat industry. The hilly region of the Salero appears very favorable. The goats feed chiefly upon the low-growing acacia-like shrubs in preference to grasses.

CITY OF TUCSON.

Tucson, the county seat, has been styled by Miss Sharlot Hall, the Territorial Historian, as the "Mother of Arizona History." It deserves the title. It was certainly an important residence place for aboriginal people long before historical records. It was a Mexican pueblo and a military post, a presidio, long before the Gadsden Purchase.

Authorities differ greatly regarding the date of its organization as a pueblo. Some claim a date as early as 1555, earlier than the San Augustine settlement in Florida in 1595. Others state that "Chookson" is recorded as a settlement in the latter part of the sixteenth century.

The Padre Marco de Niza set out from Culiacan in the year 1539 to find the cities of Cebola. He reached the Gila River and found the Pima Indians. His reports led to the expedition of Coronado in 1540, who is believed to have followed down the Santa Cruz and then visited the Indian settlement of Tucson.

In 1694 the Padre Eusebius Francis Kino, accompanied by Padre Mange, reached the Gila River from Sonora by way of the Santa Cruz valley, passing by the sites of the present towns of Tubac and Tucson, visiting the Pima Indians.

Hinton in his handbook, a good authority about Arizona, page 264, says:

"The early origin of Tucson is rather obscure. Coronado's reports of his expeditions to the 'Seven Cities of Cibola,' (N. M.) in 1540-49, though very minute in details, do not mention the valley of Santa Cruz, through which he probably passed, as being inhabited. A claim is made for it by Col. Hodge, in 'Arizona As It Is,' (on what data is not stated) that this valley was settled about the year 1560, which would make it the oldest city in the United States but one, it being stated that Santa Fe was settled in 1555, and San Augstine Florida, in 1565. Three miles below Tucson, and a mile due east from the Casa de Dominie Padre (or the Mission of San Augustin) is what appears to be an old town in ruins, but no clue can be obtained as to its origin, history, or the date and circumstances of its destruction. It is again believed that Tucson was commenced as a Spanish military station to protect the Mission of San Xavier del Bac, nine miles south, in 1694, or very soon afterwards. About the oldest inhabitant there, born in Tucson in 1819, is Francisco Leon. As far back as he recollects it was a military post, at which there were stationed about eighty or ninety soldiers. There were about 140 hovels, without doors or panels, and the windows, where there were any, had no frames: these buildings had a prison-like and singular appearance, inside and out. There were about three hundred citizens: the cultivators sold their produce to the government. Until about the year 1825 no late frosts were known to injure the fruit trees in blossom; and large quantities of grapes, peaches, pomegranates, quinces, apples and apricots were raised in the valley west of Tucson."

"Bartlett, in his 'Personal Narrative,' published after the

Mexican War, but prior to the Gadsden Purchase, states that Tucson 'has always been, and is to this day, a presidio or garrison, but for which the place could not be sustained. In its best days it boasted a population of a thousand souls, now diminished to about one-third that number. * * *The lands near Tucson are very rich and were once extensively cultivated, but the encroachments of the Apaches compelled the people to abandon their ranches, and seek safety within the town. The miserable population, confined to such narrow limits, barely gains a subsistence, and could not exist a year but for the protection from the troops. More than once the town has been invested by from one to two thousand Indians, and attempts made to take it, but thus far without success."

"A few more years and Garcilla, commanding the presidio, announced to the soldiers drawn up in line, the turning over, under the Gadsden Purchase, of that portion of the territory to the United States. On March 10, 1856, all the Mexican authorities and troops evacuated the place. Eleven days previously the first American store in Tucson was started by the arrival of Solomon Warner, from Fort Yuma, with thirteen pack animals loaded with merchandise. Hooper & Hinton, of Fort Yuma, were interested in the adventure."

"Late in 1856, Hon. Charles D. Poston made his second visit to Arizona, by way of Texas and New Mexico. He describes Tucson at the time as being a place of from 300 to 400 Mexicans, and about 30 Americans."

But whatever dates history may give us, it is certain that Chookson, Tulqueson, or Tucson, was, for an unknown period, an aboriginal settlement of the forefathers of the Papago or Pima tribes, attracted there by the exceptional advantages of abundant water supply, fertile land and favorable climate. The origin of the place is lost in antiquity but, since the acquisition of *Pimeria Alta* by the United States, its growth has been marvelous and the Tucson of today is a modern, thriving city with gas, electric light, water, sewer system, educational

and religious institutions.

The city is beautifully situated on the right bank of the Santa Cruz River on the lower part of the long, detrital slope from the Santa Catalina mountains, at an elevation of 2400 feet above the sea.

Situated upon the main trunk line of the Southern Pacific transcontinental road, at the end of a division, it is the site of the important railway repair shops and depot of crude oil used for the engines. It is also the terminus of the great railway system of the western coast of Mexico, where trains are made up for all points in Sonora and the adjoining states as far south as Mazatlan.

Tucson is acknowledged as the chief science and educational center of the Territory. It is the site of the University, with its score of professors and teachers, and of the United States Agricultural Experiment Station, with extensive chemical laboratories and experimental farms.

Here also we find the Desert Botanical Laboratory of the Carnegie Institution, with its corps of investigators under the direction of Dr. D. T. Mac Dougal.

The United States Magnetic Observatory has recently been established at Tucson.

The Territorial Museum is established at the University and the Free Public Library of many volumes is housed in a beautiful building, the gift of Mr. Carnegie, in the principal open square of the city.

Tucson has, for many years, maintained a literary club for women, the pioneer club in Arizona. At a recent meeting of the Federation of Women's Clubs of the Territory, Mrs. S. C. Newsom, Ph. D., of Tucson, was elected President of the Federation.

Tucson is the home of the Pioneers' Historical Association, which has a valuable library and collections.

The public schools of Tucson have between 2,000 and 3,000 pupils, fifty-three teachers, and five principals. Of the five ward school buildings, one is single and four are two-storied; all are of brick and substantially constructed and well equipped with the customary grammar school apparatus. The new High School building has a basement, a first and second floor, and fifteen recitation rooms, with laboratories for physiography, chemistry and physics, and a fine assembly hall with a seating capacity of more than eight hundred, fitted with desks and opera chairs and is electrically lighted.

Tucson is well supplied with religious organizations and places of worship. Nearly all the Christian denominations are represented in the population.

There are two daily papers; two or more weekly papers, and "The Plant World," a botanical magazine, is printed and published in Tucson.

Tucson, by reason of its varied advantages, and above all its unrivalled climate, is a favorable place of residence, par ticularly in the winter season.

The market gardens of the Rillito and the Santa Cruz valleys insure a constant supply of fresh green vegetables throughout the year, and the proximity by rail to the fruit market of California and western Mexico keeps the market well supplied with citrus and other tropical fruits.

The completion of the railway from Tucson to Mexico along the natural route up the Santa Cruz, has placed the modernized old pueblo in close connection with Sonora and Sinaloa, and, amongst other advantages, will permit of an abundant supply over night of fresh sea-food in great variety from the teeming waters of the Gulf of Cortez, at Guaymas, or at Lobos. Thus fish and oysters, taken from the water in the evening, may be on the table in Tucson in the morning.

The mission church of San Xavier del Bac, nine miles south of Tucson, and that of Joseph de Tumacacori, two miles south

of Tubac, are objects of much interest to historians and tourists. San Xavier is well preserved and in use, especially by the Papagoes. Tumacacori is in a ruinous condition and is reserved by the United States as a national monument.

On the hill at San Xavier, surmounted by a cross, and a place of pious pilgrimage, there is a grotto which, like the famous grotto of Massaville at Lourdes, has some important religious significance and attraction to the tourist as well as the faithful devotee.

In addition to the old mission churches and other objects of historical interest about Tucson, archaeologists may find much to attract their attention in buried villages and cities of which there is no record. Chalqueyuma, for example, opposite Rillito, fifteen miles below Tucson, on the bank of the Santa Cruz, shows nearly a mile square of buried foundations. At the mouth of Bear Canyon, the form of ancient dwellings may be traced by the foundation posts of stone, and the form of ancient walled places of refuge may be studied in the ruined walls on the top of Tumamoc hill, west of Tucson.

The natural roads around Tucson and other parts of the country are remarkable for their excellence. The caliche or lime deposit in the soil, has the remarkable property of hardening like cement mortar even when loosely filled in a roadway. It packs and sets to a solid mass and encloses the gravel and boulders which are mingled with it as firmly as if in artificial grouting. This granite mixture when worn down by travel and swept clean by the wind looks like an artificial mosaic and is very hard and durable.

CLIMATE.

Pima County enjoys the typical climatic conditons which have made Arizona famous for its salubrity and as a delightful resort from the severity of winter in the Middle West and the Eastern Atlantic States. The clearness of the atmosphere gives free passage to the vivifying rays of the sun and at night

to free radiation, bringing a refreshing and tonic coolness conducing to rest and recuperation. Arizona is a land of golden sunshine, comparable to the sun-kissed borders of the Nile and even superior in health-giving qualities.

The sun, the great life-giver, is the chief and fundamental factor in climate. It determines the winds, temperature, evaporation, and precipitation. In the clear skies of arid regions it attains its greatest power and greatest vivifying influence felt alike by vegetable and animal life. The chemical activity of its rays is not lost in clouds or fogs, but exerts its full force. The excellence of photographic pictures is a familiar example of this power.

The dry, equable and salubrious climate of Southern Arizona renders the region a favorite resort for persons afflicted with pulmonary complaints.

Special weather reporters and the scientific climatologists admit that Tucson is the center of the most favorable zone in the southwest for the improvement and maintenance of life of consumptives in the United States or even in the world. (Report of Governor Murphy, 1899.)

It is the avowed opinion of eminent physicians and experts that there is no other portion of the United States which will compare favorably with that in and about Tucson for the relief of pulmonary affections.

The Hon. Whitelaw Reid, is credited with the statement in the New York Tribune that "during five months in Southern Arizona in winter there was but one day when the weather made it impossible for me to take exercise in open air at some time or other during the day. Of course there were a good many days which a weather observer could have observed as cloudy and some were showery, but during the five months from November, 1895, to May, 1896, there were only four days when we did not have brilliant sunshine at some time during the day. Even more than Egypt, or anywhere north of Luxor, Arizona has sunshine. The nights throughout the

winter are apt to be cold enough for wood fires and blankets. Half the time an overcoat is not needed during the day, but it is never prudent for a stranger to be without one at hand.

"The atmosphere is singularly clear, tonic and dry. I have never seen it clearer anywhere in the world. It seems to have about the same bracing and exhilerating qualities as the air of the Great Sahara in Northern Africa, or of the desert about Sinai in Arabia Petrea. It is much dryer han any part of the Valley of the Nile north of Cataract. It seems to me about the same in quality as the air on the Nile between Assouan and Wadyhalfa, and somewhat cooler."

The climatic changes of the region are discussed by the writer in a report to the Desert Botanical Laboratory (Botanical Features of North American Deserts, page 66).

The enormous amounts of degradation of the mountain ranges, the excavation of rocky canyons and the vast accumulation of debris in the valleys as well as the deeply cut water channels in the debris which forms the ancient slopes, all tell of the former larger volume of water and consequently of greater precipitation than we now have..

We are living in an era of dessication dating back probably to the Pleistocene, the era of the glaciers. The rainfall is now desultory, uncertain, spasmodic, excessive at times, as "cloud bursts" so-called, but torrential and temporary, and then scany or entirely wanting.

For the accompanying table, showing the range of temperature in degrees Fahrenheit at Tucson for the year 1909, I am indebted to Director Forbes of the Agricultural Experiment Station at the University. And similarly for the tabular statement of the rainfall at Tucson for fourteen years from 1896 to 1909 inclusive.

TEMPERATURE RECORD IN DEGREES, FAHRENHEIT, TUCSON—1909.

	Max.	Min.	Mean Max.	Mean Min.	Greatest Daily Range.
January	82	29	70.1	37.4	49
February	76	23	66.4	34.5	43
March	81	25	69.3	36.8	51
April	91	30	82	44.8	49
May	96	41	87.7	49.5	47
June	106	53	100.1	62.7	46
July	108	64	98.6	71.3	36
August	102	62	94.7	70.6	35
September	100	52	92.4	63.1	43
October	94	36	87.8	70.3	50
November	91	26	74.7	39.8	53
December	79	17	62	33	39

PRECIPITATION RECORD FOR 14 YEARS AT TUCSON.

	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	Average
January	.53	1.79	1.10	.78	.16	1.15	.53	. . .	.20	2.25	.30	1.66	.76	.51	.837
February	.08	.08	. . .	.39	.49	1.38	. . .	1.11	.54	4.15	.32	.12	1.98	.50	.795
March	.27	.13	.63	.37	.54	.64	.40	1.63	.06	3.88	.32	.56	.39	.33	.725
April	.12	. . .	1.05	.62	1.12	.04	....	....	....	3.53	.50	.02	.10	....	.507
May	. . .	. . .	. . .	. . .	. . .	.41	....	.20	.61	.02	....	.43	.16	....	.13
June	.19	. . .	.20	1.27	.17	. . .	.19	.22	.18	.24	....	....	....	.54	.23
July	3.43	1.98	3.22	1.87	.65	2.57	.42	1.52	1.75	1.10	1.82	4.01	4.77	4.04	2.368
August	1.25	3.42	3.94	1.82	.95	1.99	1.31	2.67	2.65	.56	2.53	3.46	2.18	1.36	2.15
September	1.13	2.71	.10	.03	.85	.28	.58	1.17	.89	2.84	.43	.80	.55	1.25	.972
October	3.31	.54	. . .	.67	.41	1.18	1.64	....	.04	.09	....	1.13	.26	....	.662
November	.30	. . .	.85	.56	2.45	.08	1.34	....	....	4.61	....	.78	.17	.87	.857
December	.76	.11	1.63	. . .	. . .	. . .	2.15	.28	.93	.90	4.57	....	2.62	.81	1.05
Total	11.37	10.76	12.72	8.38	7.79	9.72	8.56	8.80	7.85	24.17	10.79	12.97	13.94	10.21	11.283