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SECOND ANNUAL REPORT

OF THE

GEOLOGICAL AND AGRICULTURAL

SURVEY OF TEXAS,

—BY—

S. B. BUCKLEY, A. M., PH. D.,

STATE GEOLOGIST.

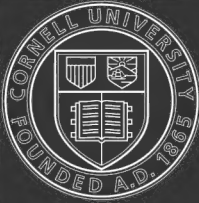
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# SECOND ANNUAL REPORT

—OF THE—

# STATE GEOLOGIST.

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*To His Excellency, Richard Coke,*

*Governor of Texas :*

This second annual report of the geological and agricultural survey of the State, is respectfully submitted to your consideration. With many thanks for the aid you have given the work,

I remain, yours truly,

S. B. BUCKLEY,  
State Geologist.

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## INTRODUCTION.

In the following pages I have given what I deem to be the most useful things pertaining to the agricultural and mineral resources of the State, which I have obtained during the past year, reserving much geological matter of scientific interest for a final report. Since the last report, I have bought chemical apparatus sufficient to analyze mineral soils and mineral waters, which will be of great assistance in the future work of the survey. This apparatus has only been recently obtained.

AUSTIN, March 27th, 1876.

THE IMPORTANCE OF GEOLOGY AND GEOLOGICAL SURVEYS.

I supposed that the importance of geology and geological surveys was so well known and acknowledged that it would not be proper here to say anything about their usefulness. Nor should I allude to these things, had I not a few weeks ago, heard one who was called a leading member of the late Constitutional Convention, state in a public speech to that body, that "Geology is a humbug and he knew it to be so."

It is strange that all the leading universities, colleges and schools of the civilized world have been teaching a humbug for the last 45 years; and still more strange, that all civilized countries, including every one of the United States, excepting Florida, have had or are having geological surveys made of their domains; also, the United States Government, during the last 15 years or more, has had and still continues to have geological surveys made of its territories. These things have cost much toil and money. Has the labor been useless and the money wasted?

Far from it. The States where these things have been done are the most prosperous and have the largest incomes in agriculture and manufactures of any in the world.

The State of New York in 1836 appropriated \$104,000 for a geological and natural history survey of that State. In 1842 a further sum of \$26,000 was appropriated, since which other sums have been appropriated for its geological and natural history survey, making the entire amount given for this purpose about \$500,000. The first act for the survey was passed by its House of Representatives unanimously. Last year, 1875, \$20,000 was appropriated for its State museum and geological survey.

The United Kingdom of Great Britain, with a territory at home less than that of Texas, has more productive wealth than all the cotton States. This arises from her superior agriculture and manufactures, joined with mineral wealth and sufficient intelligence to make the most of every natural advantage. Her mines are being developed at depths of from a few hundred to more than two thousand feet. In 1874, she appropriated 206,697 pounds sterling for the advancement of science and art, as follows: 102,442 to the British Museum, 17,862 to Kew

Gardens and Museum, 38,024 to South Kensington Museum, and 8,998 to the Geological Museum. I could give many more such examples of other prosperous States and nations.

Texas has more fertile soil, greater mineral resources and a better climate than England, all which gives promise of a rich and prosperous future, if her domain is rightly managed, by giving proper encouragement to her agriculture and manufactures and the development of her mineral wealth, now mostly hidden and unproductive.

Let the true condition of Texas be made known; capital will come here, intelligent, industrious people will also come, help bear our burdens, enrich themselves, and make us as a State richer.

A geological, agricultural and natural history survey of Texas will make her known abroad and give reliable information to many people in other States and countries, which are less favored by nature, having soils less fertile, climates less pleasant and less healthy, and also having less advantages for the easy accumulation of wealth and making pleasant homes.

#### SYNOPSIS OF WORK DONE FOR THE SURVEY IN 1875.

Continuing the plan adopted last year of ascertaining, by a general reconnoissance of the State, its main geological and agricultural features, our observations have been made mostly in the region west of the Colorado river and north of latitude 29 degrees.

Leaving Austin early in May, we went through the counties of Hays, Blanco, Llano, Burnet, San Saba, Mason, Menard, by way of Forts McKavit, Concho, Stockton, Davis and Quitman, to El Paso. Returning to Fort Davis, we went to Presidio del Norte, examined a portion of Presidio county: then back to Fort Davis, and via Stockton, down the west bank of the Pecos to a ford near old Fort Lancaster; thence down Devil's river via old Fort Hudson, San Felipe springs, Fort Clark, Uvalde, Castroville and San Antonio to Austin, where we arrived on the 27th of September.

We started with four teams and two young men on horseback. One of these teams belonged to Col. John M. Moore, a member of the last Legislature, from Corpus Christi. He is experienced in mining in Alabama, and

also in the silver mines of old Mexico. He went as a volunteer, going as far as El Paso and back to Fort Davis with us, rendering valuable assistance. For the State collection we obtained many valuable specimens of minerals, fossils, etc., and also a large collection of dried plants for the botanical department, especially of western grasses.

We had been told that a small party could not safely go to El Paso on account of hostile, thieving Indians, who occasionally make raids into Texas from New Mexico and the Indian Reservation in order to steal horses and sometimes other stock, and also kill people. However, a small party of five or six men, well armed, can go over the route traveled by us with perfect safety. It is often done by two or three men. The El Paso stage has but one soldier as a guard. Wagon trains drawn by mules or oxen, conveying merchandise and supplies to the forts and people in the valley of the Rio Grande are going out west and back again, being almost constantly on the road. Small parties, for perfect safety, can join these. Roads of the route good and comparatively level.

#### GEOLOGY.

The following are the subdivisions of geological time now in general use in this country :

- I. *Archean time*, including
  1. Azoic age.
  2. Eozoic age.
- II. *Paleozoic time*, which includes
  1. Age of Invertebrates or Silurian.
  2. Age of Fishes or Devonian.
  3. Age of Coal Plants or Carboniferous.
- III. *Mesozoic Time*.  
The Age of Reptiles.
- IV. *Cenozoic Time*.  
Tertiary.  
Quaternary.

Our examinations during the past season have been of the—

1. *Azoic age*.
2. *Eozoic age*.

In the Paleozoic Time of the Lower Silurian and Carboniferous.

The Cretaceous of the Mesozoic Time. Lastly the *Tertiary and Quaternary*.



The Azoic age includes the granites and their associated rocks, destitute of fossils, viz: shales, mica schists, gneiss, hornblendes, porphyries, etc., which form most of the mountains in the western part of Burnet county, from which they extend westward through Llano and Mason counties beyond the town of Mason on the Menardville road, about eight miles. The southwestern boundary of these rocks is unknown, but is probably somewhere in Kimball county.

There are two or more periods of the upheaval of the granite in the region under consideration. In the eastern part of Llano county, at and near the Packsaddle mountain, are shales of laurentian age, uplifted at angles near the perpendicular, associated with and on the outer borders of the granite, which are overlaid by nearly or quite horizontal strata of the lower silurian (Potsdam) to the depth of several hundred feet. In other localities, at Marble Falls on the Colorado, and in Honey Creek cove in Llano county, the limestones and sand rocks of the silurian and carboniferous are uptilted by the underlying granite, at angles of from 25 degrees to 45 degrees and upwards. Still farther west, near Fredericksburg, horizontal strata of the cretaceous, and no other rocks but the cretaceous rest upon the granite.

#### AZOIC ROCKS WEST OF THE PECOS RIVER.

Fifteen or twenty miles beyond Leon springs, on the road from Fort Stockton to Fort Davis, and a few miles west of Barilla springs, is the eastern border of some azoic rocks, which extend westward to the Rio Grande and into Mexico. In going westward at Barilla springs, at the eastern boundary of the Limpia valley, and on each side of it, are rough and precipitous mountains of dolerite and basaltic rocks. Farther westward, in the Limpia cañon, the road is hemmed in on each side by nearly and sometimes perpendicular walls of these rocks, to the height of one thousand feet or more. A few miles to the east of Fort Davis they become feldspathic granites, with little or no mica, and such are most of the mountains around Fort Davis. Col. Andrews, commandant of the fort, told me that one of his officers had seen crystals of mica in that neighborhood, but I did not see any. This mineral is absent or but sparingly disseminated in all the western

granites which came under our notice, with the exception of that east of Isleta.

About twenty miles west of Fort Davis, near the El Paso road, are several mountains of white quartz, so white that in the distance they resemble mountains covered with snow. Some of these are 7000 feet or more high.

At Muerto springs, westward a few miles further, quartzose and feldspathic veins are common, forming whitish lines up the sides of the mountains.

About thirty miles further west, at Van Horn's well, the prevailing rocks are dolerites and basalts, dark colored and massive. Twelve miles further west, are feldspathic granites intersected by large veins of quartz and feldspar of the orthoclase form. Hornblende rocks are also here. At Eagle springs, the mountains are similar as regards their rocks, to those at Fort Davis. Ten or twelve miles east of the Rio Grande, near the El Paso road, north side, one of the highest mountains is called Blanco, from its white appearance, caused by its quartz rocks. These mountains abound in quartzose veins. Twelve to fourteen miles east of Fort Quitman, is a group of mountains of igneous origin, which I did not visit.

About a mile above Hart's mill, on the Rio Grande, and four miles above El Paso, there is a mass of quartzose granite, the quartz placed so regularly as to resemble porphyry. This granite has a few small specks of mica, and is an excellent building rock. It rises but a few feet above high water mark on the river, and is overlaid by carboniferous and cretaceous rocks.

About thirty miles east of Isleta, is a group of granite mountains of two or three hundred acres area rising from 300 to 500 feet above the plain; these are called Cerro Hueco. These mountains are naked or nearly naked granite, and isolated from all other rocks. These granites contain but a small proportion of mica. From two to three miles further east, are the Sierra Alta mountains, of a height of more than 6000 feet composed mostly of limestones. On the western side and near the base of one of these mountains, there is a large dike of feldspathic granite, about forty feet thick dipping at an angle of about forty-five degrees beneath limestones of carboniferous age.

Going southward into Presidio county, below Fort Quitman on the south, to and in the vicinity of the Hot springs,

there are many large dikes of basaltic rocks, some of which extend across the Rio Grande into Mexico.

The Chinati mountains, in the southwest part of Presidio county, are chiefly igneous rocks, granites, dolerites, etc.

On the road from Presidio to Fort Davis, about forty miles south of the latter, are low hills of dolerite and basaltic rocks.

All the igneous rocks that we saw north of the Pecos are either of upper cretaceous or tertiary age, shown by the uptilted strata of the cretaceous rocks amid and bordering the mountains. The Cerro Hueco mountains may be an exception. I saw no tertiary fossils beyond the Pecos.

#### OTHER BASALTIC ROCKS.

About four miles east of Fort Clark, in Kinney county, on the San Antonio road, are dolerite and basaltic rocks, extending fifteen to twenty rods along the road, and covering much of the hill over which the road passes.

Again, about two miles west of the Nueces, on the same road, there is a similar outcrop.

On the west bank of the Frio at the ford, there is a large mass of basaltic rocks about fifty feet high, extending several hundred feet up the river. On the eastward from the Frio, I saw dolerite rocks in the road and near it quite often. At one place, about four miles eastward from the river, there is a mass of dolerite covering several acres, surrounded by cretaceous limestones.

Again, Pilot Knob, about ten miles southwest of Austin, is dolerite, and here these rocks extend three or more miles, also surrounded by cretaceous limestones.

There are probably other localities of these rocks along the southern borders of the cretaceous region of the State.

#### LOWER SILURIAN.

The rocks of the lower silurian in Burnet and Llano counties have been noticed in previous reports. To define them correctly, a detailed survey is needed.

In the northwest part of Llano county, about two miles southwest of Smoothing Iron mountain, is a mountain with a sandstone base and limestone top, all of lower silurian; the sandstone below of the Potsdam period, the

limestone above probably belongs to the Trenton period, indicated by shells of *Orthis*, *Strophomina*, *Leptena* and crinoids, specimens of which I collected last Spring.

The lower Potsdam sandstones have the peculiar green sand (glauconite), common to the rocks of the period in Burnet and Llano counties. The entire strata of the mountain has a thickness of about one thousand feet and all horizontal, most of the adjacent mountains being granite.

Sandstones of the Potsdam period abound in Mason county, and extend westward in Menard county, nearly to Menardville.

There is a fine exposure of these rocks in the western part of Mason county, on the Llano river, at the foot of Loyal valley.

Rocks which may and probably do belong to the lower silurian are upraised at the base of the Organ mountain at Fort Bliss, near the town of El Paso, where there is a fine display of uptilted strata of lower silurian, carboniferous and cretaceous rocks to a nearly perpendicular height of 1600 feet above the valley.

#### CARBONIFEROUS.

The rocks of this age in Burnet and Llano have been alluded to in former reports, and are noticed elsewhere under the head of coal.

#### CRETACEOUS.

These rocks have been traced the past season from a few miles west of Menardville to Fort McKavit, thence northward as far as Kickapoo springs, south of Fort Concho, again, from the Twin mountains, about six miles west of Fort Concho, westward to near Barilla springs, beyond Fort Stockton; thus far with no interruption by other rocks; thence westward to the Rio Grande. We saw no other sedimentary rocks except cretaceous, and only these at rare intervals, in uptilted strata among or on the sides of the granitic and basaltic mountains of that region. North of the Toyah valley are many limestone mountains which are probably of cretaceous age.

About four miles north of El Paso, above the Pass of the Rio Grande through the mountains from which the

town of El Paso takes its name, are cretaceous rocks abounding in fossils. I was guided to them by the Rev. Dr. Tays, of Franklin. Here are ostreas, exogyras, grypheas, and many others of well known cretaceous forms, such as are common in the northern and central portions of the cretaceous formation of the State—gryphea pitcheri, and its large form var. Tucumcarii, this last quite common, as also is Exogyra Texana, Natica Pedernalis, Ostrea Marshii, and carinata, etc. In cretaceous mountains near Antelope springs, about fourteen miles northeast of Fort Stockton, I found Gryphea Pitcherii, Exogyra Texana, Inoceramus problematicus, Nautilus Dekayii, Heteraster Texanus, Cyphosonia Texana, Toxaster elegans. This last is quite common west of the Pecos, and so is Trigonia Texana, Amonites Texanus, and A. Leonensis, and others. In short, the fossils of the cretaceous west of the Pecos are many of them of the same species as those at Comanche Peak in Johnson county, and also in the cretaceous rocks in the neighborhood of Austin. Their lithological characters also are similar.

#### TERTIARY.

Early last spring we passed through Guadalupe and Caldwell counties, the sandstones and limestones of which belong to the older tertiary. These rocks are rarely seen, except in the beds of streams and on their banks. These counties are well watered by many streams, have plenty of timber for fencing, and fire wood, oak, elm, pecan, box alder, hackberry, mesquite, etc. Soil mostly a dark, rich sandy loam. These are two of the finest agricultural counties in the State—equal to the best, and now easy of access by the nearly completed railroad from the cities of Galveston and Houston to San Antonio. These counties are moderately undulating, low hills, broad valleys and rich prairies, skirted by woodlands.

#### QUARTERNARY.

The valley of the Rio Grande, from where the El Paso road strikes the river, about six miles below Fort Quitman, northward to El Paso, has two and sometimes three terraces. The two upper terraces are composed of sand and gravel, the gravel often filled with large quartzite

water worn pebbles. This gravel has sometimes a thickness of one hundred feet or more, and a large portion of the distance extends back from the river fifteen or twenty miles to the mountains.

#### MINERALS—GOLD.

Near Muerto springs, eastward, near the head waters of the Limpia, are many quartz and quartzite veins. In one of these Mr. Delany, an employé at the Muerto stage station, says he got specimens of gold, of which he gave us some fine ones in quartz. He reports the gold to be abundant, but he refused to show us the locality unless we would give him \$1000, and also buy the land and give him one-half interest in the property, to which we did not agree.

However, the indications in that region are such that probably both gold and silver will be found there.

Mr. Williams, agent of the Central Railroad, told me that he had seen gold panned out of the sand and gravel of ravines in paying quantities, near and at the lead and silver locality, fourteen miles east of Fort Quitman. A spring of good water is said to be near.

The Hon. C. R. Johns, of Austin, has lately shown me some specimens of gold ore, from rocks near the head waters of Little Llano, in Llano county. It is in quartzite and feldspathic (orthoclase) rocks.

#### ARGENTIFEROUS GALENA, OR SILVER AND LEAD ORES.

About fourteen miles eastwardly from Fort Quitman, on the western borders of the mountains, argentiferous galena is said to be abundant along a ravine. It is also said to be in veins. We saw numerous large specimens of the ore in the hands of different persons at Fort Quitman. Our specimens have but a small per cent. of silver, being nearly pure galena.

These ores also occur in a spur of the Organ mountains, about one mile north of Franklin, in El Paso county, at the old Padre mine, which is said to have been worked to the depth of about ninety feet. Here argentiferous galena was obtained, and the mine was worked for its silver. The vein filled a fissure of carboniferous limestone, which is overlaid by cretaceous limestones and sandstones a few

hundred feet higher up the mountain. The strata are inclined at high angles, the upheaval having been made at or near the close of the cretaceous period. The dip is to the northwest of the mine, being but slightly inclined from the perpendicular. Iron ores, red hematites, which were dug out at or near the surface, lie around the entrance of the vein. Did not go into the mine, the wooden steps being much decayed, and did not get any good specimens of argentiferous galena from it.

In the valley, on the the northwest side of the mountain, about one mile distant from the Padre mine, is a vein of argentiferous galena from two to three feet thick, which seems very promising. It is in hard limestones, which contain large rhomboidal crystals of calcite. Here diggings to the depth of only two or three feet have been made, and good specimens obtained at several places, the vein extending one hundred or more feet.

The most promising mineral region I have seen in the State for rich ores of silver, lead and copper, is in and on the outskirts of the Chinati mountain, in Presidio county.

Mr. Williams, agent for the Central Railroad, in the location of lands, says that he has seen more than one hundred veins in different localities, of argentiferous galena and copper there. Iron ore also abounds. Accompanied by him, I visited that region and examined some of said veins. The Chinati mountains are from four thousand to five thousand feet high, in the southwestern part of Presidio county, the region examined being about twelve miles eastward from Mr. Spencer's, who has a large farm on the Rio Grande, twelve miles above Presidio.

The Spencer mine is in a ravine, near a fine spring, on the western base of the mountains. It, like all others seen by us in that region, is a *fissure vein*, extending across the ravine, exposing a width of ten feet and extends up the hills on both sides to an unknown distance. There diggings have been made to a depth of about three feet; not deep enough to see the dip or inclination of the vein.

About sixteen years ago, Mr. Spencer took several cart loads of surface ore from this vein into Mexico to be smelted. It gave \$20.50 of silver to the ton. No account was taken of the lead. Since then great improvements have been made in smelting silver ores. I gave some of the ore from this locality to Mr. McCrary, of Omaha, who had it analyzed at Balbach's smelting works in that city, who

reported it to be fifty per cent. lead and to give thirty ounces silver to the ton. At the request of Mr. Theodore Balbach, who now has charge of the Swansea Smelting Works, at Denver, Colorado, I sent him some of this ore, and also from other localities in Presidio county. In reply, he states that they all indicate that mining will be profitable in that portion of Texas.

Mr. Anderson, one of the proprietors of the Spencer mine, was with us in that region. His company own 640 acres, a section which includes the Spencer mine. His company had begun to erect works in Presidio for smelting ores.

Mr. Anderson gave me the following analysis of ores from different localities on the property of the company, made by Chauvenet and Blair, well known analytical chemists of St. Louis, Missouri :

			PER TON.
No. 1.	13 oz.	Coin value.....	\$16 80
No. 7.	15 oz.	Coin value.....	19 30
No. 8.	59 oz.	Coin value.....	76 28
No. 9.	20 oz.	Coin value.....	25 85

All susceptible of much concentration, by which process they would yield a larger per cent. of silver. No bismuth or antimony in the ores. No account given of the lead, it being of little value in Presidio county.

Mr. Anderson, at another time, sent ores to the same chemists, who gave the following report :

			PER TON.
No. 1.	Silver.....		\$144 80
No. 1.	Lead.....		34 25

This is a valuable ore, which can be made to yield a much larger per cent. of silver by lately improved methods of smelting.

A specimen of copper ore from a place about a mile from the Spencer mine, according to Chauvenet and Blair, has—  
 Siliceous matter.....49.07  
 Peroxide of iron.....14.65  
 Metallic copper.....19.48  
 Silver, \$2 58 per ton.

This is the carbonate of copper, an easy form for smelting.

To examine sufficient to make a good report upon the rocks and minerals of the southern portion of Presidio



county, would require months of hard work. I was there but one week, and a rainy, cold, unpleasant week for us it was in the Chinati mountains.

I saw four large fissure veins of argentiferous galena, three of silver ore and two of copper, from all of which I selected specimens for the State cabinet. We intended to have visited many other places, but bad weather and limited time prevented. A part of the mines are on the six hundred and forty acres of the Anderson Company, and a portion on lands recently located by the Central Railroad. The course of the veins is not all in the same direction, nor are they all in the same plane with the strata of rocks, some being rents at nearly right angles to the trend of the line of upheaval, which is generally northeast and southwest. The veins are in cretaceous rocks, and are of the age of the upper cretaceous, or it may be the tertiary; fossils of the cretaceous period, being quite abundant *ostrea*, *exogyra*, *gryphea*, etc. Width of veins from two to ten feet, or more, only one being as small as two feet, this being argentiferous galena, and thought by Mr. Anderson to be one of the best. It is on the side of a mountain, whose upper portion is limestone, and the vein grows wider downward. Its name is the Anderson mine.

The silver, lead and copper mines of New Mexico, and those of Chihuahua in old México, yield millions of dollars annually. The mineral region of El Paso and Presidio counties has the same geological formation of similar rocks, and probably will prove to be equally productive in the precious metals.

The gold and silver mines of Nevada and Colorado have given the most profitable results at depths of more than 1000 feet. The Consolidated Virginia, one of the most profitable mines in the world, has given a yield in bullion the past year of \$16,731,653 43, besides having \$478,080 of ore, as valued by assay, in the ore house and at the mills at the time the annual report of the superintendent was made; all taken at depths ranging from 1200 to 1500 feet, the yield from the ore averaging \$98 per ton. Other mines at the west are now giving their best and most profitable yields of ore at depths nearly and more than 2000 feet. Mines which had proved unprofitable, and some even which had been abandoned, by going deeper furnish rich ores, and give high dividends to their stockholders. Immense bodies of ores called bonanzas were found at depths of

more than 1500 feet, and the increased production of the last few years is chiefly owing to deep diggings. To show this increase, the following from Rossiter W. Raymond, United States Commissioner of Mining Statistics, is given, published last May in the Engineering and Mining Journal :

The total product of silver in the United States since 1848, is estimated as follows :

From 1848 to 1858, inclusive, \$50,- 000 per annum..	\$550,000	1866 .....	10,000,000 <sup>1</sup> / <sub>2</sub>
1859 .....	100,000	1867 .....	13,500,000
1860 .....	150,000	1868 .....	12,000,000
1861 .....	2,000,000	1869 .....	13,000,000
1862 .....	4,500,000	1870 .....	16,000,000
1863 .....	8,500,000	1871 .....	22,000,000
1864 .....	11,000,000	1872 .....	25,750,000
1865 .....	11,250,000	1873 .....	36,500,000
		Total.....	\$186,800,000

The same authority estimates the sum of the gold product of the United States, from 1847 to January 1, 1874, to be \$1,240,750,000.

For the past two years, J. J. Valentine, General Superintendent of Wells, Fargo & Co., publishes the following :

STATEMENT OF PRODUCT OF PRECIOUS METALS WEST OF  
THE MISSOURI RIVER, FOR 1875.

States and Territories.	1875.	1874.
California.....	\$17,753,151	\$20,300,531
Nevada .....	40,478,369	35,422,223
Oregon.....	1,165,046	609,070
Washington .....	81,982	155,535
Idaho .....	1,554,902	1,880,004
Montana.....	3,573,609	3,439,498
Utah.....	5,687,494	5,911,278
Arizona.....	109,093.	26,066
Colorado .....	6,299,817	4,191,405
Mexico.....	2,408,671	798,878 <sup>1</sup> / <sub>2</sub>
British Columbia.....	1,776,953	1,636,557
Total.....	\$80,889,037	\$74,401,055

In 1874, the Big Bonanza of the Nevada was discovered, at a depth of more than 1500 feet, where the amount of ore in sight has been estimated at from \$60,000,000 to \$1,500,000,000. To this is owing, in a great measure, the large yields of Nevada given in the above table.

I have given these statements of the value of the mining interests of the country for the encouragement of the mining industry of western Texas. Such veins as those of Presidio and El Paso counties rarely become poorer on going deeper.

#### SILVER IN MASON COUNTY.

About five miles northeast of the town of Mason are some silver mines, which, at the time of our visit, about the first of last June, were being worked by Messrs. Thompson, Wood & Morrill. Vein at top, twelve to fourteen inches thick; at the depth of forty-two feet, its thickness is nine feet. It is mostly calcite, dipping at an angle of about forty-five degrees. Its upper wall is a layer of mica schist, about sixteen feet thick, quartzite granite beyond and also below the vein. The silver is in small grains, disseminated in gray limestone. Mr. Thompson told me that he had obtained specimens which assayed \$300 to the ton. Those which I saw will give a much less yield.

In the eastern part of Mason county, on land belonging to C. R. Johns & Co., are said to be large veins of silver ore. Specimens of this ore I have seen which assay from \$14 to \$16 to the ton. The gangue is granular epidote in a quartzite rock, through a portion of which is scattered the granular silver.

I have a small specimen of copper and silver ore from a vein said to be two feet thick, which has been traced to the distance of three miles or more. So says Dr. C. S. Smith, of the town of Llano, through which the vein is said to extend. This specimen has a large per cent. of silver and also of copper. If enough of such ore is there, it will be very valuable, and give a new impetus to mining in Llano county. I am indebted to Dr. Smith for these and other valuable specimens. The vein is in the metamorphic rock of mica schist in the granitic region.

In the western part of Burnet county, about three miles from the town of Bluffton, are lead ores (galena) in the

sandrocks of the Potsdam period. We visited this place last spring. A shaft has been sunk to about twenty feet, and the mine abandoned, the ore being scattered through the rocks and no regular veins; indication unfavorable.

The following list, from the Mining Review, of Denver, of June 10, 1876, embraces nearly all the shafts in the West, that have been sunk to a depth of 500 feet and over, on veins worked mainly for the precious metals:

State or Territory.	Place.	Metal.	Name of Mine.	Depth
California.	Grass Valley..	Gold..	Empire.....	1400
do.	do.	do.	North Star.....	1300
do.	do.	do.	Eureka.....	1300
do.	do.	do.	Idaho.....	1200
do.	Bear Valley..	do.	Pine Tree.....	1100
do.	do.	do.	Princeton.....	900
do.	Grass Valley..	do.	N. Y. Hill.....	800
do.	Amador co.	do.	Consol. Amador.....	900
do.	Silver Mt.....	do.	Pennsylvania.....	800
do.	Bear Valley..	do.	Josephine.....	700
do.	Amador co.	do.	Mahoney.....	700
do.	El Dorado co.	do.	St. Lawrence.....	500
do.	Deer Creek..	do.	Providence.....	500
Nevada.	Virginia City..	Silver	Hale & Norcross....	2200
do.	do.	do.	Imperial Empire....	2200
do.	do.	do.	Savage.....	2000
do.	do.	do.	Best & Belcher.....	1800
do.	do.	do.	Gould & Curry.....	1750
do.	do.	do.	Bullion.....	1700
do.	do.	do.	Crown Point.....	1700
do.	do.	do.	Belcher.....	1600
do.	do.	do.	Julia.....	1600
do.	do.	do.	Consol. Virginia....	1600
do.	do.	do.	Ophir.....	1600
do.	do.	do.	California.....	1600
do.	Pioche.....	do.	Meadow Valley.....	1350
do.	do.	do.	Raymond & Ely.....	1300
do.	Eureka.....	do.	Richmond Consol....	1200
do.	do.	do.	Eureka.....	1100
do.	do.	do.	K. K. ".....	900

State or Territory.	Place.	Metal.	Name of Mine.	Depth
Nevada...	Virginia.....	Silver	Justice.....	900
...do....	...do....	..do..	New York.....	900
...do....	Eureka.....	..do..	Ruby Consol.....	800
...do....	Belmont.....	..do..	Eldorado.....	500
...do....	Virginia.....	..do..	Lady Washington...	530
Idaho....	Owyhee.....	Gold..	Ida Elenore.....	1040
...do....	...do....	..do..	Mahogany.....	920
...do....	...do....	..do..	Golden Chariot....	910
...do....	...do....	..do..	War Eagle.....	840
...do....	...do....	..do..	Minnesota.....	800
...do....	...do....	..do..	Empire.....	600
Utah.....	Ophir.....	Silver	Chicago.....	1200
...do....	Dry Cañon....	..do..	Hidden Treasure....	1100
...do....	Cottonwood...	..do..	Flagstaff.....	900
...do....	Dry Cañon....	..do..	Flavilla.....	700
...do....	Cottonwood...	..do..	Vallejo.....	600
...do....	...do....	..do..	Emma.....	500
...do....	Parley's Park.	..do..	Ontario.....	500
...do....	Bingham.....	..do..	Winnamuck.....	500
...do....	...do....	..do..	Neptune & Kempton	500
Colorado	Central.....	Gold..	Burroughs.....	850
...do....	...do....	..do..	Briggs.....	600
...do....	...do....	..do..	Gunnell.....	600
...do....	Caribou.....	Silver	Caribou.....	540
...do....	Central.....	Gold..	Leavitt.....	530
...do....	Georgetown...	Silver	Dives.....	500
...do....	...do....	..do..	Terrible.....	500

## COPPER IN PRESIDIO COUNTY.

This has been noticed under the head of silver and lead ores of that region. I saw at three different places in the silver region of the Chinati mountains veins of copper associated with iron of a width of from ten to twenty feet. This was at one place visited in company with Colonel Anderson. Here there are several fissure veins of widths as above named. The deposits of iron and copper are immense; an analysis of this surface ore is given elsewhere under silver. Another outcrop of similar copper ore at the

top of a hill is about six feet wide extending along the surface one hundred or more feet.

Several persons who had seen it told me of a copper vein about thirty miles below the Hot springs, which is said to extend across the Rio Grande. I have seen specimens of this ore, which is a malachite or green carbonate of good quality.

#### COPPER IN MASON COUNTY.

About two and a half miles northwest of the town of Mason, near the Menardville road, there is a vein of copper near the bottom of a ravine; its width is little more than six feet in feldspathic and quartzose rocks. The best surface specimens of this ore yield about ten per cent. of copper; its appearance is promising.

Near the head waters of the Little Llano are copper veins of similar quality in similar rocks.

#### PYROLUSITE.

There is a vein nearly ten feet thick of this mineral near the top of a mountain in the eastern part of Mason county, at a place called the Spiller mine, from which about thirty tons of ore were sent abroad last spring to be smelted, it being reported to be very rich silver ore. The assay and smelting showed that it had not enough silver to pay for working.

#### TOURMALINES,

Of black, brown and white colors are quite common in several parts of Llano county, in granite regions.

#### GARNETS.

In the mica schistose rocks near the Sandys in the middle and southern part of the same county.

#### AMETHYSTS.

In the granite regions of Burnet and Llano counties.

#### MOLYBDENA.

In Burnet and Llano in thin layers in gneissoid rocks.

## ASBESTOS.

Near the Sandys, in the neighborhood of Enchanted rock, not seen in sufficient abundance to be of commercial value.

## STEATITE OR SOAP STONE,

In large veins of massive form and light gray color, is on the Hondo, a branch of the Sandy and also on the Sandys, in the mountains about midway of its course through Llano county. The various uses of this mineral are well known. Inexhaustible quantities of it are in Llano county.

## OBSIDIAN.

About six miles distant westward from Muerto springs in Presidio county, along the valley range of mountains, not from the El Paso road, are large massive veins of obsidian.

## JASPER.

Large masses of green and red jasper are near the Barilla spring. They are probably altered sandstones of cretaceous age, being near the base of mountains of igneous origin; I also saw red jaspers among the mountains near Fort Davis.

## OPALS.

Common opals of good quality are quite abundant near Van Horn's well, also sparingly scattered among the igneous rocks of the west.

## PHRENITES

Are quite abundant associated with opals.

## AGATES,

Of both the moss and common kinds, are in the same region; also carnelian and chalcydony, which, when united, form agates.

We collected good specimens of all these and others for the State collection.

## SALT.

Abounds in the country along the upper Pecos above the road from Fort Concho to Fort Stockton,

Near the Horse Head crossing of the Pecos are large deposits of salt in the bed of what is called Salt Lake. To this place wagons resort for supplies of salt for El Paso, Presidio and other counties.

## BITUMINOUS COAL.

In Llano county, in Honey Creek cove, at a place visited by me last year, with Dr. C. S. Smith, of Llano, there is a bed of bituminous coal, about two feet thick, of excellent quality; the bed has been traced along the side of the hill to the distance of about twenty-five feet; so says Dr. Smith, who has opened the mine to the extent of only a few feet. In the State collection, there is a specimen of this coal weighing forty pounds. Dr. S. thinks that lower down there is a larger bed, and this is probable. This is on the carboniferous.

In the northeastern portion of Concho county and southwestern part of Coleman county, not far from the Colorado river, there is a large bed of bituminous coal, which is about three feet thick. This coal is of good quality and is used by the blacksmiths, at Fort Concho, and at Ben Ficklin, in Tom Green county. These coal beds are said to be very extensive and good coal abundant.

In Presidio del Norte we were shown samples of coal of very good quality, which were said to have been obtained from a bed cropping out to a considerable distance, four feet thick. This is sixty miles below Presidio del Norte, on the east of the Rio Grande, twenty to twenty-five miles back from the river. The bed is in loose slate and sandrocks. It had recently been visited by a party sent by the Central Railroad Company, and a mining company, located at Presidio. Thus placed, in a region abounding in rich ores of silver, lead and copper, it is very valuable.

## CANNEAL COAL.

In Kinney county, on the Nueces river, about twelve miles below the road from San Felipe to San Antonio, are several beds of this coal, from three to four feet thick, as



reported by Col. John M. Moore and others. I have seen specimens of the coal, which is of a very good quality.

The carboniferous formation extends northward from Llano county to the Red River in Wichita county, throughout which, in various places, coal crops out. Some of these places are noted in my last report. But as yet only diggings near the surface have been made. Deeper, larger beds and better coal may be, and probably will be found.

From recent experiments made to ascertain the comparative value of the bituminous coal of Cumberland, Maryland, and the anthracites of Pennsylvania, we learn that for steam raising power the bituminous coal is the best by from ten to fifteen per cent. A notice of these experiments appeared about a year since in the Coal Trade Journal. They were made by fifteen or more customers (living in different parts of the country) of Messrs. Stevenson & Pierson, large coal dealers of Boston, and at the suggestion of Messrs. S. & P.

Anthracite has long been considered as the best coal for almost every purpose, but these experiments prove that it is not.

#### TEXAS LIGNITES OR BROWN COALS.

Since my last report, I have been informed by letters that the brown coals or lignites of Robertson county have recently been used as fuels at Dallas and elsewhere, and given general satisfaction.

The proprietor of the hotel, Mr. Nicholson, at Bastrop in Bastrop county, lately told me that during the last three years he had used the Bastrop coal (lignite) as fuel for cooking and warming the hotel rooms, and found the coal cheaper and better than wood, and wood is abundant in Bastrop county near the town.

The composition of the Texas lignites does not differ materially from the lignites of the Pacific and Rocky mountain States, generally leaving from forty to fifty per cent. of fixed carbon. The western lignites are extensively used for generating steam, and as fuels in dwellings, and there is no doubt but that those of Texas can be used for the same purposes.

The great drawback upon the commercial value of the lignites is, that they will not coke by the ordinary process

of coking. It is said that successful experiments have lately been made in coking lignites, and if this be so, the value of those of Texas will be greatly enhanced. The following, in relation to the subject, is from a late number of Ware's Journal of "*Mines, Metals and Arts*," of St. Louis :

#### COKING LIGNITES.

Mr. W. J. Lynd, of Denver, after successfully experimenting, has devised a method of treatment by which he makes a serviceable coke, which is said to be very well adapted to furnace and other uses. It is even claimed that this fossil coal coke is comparable with Connellsville coke, which we could hardly expect, from the larger quantity of ashes in the lignite coal. Mr. Lynd has secured two patents. We give the following extracts from the description, wherein he says :

"That it may be more clearly known what are the coals understood by certain fossil coals, I specifically designate as such the coals found in the territories of Colorado, Wyoming, Utah, and New Mexico, and all similar coals wherever found in the United States. Some of these coals are at present mined near Cañon City, in Fremont county, at or near Trinidad, and elsewhere in Colorado territory, at Rock Springs and elsewhere in Wyoming territory ; at Evanston and elsewhere in Utah territory ; at Coos Bay and elsewhere in Oregon territory ; at Bellingham Bay and elsewhere in Washington territory ; at Monte Diablo and elsewhere in California. These fossil beds are reported by geologists to be of the eocene formation. In the geological survey of Ohio, vol. 1, page 83, is the following statement: 'It should also be mentioned that in North America the cretaceous was a great coal making period, as rocks of this age in the far west contain, at various points, important beds of lignite, some of which are from thirty to fifty feet in thickness. The coals of Vancouver's Island, Bellingham Bay, Monte Diablo, those of New Mexico and Arizona, as well as some of the most valuable beds in Utah, Colorado and Wyoming, are of cretaceous age. These, with some tertiary lignites, comprises all the so-called coals of the far west.' In Professor Hayden's report of 1870, page 186, is the report of the Omaha Gas Company : 'Residue, after coking in retort, twelve bushels of earthy breeze in small cubes, which, when put in the furnace fires, smoth-

ered them. The coke is worthless for heating purposes. Coal from Rock Springs, Wyoming, was also treated, and is also precisely similar.' These coals are commonly called and recognized as lignites; yet, as other names are given I prefer to denominate them as fossil coals, and to specify localities at which some of them are found and mined, that they may be definitely known. From these coals I make a serviceable coke, useful for all heating purposes. I coke them on a principle founded on the admitted fact that no fossil coals contain bitumen is formed. These constituents are hydrogen and carbon, and sometimes oxygen combined with them.

In carrying out my invention I use coal, either in the slack or finely pulverized state; but I prefer to use the powdered coal. I have discovered that the more finely powdered coal is better adapted by these processes for making good coke. When the coke is finely powdered, and the heat is properly applied thereto, as hereinafter described, the constituents of bitumen will be more readily disengaged, and will combine so as to draw the particles of the coal and make them cohere, and form a uniform, compact, dense coke.

Another process is mainly applicable to coals in the lump, and by it such coals can be thoroughly coked without disintegration or losing their original form. This is a feature with most of the varieties of the lignites, which, when in the condition of slack, or when once disintegrated, cannot, by ordinary processes, be again caused to cohere and coke."

Dr. Lynd in practicing his system of coking does not confine himself to any one kind of apparatus, the sole purpose of the invention being to make a good merchantable coke from the lignites that so abound in the West. Dr. L. claims that any of these lignites can by his method, be converted in good coke. If the doctor does not claim too much for his invention as to percentage of coke and other minor points, this invention will prove of immense importance to the smelting industry of the West. We have not yet seen a specimen of the coke.

#### FELDSPAR AND PORCELAIN CLAYS.

In Llano county, near the base of Packsaddle mountain,

easterly, are large beds of feldspar, from two to four feet thick.

Extensive beds of the same variety of feldspar (orthoclase) are near the Anderson Copper Mine, in the Chinati mountains, in the southeastern part of Presidio county. There the beds are from 20 to 50 feet thick, inclined at an angle of about forty-five degrees, and of a yellowish white color.

These feldspars can be utilized in the manufacture of the finer porcelain.

Porcelain clays, suitable for making common wares, prevail in Concho and Tom Green counties, and westward to the Rio Grande.

#### SLATE—ROOFING.

Near the base of Packsaddle mountain, on the banks of Honey creek, are large beds of bluish black slates, of a jointed and thinly stratified structure, in beds inclined at high angles. These slates resemble the surface slates of New Hampshire and Vermont, which lead lower down to quarries of good roofing slates.

It may be that those of Llano county, when quarried to the depth of a few feet, may afford a good material for roofing. Mr. Williams, who has recently been locating lands in Presidio county for the Central Railroad, assures me that extensive beds of good roofing slate are in the Chinati mountains of that county.

These slates are on section 3d of the Central Railroad survey. Strata about one hundred feet thick and dip southward.

#### GYPSUM

We saw disseminated in the shales and clays bordering the Rio Grande, between Fort Quitman and the Hot springs. We were told by the United States officers and others that gypsum abounds in the eastern part of El Paso county, the northern portion of Presidio county, and also in the northern part of Bexar Territory. These deposits, with those in the Pan Handle, on the waters of the sources of the Red River, show that Texas has enough of this valuable mineral for fertilizing and other purposes.

Besides its well known use as a fertilizer, it is used for stucco work, for casts, etc. Under the name of plaster of

Paris, it is used for plastering walls for a hard finish. Within a few years, gypsum burnt with alum, called alumed plaster, has been used in the arts. It is harder and more beautiful than common plaster, and like some alabasters, has considerable transparency.

It is thus prepared: After the plaster is burnt, it is immediately saturated with alum water; after having been wet for about six hours, the water is poured off, the plaster dried in the sun and again burnt. It is then used like common plaster, but moistened with a solution of alum instead of water. Mixed with half sand, it acquires great hardness.

According to the last census there were three hundred and twenty-one mills in the United States for grinding gypsum, and the value of the product amounts to \$2,500,000. Most of this is used in the States east of the Mississippi river and north of the cotton States for improving the soil and crops.

There is no doubt but that Texas has vast wealth in her gypsum now lying dormant for want of cheap transportation. When railroads extend to the gypsum region, this wealth will begin to be realized. At present Texas imports most of the gypsum used in the arts and for finishing the walls of buildings.

For further notice of iron ores, see manufactures.

#### METEORIC IRON.

In the State collection is a specimen of this weighing three hundred and fifteen pounds. It is said to have been found on the head waters of the Red River, northward of Young county. It was an object of worship or veneration to the Indians, who revered it as foreign to the earth and coming from the Great Spirit. In 1858 or '59 Maj. Neighbors, then in command at Fort Belknap, sent a wagon after the meteorite and had it brought into the fort. It was thence sent in a government wagon to San Antonio and onward to Austin.

Various have been the conjectures as to the origin of meteorites, some asserting that they came from volcanoes in the moon, having been thrown beyond her centre of gravity, but few if any now believe this. Others think they are fragments of a broken planet, and others think that they belong to a large class of meteors flying through

space, which occasionally happen to light upon the earth.

One thing is certain, they come from the space beyond the earth. This we know, because they have been seen to fall. Meteoric iron usually has a small per cent of nickel, cobalt, manganese, copper and tin. It is malleable, exceedingly tough, and may be used like manufactured iron. Our meteorite has a strong resemblance to one in Yale College cabinet, weighing 1635 pounds, which also came from the Red River of Texas.

#### MINING RIGHTS.

I have been asked what is the law in regard to mining tunnels.

The law confers a right to the owners of the tunnel to all ores on the line of the tunnel and of the width of the tunnel within three hundred feet of its face; provided there are no veins or indications of ore belonging to other parties above the line of said tunnel, which did belong to said parties before the commencement of the tunnel.

Such seems to be the meaning of the "Tunnel Act" of Congress, 1872.

#### HOT SPRINGS.

These are in Presidio county, about a quarter of a mile from the Rio Grande, about thirty miles below Fort Quitman, amid rugged mountains. To get there, we went on horseback by a dim path, up and down mountains, guided by a Mexican.

The springs seem to have originally been a pond or lake of an area of about twelve acres, which has been gradually filled up by depositions of siliceous matter, strongly impregnated with soda, magnesia, etc., of a granular texture, so hard as to be broken with difficulty. It has a mottled color of dark gray and bluish black. The rocks of the outer rim of the area are similar to those now being made by depositions from the springs.

There are two springs, about one hundred and thirty feet apart, each about ten feet in diameter, inclosed in a circular rim about three feet high; water clear and of an unknown depth, attempts to sound them with a line nearly one hundred feet long have failed. Gasses are continually ascending to the surface, which keep the water in continual agitation; water strongly impregnated

with salt, soda and magnesia; temperature of one, one hundred and ten degrees, and the other ninety-four degrees. They are three thousand two hundred and sixty feet above the sea.

Southwest of there, in Mexico, at no great distance, are hot springs, hot enough to boil an egg or blister the hand. So said Mr. Russell, an American merchant of Presidio, who has lately visited these springs.

These springs, both Texan and Mexican, are in a region of igneous rocks, of dolerite and trappean form. Large dikes of these are in the limestones near and in the vicinity of the springs.

#### MASTODON AND ELEPHANT.

Bones of the mastodon and elephant have been found in nearly every part of the State, showing that these huge animals were quite numerous in the olden time, say a few thousand years ago, when man was also living.

Bones of the ancient elephant were found recently in digging a cellar at Austin, at the depth of five or six feet in a dirt bed, where it would not be strange to find the bones of man. The teeth show that it was the ancient elephant (*elephas primagenius*), different from the one now living.

#### PAINTED ROCKS AND CAVES.

At the Cerro Hueco, or Waco Tanks, about thirty miles a little north of east from Isleta, are painted rocks and caves. The Cerro Hueco is a small group of granite mountains, abounding in caves and precipices. Some rocks have perpendicular faces from three hundred to four hundred feet high, and one, Blanchard's Tower, has a height of more than five hundred feet above the plain. On the perpendicular sides of some of these, and in cave-like hollows beneath overhanging rocks, are numerous rude paintings of men, women, and various animals, including birds and serpents. In one place there is a conspicuous figure of the sun facing the east and sending forth his rays. The paintings were made with red, blue, black and white paints, with little or no regard to perspective.

Mr. Blanchard, of Isleta, who accompanied us, stated that about sixteen miles southeast of this locality there also are similar paintings in an excellent state of preserva-

tion on rocks. At a place called Painted Caves, near the lower crossing of the Devil's river, are also a few paintings of a similar character.

#### ANCIENT SHELL BANKS.

Mr. Triplett and Judge Pickett, late members of the Legislature, inform me that there are numerous artificial shell mounds along the coast, thirty to fifty miles inland in the southeastern part of the State. Charcoal beds where fires were made are also there at and near the surface.

In the State collection is a vase about fourteen inches high and eight in diameter at the top. It is of dark brown pottery, and has some rude carvings or marks on the outside. It was found beneath a ledge of rocks by Mr. Wm. Ditto, near Graham in Young county. It had been slightly covered with earth, and some animal had dug and partly uncovered it.

#### HEIGHTS ABOVE THE SEA.

The following measurements of heights were made with one of Green's improved and compensated aneroid barometers of late date (1875), and may be relied upon as being nearly true :

The country west of Fort Concho is higher than is generally supposed, and its mountains are higher, the highest probably being in the neighborhood of Fort Davis and at the head of the Limpia, on whose waters the fort is situated, at the base of some precipitous mountains, at an elevation of about five thousand feet. Ten or twelve miles west of the fort, near the El Paso road, is what is generally supposed to be the highest mountain in that region, a mountain which is a prominent feature in the landscape, being seen from long distances. It being unnamed and its height unknown, I went to its top and found it to be seven thousand four hundred and fifty feet high; it being the highest point which I have visited in the State and several hundred feet higher than any mountain in the States east of the Mississippi river. I have named it in honor of Richard Coke, our present worthy Governor.

Farther west there is another prominent mountain, the highest at Eagle springs. This is six thousand five hundred and fifty feet high. It has been supposed by many to be higher than the preceding, because it has been looked



up to from a much lower plain. This is Moore's peak, in honor of Col. Jno. M. Moore, of Corpus Christi, who accompanied me in most of the trip, rendering essential assistance.

The Staked Plain extends southward from the northern part of the State, to near the northern boundaries of Medina, Uvalde and Kinney counties, northeast of San Antonio. In its southern portion it had a height of about one thousand feet. At the far north it is often five thousand or more feet high. On the El Paso stage road, west of Fort Concho, its highest portions east of the Pecos are about three thousand feet. West of the Pecos, at Fort Stockton, it is three thousand feet high. On the road from Fort Stockton to Fort Davis, its limestones are seen a few miles west of Leon springs, at an elevation of a little more than three thousand feet; thence it trends westward and northwestward, being the northern boundary of the Toyah valley, and also of the valley of Eagle springs, being readily distinguished by its flat topped limestone mountains of the cretaceous period.

It is not now all a plain, as it once was long, long ago. That it was all plain is proven by its nearly horizontal strata, so like in appearance and thickness throughout the entire region, as to prove that the whole was once continuous and unbroken. Now it is intersected by rivers and valleys, the largest river and valley being that of the Pecos. Viewed from the top of many of its mountains, it presents the appearance of a vast plain, with here and there a mesa or table, a few feet higher than the rest.

For the convenience of reference, the following table of heights along the route are given :

Austin.....	500 feet.
Highest portions of Hays and Blanco counties.....	100 to 1500 "
Bluffton, in the eastern part of Llano county.....	1250 "
Highest mountains in the eastern part of Llano and the western part of Burnet counties..	2000 "
Smoothing Iron mountain, in the northwestern part of Llano county.....	2343 "
Camp near its base.....	1800 "
Highest mountain near Spiller mine, in the eastern part of Mason county.....	2350 "
Spiller mine.....	2000 "

Old Fort San Saba, Menard county.....	2100 feet.
Mountains near fort.....	2300 "
Fort McKavit.....	2040 "
Fort Concho.....	1825 "
Twin mountains.....	2200 "
Height of first stage station on the Concho, west of Ben Ficklin, in Tom Green county	2125 "
Second station, at head of Concho.....	2450 "
Mustang Holes, fifteen miles of the head of Concho.....	2525 "
Height of camp about three miles west of Cen- tralia.....	2625 "
Plain between there and Pecos.....	2700 "
Pecos, near stage stand and bridge.....	2100 "
Escondido spring.....	2230 "
Fort Stockton.....	3000 "
Leon springs.....	3050 "
Camp at Barilla springs.....	3680 "
Fort Davis.....	5000 "
Mount Coke.....	7450 "
Point of rocks west of Fort twelve miles.....	1600 "
Muerto springs.....	5150 "
Highest point on the El Paso road, on the west end of Skillmas grove, about fifteen miles west of Fort Davis.....	5950 "
San Salomon springs, at the head of the Toyah	3250 "
Crows Nest, between Fort Davis and Muerto	5800 "
Van Horn's mill.....	4000 "
Eagle springs.....	4600 "
Moore's peak.....	6550 "
Fort Quitman.....	3500 "
San Signacio.....	3600 "
San Elizaria.....	3675 "
Isleta.....	3700 "
Franklin.....	3740 "
Hot springs.....	3260 "
Presidio del Norte.....	2200 "
Flat Topped mountains, near old Fort Lan- caster.....	2400 to 2500 "
Cedar brakes, Bexar territory.....	2500 "
Johnson run.....	1800 "
High Prairie South.....	2000 "
Head of Devil's river.....	1650 "
Camp on " ".....	1600 "

Hills above valley.....	300 to 400 feet.
Yellow banks....	7250 "
Painted caves.....	900 "
Crossing of Devil's river.....	850 "
Prairie South, on road, highest points....	110 to 1200 "
San Felipe spring.....	900 "
Mud creek.....	1100 "
Fort Clark.....	1200 "
Nueces.....	860 "
Uvalde.....	850 "
Castroville.....	630 "
San Antonio.....	550 "
New Braunfels.....	565 "
Mountain City, Hays county.....	900 "

#### HYDRAULIC CEMENT.

There are many impure limestones in Texas which can be made into hydraulic cements of more or less efficiency. Argillaceous limestones yield hydraulic lime immediately on burning. Such limestones must contain at least from ten to twelve per cent. of clay. Cements made from such rocks require about twenty days to harden under water or in moist places. Cements made from limerocks having twenty or twenty-five per cent. of clay set in two or three days; and those having thirty per cent. harden in a few hours. This last form of lime is sometimes called Roman cement.

However, every neighborhood which has good limerock and clay has all the elements necessary to make a good hydraulic cement. These artificial cements are now extensively made in Europe and America.

Artificial hydraulic limes were used in a majority of the buildings in Paris, France, where hydraulic lime is made by using four parts of chalk and one part of clay, all from Mendon, a few miles from the city. The clay and chalk are ground by large wheels revolving in a circular track, made into a paste and formed into bricks, which are dried in the sun, and burnt like hydraulic limestones.

The burning of hydraulic limestone requires peculiar care, because, if the temperature be too great, the siliceous part of the clay is melted, and forms a too close combination with the lime, and then it will not form a new compound and make a good cement by the addition of water; hence, the

heat should only be sufficient to expel the carbonic acid from the lime and the water in the clay.

Small quantities of magnesia and iron are in many hydraulic limestones, but these are also in many clays which often have a reddish brown color from the presence of iron.

Hydraulic mortars are also made by mixing burnt lime with certain porous rocks resembling in composition burnt clay, such as the well known pozzuolana, formerly exported extensively from Italy for making hydraulic limes. It occurs at Pozzuoli, near Naples. A majority of volcanic tufas possess similar properties. Most burnt clays, when not too highly calcined, are good substitutes for pozzuolana : as also are common bricks, tiles and common earthenware pounded. Mortars made from burnt lime and pozzuolana are very hard and durable, as is shown in the remains of buildings at Rome, where the cement has outlasted the rocks used in their construction. The old Roman, Vitruvius, gives the following directions for making this cement:

Pozzuolana, well pulverized.....	12 parts.
Quartose sand.....	6 “
Rich lime, recently slaked.....	9 “
Fragments of broken stone.....	6 “

The Rev. Mr. Wilson, principal of the academy at Seguin, informs me by letter that the late Dr. Park, formerly living there, made a very good hydraulic cement by burning the clays in that neighborhood, and mixing them with the proper proportion of burnt lime.

The following are the analyses of some of the best hydraulic cements of France and of the United States :

METZ.

Carbonate of lime.....	77.3
“       magnesia.....	03.0
“       iron.....	03.0
“       manganese.....	01.5
Clay or silex.....	15.2

## LEZOUX (PUY DE DOME).

Carbonate of lime.....	72.5
"    magnesia.....	04.5
Clay or silex.....	23.0

## BOLOGNE—PORTLAND CEMENT, NATURAL.

Lime .....	65.13
Magnesia .....	00.58
Silica .....	20.42
Alumina and a small quantity of oxide of iron	13.87

## LONDON—PORTLAND CEMENT, ARTIFICIAL.

Lime .....	68.11
Silica.....	20.67
Alumina .....	10.43
Oxide of iron.....	00.87

## UNITED STATES—ROSEDALE CEMENT, NEW YORK.

Carbonate of lime.....	46.00
Silica, clay and insoluble silicates.....	27.70
Carbonate of magnesia.....	17.76
Alumina.....	02.34
Peroxide of iron.....	07.26
Sulphuric acid.....	00.26
Chlorides of potassium and sodium.....	04.02
Hygrometric water.....	00.22
Loss.....	00.44

The Rosedale is an excellent cement, which is used to a considerable extent at Austin, where it is sold at \$3 50 per barrel.

## CUMBERLAND CEMENT, ROCK, (MARYLAND.)

Carbonate of lime.....	41.80
Silica clay and insoluble silicates.....	24.74
Magnesia.....	04.10
Alumina.....	16.74
Peroxide of iron.....	06.30
Soda .....	04.64

Potash .....	01.54
Sulphuric acid.....	02.22
Hygrometric water.....	00.60

## BALCONY FALLS ROCK (VIRGINIA).

Lime .....	17.38
Silica.....	34.22
Alumina.....	07.80
Magnesia.....	09.51
Carbonic acid.....	30.40
Water and loss.....	00.69

The analyses of many cements in extensive use show quite a difference in the proportion of the lime, clay and sand; yet the best cements have a range of from fifteen to about thirty-five per cent. of silica and alumina.

This range in the proportion of the ingredients renders the making of these cements an easy task.

## ZEIDEOLITE

Is a comparatively new material which has lately been largely used in France in place of hydraulic lime. It is said to be much superior to that article for uniting stone and resisting the action of water. It is made by mixing sulphur and pulverized stoneware and glass in the following proportions:

Sulphur.....	19 pounds.
Stoneware and glass.....	42 “

Mix and expose to a gentle heat, and stir all thoroughly together, and then pour into suitable moulds and let it cool. It is as hard as stone at 230 degrees Fahrenheit, but at 248 degrees it melts, and may be recast or made into any desirable form by heating. Slabs of it may be joined with a paste of it heated sufficiently to melt the edges of the slabs.

West of the Pecos, adobe houses are the chief and almost the only buildings used, and this is also the custom in northern Mexico. Adobes are made of clay dried in the sun. The general form in use at El Paso, is 24 inches long, 12 inches wide and 4 inches thick. A little straw or

hay is mixed with the mud, and then it is moulded into the proper shape. The price of adobes (1875) at El Paso, was \$7 per thousand, hence building there is very cheap. Roofs are also made with first a layer of clay, above which is sometimes spread a thin layer of ashes, and above this is placed a thick layer of cement made of clay, gravel and lime; about two-thirds clay and sand, and one of lime. These roofs are nearly flat, only having inclination sufficient to let the water run off. The roofs of the old mission churches near San Antonio were made of cement, and are still in a very good state of preservation. Adobe houses are very cool in summer and warm in winter.

Cement floors are also used in the adobe houses. The mortar is evenly spread to the thickness of three or four inches over a layer of broken limestone. When the mortar has stood about twenty-four hours, and its surface is quite dry, it is pounded all over with a block of wood about twelve inches square, and three to four inches thick, having a handle in the middle. This makes the floor smooth and moist, and when it becomes dry it is again pounded until very little moisture comes to the surface. In some of the best houses, a thin layer of red ochre is then sifted on the floor, and it is thoroughly rubbed in and polished with a smooth, flat stone.

#### WATER POWER IN TEXAS.

The great objection to utilizing the large and varied water power of the State, has been that heavy rains sometimes caused the sudden rise and overflow of streams, doing more or less damage to mills and factories. In some instances, factories and mills have been swept away, as was done a few years since at New Braunfels.

It is now demonstrated that power can be transmitted to great distances by wire or raw hide ropes. In Europe this has been done extensively—Pirn being the inventor. In one instance by a combination of ropes and pulleys, the power of a waterwheel was transmitted to distance of several miles.

A good illustration of this method was lately given in "Mines, Metals and Arts" of Saint Louis, where there is a view of the mills of Messrs. Smyser & Milton, at the falls of the Ohio river, Indiana. There the wheelhouse is two hundred feet distant below and across a race or

canal, from the mill on the hill, the power being conveyed by wire ropes running in grooved wheels from the wheelhouse to the mill. By intermediate supports, power can thus be transmitted to the distance of a mile or more.

Mills may be located on hills, safe from overflows, and the less expensive wheelhouse placed below, and often firmly placed, because its small size will give little resistance to the force of the flood.

By the application of this method, the extensive water power of central and western Texas, which is now mostly useless, may be made to be of immense advantage to the State.

#### BUCKLEY'S FALLS.

In the southeast corner of San Saba, and in the northeast corner of Llano county, are some falls, on Falls creek. These falls I first measured and published a description of in 1860 and '61. I also gave a description of them in my Preliminary Report on the Geological and Agricultural Survey of the State, published in 1866. Last spring we again visited them, accompanied by Col. Jno. M. Moore, who calls them "Buckley Falls," they having previously been unnamed.

The following is the description published in 1866 :

The falls of Falls creek, in the northeastern part of Llano county, have a perpendicular height of about one hundred and twenty feet. The stream is about sixty feet wide at the top of the fall, and descends into a basin of about half an acre in extent, of deep, clear water, fine for both bathing and fishing. Ferns, mosses and climbing plants hang in green festoons from the high, rocky precipices, which are on each side of the sheet of falling water. Cedars and other evergreens grow on the surrounding rocky cliffs, and both cedars and live-oaks abound on the broad plateau at the foot of the falls, from which the ascent is by three or four terraces of a few feet each, into the Llano valley.

We were told that there is a fine sulphur spring in the Colorado river not far above the falls, which our limited time did not permit us to visit. These things have an economic value to the people of the State, affording advantages for summer resort which are rarely equaled; such as a pure, healthy atmosphere, mountains, springs, waterfalls, bathing, fishing, hunting, fine carriage drives and horseback rides over the plains, fine climbs up the hills to



charming views of varied scenery from their tops. It is just the place for invalids to get strong, and for the healthy to become more robust. Much time and money is spent annually in visiting places abroad far less attractive.

#### AGRICULTURE.

The agriculture of Texas has made rapid and decided improvements during the last ten years. Large plantations have been divided into smaller farms, and those farms have been better cultivated and better managed. Improved agricultural implements and machinery are now in common use. These things lessen the labor of the farm and make it a pleasurable pursuit. One man and two or three horses or mules can now plow from three to four acres a day with a sulky or riding plow, sitting under an umbrella if he chooses; besides the plowing can be done better and at a more uniform depth than by the old method. The increased crops resulting from the use of these plows is often more than sufficient to pay for them; besides, there is a saving of time and labor, one man being able to accomplish more work than was formerly done by two or more. With improved plows, cultivators, etc., one man can cultivate fifty acres on the prairie lands of the State, and more than this has been done.

Even now the old, very old methods of farming are prevalent in Texas between the Pecos and Rio Grande. In that region the plows in common use are similar to those used by the old Greeks and Romans. The plow consists of a long stick or pole, of from four to six inches in diameter. Another short stick of a little larger diameter, and sometimes no larger, is joined to the first at an angle of about forty-five degrees, and on the lower portion of the short stick a small shovel plow is fastened, and at the upper end are one or two handles. This is the Mexican plow. With this and the hoe, crops are made, and very good crops, on light soils, but on stiff clays, not so good. Grain is cut with sickles or large knives. One Mexican (an expert) will cut and put up, in little stacks, about five hundred pounds of hay in a day. Twenty-five cents, without board, is the ordinary price per hundred for cutting and hauling to market. Four hundred tons of hay for the Government (military) at Fort Davis was thus supplied last year. This was the price paid by the contractor. What he received, I do

not know. The ox yoke in common use is fastened by strings of raw hide to the top of the head around the base of the horns. Some contend that an ox can draw more with the yoke thus placed than when fastened to the neck and shoulders. This last method is now there used to a considerable extent—long teams, consisting of several yoke of oxen, some pulling by the horns and others by the shoulders, being occasionally seen.

Some have tried and are now endeavoring to introduce into common use in that region improved agricultural machinery—mowing machines and steel plows, but it is difficult to make the Mexicans use them, and these are the chief laborers of that country. They will work and board themselves at from five to ten dollars per month. The threshing is done on the hard ground, the grain tramped out by horses and chaff winnowed out by throwing the grain up into the wind.

A few more years and this system of Mexican farming will cease in western Texas and give place to the methods in use in other portions of the State; consequent mostly from the influx of immigration into the country between the Pecos and Rio Grande, which is sure to result when its mineral and agricultural advantages are well known.

The grange has had and continues to have a beneficial influence upon the farmers of the State. It unites them and makes them more intelligent in the management of their farms, the marketing of their produce, the buying of their supplies and agricultural implements. It increases their social joys and home enjoyments and makes them wiser and better.

In 1870, I wrote to its chief secretary (Mr. Kelly) at Washington, D. C., for information regarding the objects of the grange. He sent me grange publications, explaining the uses of the order, and also an appointment of special deputy, for organizing granges in Texas. I tried to establish a grange at Austin, and failed. It was too soon; the farmers did not understand and the newspapers of the State opposed and denounced what was then termed the grange movement. Six years has wrought a great change in this respect.

Another important item is the large and increasing attention given to horticulture; the growing of fruits and vegetables, the growth of ornamental trees, shrubs and plants, which embellish and beautify so many homes.

Improved houses for diminishing the labor and increasing the comforts of the family are being made. Such combinations are capable of making the farmer's life more desirable and happy than any other, because his life is not subject to the uncertainties of many other avocations.

The farmers of Texas have a great advantage over those of some of the older States, in not being obliged to buy fertilizers, in order to make good crops. The State Inspector of fertilizers in Georgia says that the people of that State expended in one year \$10,000,000 for fertilizers. However, it would be unwise for our people to trust so far to their rich lands, as to raise continued crops and not return anything to the soil. Many years ago, the black lands of Marengo and other counties adjacent to it, in Alabama, were noted for their large yields of cotton and corn, but continued tillage and no manuring has exhausted them so much that now they will not bear profitable crops without the liberal use of fertilizers.

#### AGRICULTURAL JOURNALS.

Of these, I believe none are now published in the State. Every farmer should take at least one Southern agricultural paper. The best weekly, of our knowledge, is the Southern Plantation, published at Montgomery, Alabama, Dr. H. A. Swasey, editor. Of monthlies, the Southern Cultivator is well known. The Rural Carolinian, published at Charleston, S. C., is another excellent journal.

#### CLIMATE.

Texas extends from latitude twenty-six degrees south to latitude thirty-six degrees north and longitude from Washington of a little less than seventeen degrees west to more than twenty-nine degrees west; hence it has a great range and great variety of climate, from nearly tropical to temperate.

At Fort Davis, at an altitude of 5000 feet above the sea, in the month of January, 1873, the thermometer was once fifteen degrees below zero, and in 1875, in the same month, it was five degrees below zero, yet yuccas, agaves, dasyliirions, cacti, are common on the prairies, in the valleys and on the mountains of that region at an elevation of 6000 feet and upwards. On the mountains the cold was probably

greater than at the fort, where meteorological observations are kept, under the direction of Dr. McGraw, to whom I am indebted for a copy of observations kept in 1872, '73 and '74 to 1st of August, 1875. The mean temperature of the thermometer in the summer is less than seventy-five degrees. In the warm season, it is a delightful climate, amid fine mountain scenery, a portion of which resembles towers, domes and precipices of more than one thousand feet in height, perpendicular. In 1872, the amount of rain fall there was 12.16 inches, of which more than half fell in the months of July and August. In 1873, it was 17.65 inches, more than half of which fell in June, July and August. In 1874, it was 20.11 inches, more than half of which fell during the months last named. For the past seven months of 1875 the rain fall was 18.38 inches, fifteen of which fell in July and probably an equal amount fell in August, about the middle of which we left that region, amid rains and floods, which made the Limpia unfordable. These summer rains make plenty of grass and good crops. The annual rain is increasing in that region.

The usual annual rain fall at El Paso is about 8 inches. Last year it was more. At Fort Griffin, there is an average annual rain fall of about 20 inches. It is about the same at Fort Richardson, at Jacksboro. In the north eastern part of the State the annual rain fall is about 30 inches. In the southeastern portion about 40 inches. At Ringold Barracks, a few miles above Brownsville, the average annual rain fall is less than 20 inches. At Fort Duncan, Eagle Pass, about 20 inches. At Fort Clark, average about 25 inches. At San Antonio, a little less than 30 inches. At Austin, the average rain fall for the last five years has been about 35 inches, showing an increase from the preceding five years, when it was about 33 inches, and the preceding five years still farther back, it was a little less than 30 inches. This is from observations kept by Prof. Van Nostrand, principal of Deaf and Dumb Asylum, at Austin.

The increased rain fall in the western part of the State may be partly owing to increased area of land in cultivation, and also to increased growth of the mesquite and other trees in the prairies. What were prairies fifteen years ago are many of them no longer such, but covered with a thick growth of mesquite (*algorobia*), elm (*ulmus crassifolia*), and other trees. This may be seen on the road

between San Antonio and Seguin, where the former prairies are covered with a luxuriant growth of trees in a soil as rich as the best lands near New Braunfels, now made so productive by the Germans. Throughout most of the State, the heat in summer is seldom more than one hundred degrees. In central Texas, and westward from Fort Concho to Fort Stockton, south winds prevail during the day in the summer time, beginning about 9 a. m. They are generally cool and pleasant. In the valley of the Rio Grande, above Presidio, such winds are far from being of daily occurrence, nor are the cold north winds of winter common there. Below is the range of the thermometer for 18 years at Austin, condensed from Prof. Nostrand's observations :

High'st.	Low'st.	High'st.	Low'st.	High'st.	Low'st.	High'st.	Low'st.				
1858..	98..	22	1863..	99..	17	1868..	96..	15	1873..	96..	13..
1859..	101..	10	1864..	99..	6	1869..	97..	19	1874..	104..	28..
1860..	107..	18	1865..	106..	18	1870..	96..	11	1875 to Aug. 1, 99-10		
1861..	100..	23	1866..	96..	21	1871..	102..	22			
1862..	104..	23	1867..	98..	17	1872..	99..	15			

#### BAT CAVES.

We again visited the bat cave in the western part of Burnet county, not far from Bluffton. This cave has large quantities of bat guano, good for the manufacture of saltpetre, or it can be used as a fertilizer, being equal, if not superior, to much of the imported guano.

In the southern part of Llano county there was a bat cave which would have been valuable for its contents had it not been intentionally or carelessly set on fire, which expelled the bats and destroyed the guano.

There are said to be other bat caves still farther west. They are more or less valuable, and should be preserved.

#### BONES AS FERTILIZERS.

Over the prairies of Texas, especially in the cattle regions, are large quantities of bones scattered on the ground. As is well known, these bones are valuable as fertilizers. In some of the northern counties, buffalo bones lie here and there at short intervals on the plains.

It is said that many of the settlers in Kansas, in the valley of the Arkansas river, have made the gathering of buffalo bones profitable; especially along the railroad lines, to the distance of forty miles on each side of them, these

bones have been gathered. Heads and ribs are worth five dollars a ton, being sent to Philadelphia and ground up for fertilizers. Shins and shoulder blades are ten dollars a ton. These are used in the sugar refineries. Horns are worth thirty dollars per ton. The tips are sawn off and sold at manufactories of umbrellas, fans, pipes, etc., and the remainder is used by the chemists. Bits of hide hanging on the heads are used to make glue. Thus every part is used and made useful.

Dr. Voelcker, Chemist of the Royal Agricultural Society, says: "High pressure steam renders bones so brittle that they can be easily ground into fine powder, which is readily assimilated by plants." He adds: "Bone meal, prepared by high pressure steam, contains not much less nitrogen than ordinary bone dust, and as a manure, is far more efficacious and valuable."

Placed in a heap with ashes or sand, and occasionally wet with liquid manure or water, bones decay and make a more soluble and energetic manure than ordinary bone dust. Bones may be soon rendered available for fertilizing purposes by placing them in a large kettle, mixed with ashes, and about one peck of lime to a barrel of bones. Cover with water, and boil. In twenty-four hours all the bones, with the exception perhaps of the hard shin bones, will become so much softened as to be easily pulverized by the hand. They will be in a pasty condition, ready to mix, with much loam and ashes. By boiling a few hours longer, the shin bones may be made soft. Alternate layers of bones and ashes placed in a cask will, in a few months, decompose the combination, being an excellent fertilizer. These methods are cheaper than to dissolve bones by acids, as has been practiced to some extent.

#### IRRIGATION

Is the chief and probably the only profitable way of raising grain, fruits and vegetables west of Fort Mason, in Texas. It is also largely done in Llano, San Saba, Bexar and other counties west of the Colorado. Properly done, with good cultivation, it is the best and most satisfactory method of farming, because its results are sure to be profitable. Good crops are generally sure, let the climate be as it may. Insects may injure the crops, and grasshoppers sometimes do, but rarely. This is true westward

as far as El Paso, because grasshoppers and other insects do but little injury to vegetation in the region under consideration. Grasshoppers in numbers sufficient to do damage, have visited El Paso, only once during the last twenty years. This was in the spring of 1875, when their stay was so short that good crops of fruits, grain and vegetables were made after the grasshoppers had left.

One of the best irrigated-farms we saw is that belonging to Messrs. Taylor & Spears, at Ben Ficklin near Fort Concho, in Tom Green county. Here nine hundred acres are irrigated from the south branch of the Concho river. We went over the place on the 17th of June. Six reaping machines drawn by horses were cutting the barley; large barley stacks were being made; barley gathered by horse rakes; threshing done by machines; wheat and oats had been harvested; corn, large and growing luxuriantly. Rarely have we seen so much order and agricultural beauty. Last year (1874), six hundred acres were irrigated, and about fifteen thousand bushels of barley grown; ten thousand of which were sold at Fort Concho at \$1.89 per bushel; corn, three thousand bushels grown; worth \$2.00 per bushel; oats, ninety tons worth \$30 per ton.

All kinds of vegetables are grown, which are suited to the climate. At Mr. Taylor's table we had Irish potatoes, green peas, beans, beets, etc. Fruit trees had been planted and were growing finely. After the barley is harvested, millet and beans succeed.

The river is dammed, which gives an abundant supply of water at all times, with a fall of water fifteen feet. From twelve to fifteen miles of ditch are made, four feet wide at the bottom, and six feet at the top. These are the main ditches, from which water is conveyed by small gateways into side ditches, running more or less parallel to each other, and from there distributed over the fields so as to cover the whole ground. This is done a short time before sunset or during cloudy days. After the ground is thoroughly saturated, the water is shut off. The side ditches are so shallow as not to interfere with the machines used in harvest time.

At the stage stand, near the forks of the roads leading to Forts McKavit and Concho, are fine large springs, from which about forty acres are irrigated. At Fort McKavit, the troops have irrigated gardens of from eight to ten

acres, the supply of water from large springs which are one of the sources of the San Saba river. Here the irrigation is done by letting the water run along a gentle descent between the rows of the plants; hence, the water runs off rather quickly, taking more or less soil with it. It would be better to have the water run around or along the side of the hill, instead of down it; then less water would be needed, and the substance of the soil would be less liable to be washed away.

At Fort Stockton and neighborhood, more than 3000 acres are irrigated and cultivated for the growth of barley, corn, oats, wheat, grapes and vegetables. The water supply is from Comanche creek, which is fed by about fifty springs at the base of the hill on which the fort is placed. Some of these springs are very large, over one of which is a fine bath house. The temperature of the springs is from seventy-two to seventy-five degrees, mostly seventy-three degrees.

Mr. Corbit has the largest irrigated farm. In 1874, he raised about 8,000 bushels of barley, corn 6,000 bushels, wheat 4,500 bushels, and a few sacks of oats.

He is trying to introduce American plows and improved agricultural machinery, but in this he is opposed by his Mexican workmen, who prefer their old rude instruments. However, last year he had a portion plowed with a steel plow, and another portion adjoining plowed with the Mexican plow, and the result being about twice as much grain from the former as the latter, many were convinced of the superiority of the steel plows.

The officers of the fort also have a garden for the growth of vegetables. This is in the valley, about three miles from Stockton.

In the valley of Toyah creek, about 1500 acres are irrigated from the creek, which is fed by several large springs gushing up in the plain and running away with sufficient water and fall for mills and much machinery. Wheat, barley and corn are the principal crops. The forts at Davis and Stockton give a good market for the grain grown here, and also in the Comanche valley near Fort Stockton. The principal settlements on Toyah creek are at San Salomon springs and at Victoria, a few miles below, where Mr. Murphy, of Fort Davis, has several hundred acres in cultivation. At Davis, Mr. Murphy also has a steam flouring mill.



San Salomon springs are 3,250 feet above the sea, in a broad valley. Westward, eight to ten miles from the springs, it is encircled partly by the Limpia mountains, from which the valley extends eastward to the Pecos river, distant about forty-five miles. Northwestward, a branch of it extends about thirty miles to where it intersects another valley leading to Salt Lake, on the Pecos.

Irrigation is done extensively on the Rio Grande in the vicinity of El Paso, extending southward to Presidio del Norte on both sides of the river. On the Texas side are large quantities of productive valley lands, extending forty miles below El Paso, which are more or less irrigated. Below this, very little irrigation is done on the east side of the river above Presidio del Norte. On the irrigated lands wheat, barley, corn and oats are grown; also, vegetables and various fruits noted elsewhere.

On the Limpia, at Fort Davis, irrigation is done to a considerable extent.

In the western part of Kinney county, at the head of San Felipe river, are the San Felipe springs, three or more in number, from which flows the river going with a rapid current about fifteen miles to the Rio Grande, making one of the finest water powers in Texas or any other country. Two large flouring mills are at the little town of San Felipe. On this stream, 3000 acres are irrigated and under cultivation. Corn is the main crop, which, well cultivated, would average forty bushels per acre. So said Mr. Taylor, one of the proprietors of the irrigated land. Wheat is but little raised, average crop sixteen bushels to the acre. Oats grow well. Sweet potatoes do well, and are largely grown for the western market. Irish potatoes are raised to a small extent. All garden vegetables do finely; so do peaches and grapes; other fruits recently planted and on trial. Besides the mills, San Felipe has two stores and from forty to fifty dwelling houses. Sheep and cattle do well, and are kept to a considerable extent in that neighborhood.

Eastward, on the Fort Clark road, at Mud creek, is a large valley, about 700 acres of which are irrigated and cultivated. Below Fort Clark, on the Los Moras, irrigation is extensively done.

Enough land can be irrigated and cultivated in the western part of the State to support a large population, and the minerals of El Paso and Presidio counties, joined with

their fine grazing lands, will ere long cause these counties to have a large population.

The valley of the Pecos below the stage station, between Fort Concho and El Paso, has but comparatively little irrigable land; that is, as far down as the ford near old Fort Lancaster, below which we did not see the river. In two or three places, farms of three and four hundred acres can be made and irrigated, and small places of a few acres can be made along the larger portion of the way, but the irrigation would mostly have to be done by hydraulic rams, or what would probably be better, with pumps run by wind mills. Thus stock ranches can be made, and grain and vegetables for family use raised. The stream is deep and rapid, charged with yellowish-brown mud, and confined between perpendicular clay banks six to ten feet high. Hence a person may travel along the river for miles without seeing the water. Cattle cannot get to the water except in a few places at the distance of from eight to ten miles from each other. However, a few hours work with spade and shovel can obviate this, and make roads and paths to the water for cattle.

There is a large permanent spring of excellent water on the west side of the river, eight to ten miles above the ford, near old Fort Lancaster, now unoccupied and in ruins. The spring is at the base of a hill, amid small trees and bushes, where the road turns up and goes around a mountain.

#### COTTON.

This is the staple of the State, being grown largely throughout most of the agricultural region, except in the irrigated lands of the west, and there it does well, but the distance from market prevents its cultivation.

In 1870, the number of bales raised in Texas is reported to have been 350,658. This year there was probably an equal amount, and perhaps more. Averaging the bales at 450 pounds each, which is a low average, and the average price of the cotton at ten cents, which is also too low, then the sum received, or which can be received for the cotton crop, amounts to \$15,779,610, which is a snug sum for the farmers of the State. If they raise their own bacon and breadstuff, and make their own butter, and most of them do, then, as a class, they are doing well, and better probably than any other class in the State. True, the State

imports largely of breadstuffs, of bacon, hams, etc.; of butter, cheese and condensed milk; of canned fruits, etc.; but most of these importations are for those living in cities and towns. Better would it be for the farmers of the State if they would produce enough of these things for the wants of its entire people. One thing is certain—the farmers of Texas have great advantages, with a climate and soil adapted to such a wide range of production, and also a good home market for most of their productions.

#### INDIAN CORN

Is the most general and extensively cultivated grain in the State. On the irrigated lands at the west it is largely grown. At El Paso 75 to 85 bushels per acre are said to have been raised, and much more than this can be grown, for its culture can be greatly improved. Shoots or suckers are there allowed to grow, making ten or more stalks in one hill. Sometimes nearly each one of these stalks has an ear of corn. The average yield per acre of corn in a large portion of the State can be much increased. To show how this can be done, I append the following account of Dr. Parker's crop, taken from the *Rural Carolinian*:

J. A. W., Carthage, Miss., (among others, both North and South,) having expressed great astonishment in view of the apparently fabulous quantity of corn (200 bushels and twelve quarts,) said to have been grown by Dr. J. W. Parker, of Columbia, S. C., on an acre of ground, and inquiring whether *shelled* corn could possibly be meant, we desired to set the question definitely at rest, (though having no doubt ourselves on the subject,) and addressed a note of inquiry to Dr. Parker. The following is his reply:

COLUMBIA, May 8, 1871.

D. H. JACQUES, Esq.:

*My Dear Sir*—I do not think that I can better reply to your late letter, or that you could better answer the numerous inquiries concerning the "Premium Corn Crop," grown some years ago on my farm, than by sending copies of my report on "Corn Culture," published among the Proceedings of the Annual Convention of the South Carolina Agricultural and Mechanical Society, November, 1869. In that paper, full information was given on every point

of interest connected with the cultivation of this extraordinary yield. I have but a word to add about the measurement.

The acre was within two hundred yards of my barn. The committee assembled early in the morning and the corn was broken in, hauled up and measured in the presence of one or more of the committee, who were all well known citizens. The measurement was by barrels, one or more (three I believe, was the exact number,) were taken at hazard, the contents shelled and measured. The average was then multiplied by the number of barrels, and the result obtained.

I wish much that I could find the report of the committee published by the Society of that date; it explained all this I believe, and stated that the committee would be willing to buy or sell by the same measurement. It was not uninteresting at the time to know, that a friend who had walked through the corn a few days before, by counting the ears on several rows had estimated the yield at 213 bushels.

I attribute the success more to timely irrigation, than to any other cause.

Very truly and respectfully yours,  
J. W. PARKER.

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*How Dr. Parker Made his Premium Corn Crop.*

Many of our readers have read in the "Proceedings of the Annual Convention of the South Carolina Agricultural and Mechanical Society for 1869," the report of the Committee on Corn Culture, of which Dr. J. W. Parker, of Columbia, was Chairman; but for the benefit of the thousands who have not seen it, as well as to have it here, where it can be referred to at any time, we now re-print it entire. In connection with Dr. Parker's note in our June number, it furnishes a complete history of the wonderful and much debated premium corn crop—probably the largest on record:

REPORT ON CORN CULTURE.

In performing the duty assigned me by the Agricultural and Mechanical Association, I propose, briefly, to give my

own experience with the result of two or three experiments. As early as the year 1827, I became convinced that, in the event of a drouth in summer, the ordinary method and routine of planting corn, in my neighborhood, was ruinous in its results, entailing on the planter the necessity of getting his supply elsewhere than from his own field. Acting from the suggestion derived from books on agriculture, I took for my first experiment a level, much-exhausted red-clay field, which produced not five bushels of corn per acre the preceding year.

About the first of December, I started the work of ploughing and subsoiling with bull-tongue ploughs and an old-fashioned Coulter, running two of the former to one of the latter, thus subsoiling every alternate furrow.

Early in February the field was laid off four feet each way with a seven inch shovel, followed by a subsoil plough. In each check a small shovelful of a compost of cotton seed, stable manure and the scrapings of the lots, was put and covered with a tongue plough. In March the field was planted in corn, the seed having been soaked in a solution of saltpetre, and was covered with hoes to the depth of about two inches. As soon as the plant attained the height of three or four inches it was thoroughly ploughed with tongue ploughs and followed by the hoe hands. It received two other ploughings with short shovels, and was laid by before the tassel appeared. The cultivation was level, rather drawing the earth from, than to the stalk, at the early stage of its growth.

The contrast between this and other fields around, during the hot and dry season, was striking. In this field, the vigorous growth and dark green blades gave but little indication of drouth, while in many fields around, the plant was literally being scorched to dryness.

The product was put down at twenty-five bushels per acre, being a gain of at least twenty bushels per acre over the preceding crop.

From the foregoing experiment we learn the beneficial effect of opening the soil for the reception and retention of moisture during the winter, the better pulverization by freezing, and adaptation of the soil for the ramification of the lateral roots of the corn.

It is remarkable that this method of preparing the soil, successfully practiced among the ancients, should have been lost sight of in our country until within the last forty

or fifty years, and what is more strange, but few farmers of our day know from their own experience anything of the benefit derived from deep plowing in winter or fall.

In the foregoing experiment, the error committed was in putting the manure in the hill, instead of plowing it in the land broadcast. When manure is put in the hill the plant is vigorously pushed forward, and attains a great height before the shoot appears, and then commonly within three or four blades of the top, consequently distant from its source of nourishment below, and with but little protection from above. Take carefully that stalk from the ground and immerse its roots in clear water and remove all dirt. You will observe the roots confined to a small circumference, all seeming to grasp the food just at their exit from the stem, and comparatively but few lateral roots. When the manure has been properly ploughed in the land broadcast, the plant at first does not make such rapid headway, but from a wise provision of nature, the lateral roots are being sent out with their thousand mouths in search of food and moisture. They find all that has been bestowed by nature or by the hand of man, and the corn begins to shoot about the time the roots are in condition to bestow their treasures for its support. Just at this important crisis in the growth of the crop, it has been urged by old planters that the ground should have its last good ploughing. I have seen more than one field of luxuriant corn thus ruined. Common sense should admonish the ploughman to stay his hand, and leave undisturbed the delicate little veins or roots in the discharge of their important functions.

To gratify my farmer, as well as to convince him of his error, he was allowed to give what he termed a finish with the plough and hoe to a dozen rows—the result was a decided falling off in yield. The foregoing experiment shows that with the proper preparation of the soil, four feet by four gives sufficient distance on an upland, that the preparation of the land and first ploughing to the crop should be deep, and all other cultivation shallow and level.

My next experiment was of more recent date, and on land very different in character from the first, being nothing more nor less than a quagmire, near by the city of Columbia. It was grown with rushes, willows and sour

grasses, abounding with snakes and malaria, through which a serpentine branch made its sluggish way.

My first work was to secure thorough drainage by means of a canal and underdrains, then to clearing and levelling, and third to lime and break up with a two-horse plough, all of which was the work of the summer. In November a heavy coating of cow-house manure was applied, and turned under with a two-horse plough. In January the same process was repeated, and again in March, and the subsoil plough used. In April it was necessary to plough under a luxurious growth of weeds, lime being first applied as at first. In May the hands were again on the ground with manure carts, two-horse ploughs and hoes; after ploughing another coat of manure in, the land was harrowed perfectly level, and laid off thirty-six inches apart; throughout each furrow Peruvian Guano, salt and plaster were sprinkled at the rate of 200 lbs. per acre of each. The seed corn, after being soaked in a solution of nitre, was rolled in plaster and dropped ten inches apart in rows, covered with rakes and the land rolled. Five days after planting, this corn was up and growing. As soon as it was large enough to bear ploughing it was run around with a long, narrow plough, followed by the hoe. There was nothing remarkable in the culture of this lot; it was kept clean by shallow and level culture until it began to shoot and tassel; *irrigation* was then resorted to by conveying from a reservoir a gentle flow of water through every alternate row. Thus the land was kept moist and the plant in a growing state.

The Agricultural Society awarded the premium for the largest yield to this lot, there being 147 bushels per acre produced on two acres.

The following year the same experiment was repeated, except that the rows were thirty instead of thirty-six inches apart.

Inasmuch as there were doubts entertained as to the correctness of the first crop, we were the more careful in having a larger committee to measure and report on this. Their award was the first premium as before, the yield being 200 bushels and 12 quarts of good corn on a single acre. The land was surveyed by the City Surveyor.

From the foregoing remarks and experiments the following conclusions may be drawn:

That success in corn growing depends much upon the

thorough preparation of the soil during the fall and winter, which consists in—

- 1st. Deep breaking up.
- 2d. Underdrainage on moist flat land.
- 3d. The judicious manuring.
- 4th. That the first work should be deep; subsequent work shallow and level.
- 5th. The roots of the corn should not be disturbed after it bunches to tassel.

Under the old method of culture, the question has arisen whether or not corn can be made a remunerative crop. I should say on our old plantations it cannot. On the other hand, by improved culture, the effects of drouth or scalding from too much rain can be overcome, and instead of harvesting fifty per cent. less than an average crop, as is the case the present year, there would, doubtless, be an increase of fifty per cent. over the average of past years, on the same area of ground. The question would then be responded to affirmatively, and demonstrated by evidences everywhere of increased prosperity and domestic comforts. Fat stock of all kinds would give evidence of full barns, and the old adage would be verified: "It takes corn to make cattle and cattle to make corn."

J. W. PARKER.

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The census report for 1870 gives Texas 20,554,538 bushels of Indian corn; the United States Agricultural Report for 1874, 28,016,000 bushels.

#### OATS

Are extensively grown in Texas, and their cultivation is increasing largely. A gentleman of Travis county raised last year from eleven acres upwards of one thousand bushels of oats. Similar yields have been realized in some of the northern counties of the State. According to the Agricultural Department for 1874, Texas then grew 1,118,000 bushels of oats.

#### BARLEY

Is grown and does well in Tom Green county; also in Presidio and El Paso counties. It does well throughout a



large portion of the State. The report of the amount raised in the State, given by the United States Agricultural Department in 1874, is 63,000 bushels.

#### RYE

Does very well. Sown in the fall, it gives a large amount of winter pasturage, and in the spring, if cut before ripe, when in flower, it makes good hay. In 1874, 40,000 bushels are said to have been grown in the State, but a large portion of the amount sown was used for forage and pasturage:

#### WHEAT

Is grown quite largely in the northern and central portions of the State. Texas flour is said to have received the first premium at the Agricultural Fair of last year (1875) at St. Louis.

It does remarkably well at El Paso and in other portions of El Paso county; also in Presidio county. The irrigated lands and mineral waters by which they are irrigated, all being well suited for its growth. We found flour selling at from four to five dollars per hundred pounds at El Paso. A steam mill at San Elizaria, a few miles below El Paso, does a large business in flour.

We were told that one hundred bushels of wheat per acre had been grown near El Paso, the truth of which we doubted; whereupon some of the first citizens of the place assured us that eighty bushels per acre had certainly been realized. The kernel is large and full.

According to the United States census report of 1870, 400,000 bushels of wheat were then grown in Texas. The report of the Statistician of the Agricultural Department at Washington for 1874, gives Texas 1,474,000 bushels for that year, showing a large increase; and its culture is still increasing.

#### RICE

Succeeds well. What is termed upland rice is grown to a considerable extent; but this is said to be only that raised on uplands from seed grown by irrigation, which yields well for one season when planted on uplands. Thus grown, the seed should be annually renewed. In 1870, 63,844 pounds of rice were grown in Texas.

## TOBACCO.

In 1870, 59,706 pounds of tobacco were grown in the State. In 1874, 141,000 pounds.

Jasper, Grayson, Lavaca and Austin are the largest tobacco-producing counties, distant from each other in eastern, northern and southeastern Texas, showing that tobacco can be profitably grown in the larger portion of the State.

## BEANS,

Especially the white beans, are cultivated to a considerable extent on the irrigated grounds of the western part of the State, being often planted after oats, barley or wheat. At Mr. Spencer's, in Presidio county, large crops of both corn and beans were raised last year on land not irrigated.

## ONIONS.

On the irrigated lands, the El Paso and other onions are largely grown, being in size larger than any I have ever seen elsewhere.

## HAY.

In 1870, the hay crop of Texas is reported as being 18,982 tons, and in 1874, 62,000 tons.

## SUGAR.

The census report of 1870 gives only 2,020 hogsheads of cane sugar for Texas, much less than was grown ten years before. Southern Texas has a large uncultivated area, where cane sugar can be profitably grown, especially now that improved and less expensive machinery is required for its manufacture. The climate south of latitude 30 degrees is suited to its growth, and it has been successfully cultivated still farther north, as high as latitude 31 degrees.

## GRAPES AND WINE.

Two species of native grapes extend from Burnet county northwestward into El Paso county. These are *Vitis montana* and *V. rupestris*. The hill sides and valleys of Hays, Blanco, Llano, San Saba and other western counties, are

very suitable for the cultivation of the best varieties of American grapes. These grapes are now attracting the attention of many European vine-growers. Last fall, a large order was received from Europe for cuttings and roots of American grapevines by the vine-growers of Pleasant Valley, at Hammondsport, in western New York. The kinds wanted were Concord, Catawba, etc.

At the Vienna Exposition of 1873 the official award gave the first prize medal to the Pleasant Valley Wine Company, of Hammondsport, New York, for the Great Western and Carte Blanche champagne wines, and the diploma to the Urbana Wine Company of the same place, for Gold Seal and Imperial Sparkling wines.

The valley of the Rio Grande at and near El Paso, has been noted for many years for its remarkably fine wines and excellent grapes. More than two hundred years ago grape culture and wine making began at El Paso. The grapes cultivated were probably derived from Europe, but years of cultivation have made them better than the original stock. Two varieties are grown—the black and the yellowish-white grape, both of which are very sweet and juicy, of a very fine flavor, rendering them agreeable to the taste of both old and young. During the season when grapes are ripe from about the first of August to some time in October, all eat freely of grapes, and find them conducive to health.

A late number of the New York Commercial has the following:

“In the vineyard districts of France, Spain, and other vine-growing countries, the medical properties of the grape are well known and understood. The free use of this fruit has a most salutary effect upon the animal system, diluting the blood, removing obstructions from the liver, kidneys, spleen, and other important organs, giving a healthy tone to the animal economy. In diseases of the liver, and especially in that monster compound affliction, dyspepsia, the salutary and potent influence of grape diet is well known in France. The inhabitants of the vineyard districts are never afflicted with these diseases, which, however, alone would not be conclusive evidence of the medicinal qualities of the fruit of which they so freely partake, since peasant life is rarely marred with these ailments; but hundreds who are thus afflicted, yearly resort to the vineyard districts for the sake of what is known as the

grape cure, and the result proves to be a cure, except in very long and protracted cases, which are beyond the reach of medical remedies. The invigorating influence of the ripe grape, freely eaten, upon the feeble and debilitated, is quite apparent, supplying vigor and the rosy hue of health instead of weakness and palor, and this, by its diluting property, which enables the blood to circulate in the remoter particles of the skin, which before received only the serous or watery particles."

Since the above was written, several "grape cures" have been established in France, Germany and Switzerland, where the patients are cured by partaking freely of ripe grapes, which they themselves generally pluck from the vines.

This agrees with what we were told of the invigorating properties of ripe grapes when at El Paso. The grapes of this place are said to be better and the wine made from them better than the grapes or wines of places above or below on the Rio Grande. At El Paso there are between two and three thousand acres in vines, many of which have been recently planted. Vines are planted eight feet apart. Each spring the vines are cut back to within from twelve to eighteen inches of the ground, leaving from three to four eyes or buds on the stalk, be it large or small. The older vineyards have large stumps, from which many branches radiate and these branches are loaded with fruit. No trellis used. The vines grow in bush form and almost cover the ground in midsummer. The clusters of grapes are thickly placed on the branches near the top of the stump. Each stump, when at the age of five years or more, will bear from fifteen to twenty pounds of grapes, which will about make one gallon of wine. It is said that each grape vine will grow grapes enough on an average for a gallon of wine. Such are the estimates for vines of five years old and upwards. At eight feet apart, one acre contains 680 vines. At El Paso last summer the wine was selling at from \$2 50 to \$3.00 per gal. The wine has such superior qualities that there is a ready market for it in Mexico and elsewhere. No sugar used in the manufacture. Mr. Richardson, Mrs. Angestein, Dr. Samoridia and several others have large vineyards for the manufacture of wine. Near El Paso, fine lands which can be irrigated, and which are suited for the growth of the grape or other agricultural or horticultural purposes, can be bought for

less than ten dollars per acre. Were it accessible by railroad, property there would be made higher, because it is a delightful valley, amid fine mountain scenery, a fine, mild, healthy climate, where the Texas northers do not come. It is said these northers do not prevail in the valley of the Rio Grande west of Fort Davis.

Mr. Corbit, of Fort Stockton, has a vineyard of El Paso grapes. The vines are three years old, look very flourishing and bear a few excellent grapes. The El Paso grape will succeed well in the Comanche valley, at Fort Stockton, also on the Toyah and Pecos, all of which have brackish or mineral waters, resembling those of the Rio Grande, whose salts agree remarkably well with this peculiar grape.

#### HOGS.

West of Mason county, but few hogs are raised, because there are few oak trees and but little "mast," besides there are no fences to keep hogs away from the crops. The few hogs that are kept are not permitted to run at large.

In 1870, the number of swine reported to be in the State, was 1,302,415. The number in 1874, is said to have been 1,147,400.

Texas imports annually, large quantities of bacon, hams, lard, etc. Last year the value of these imports was about \$5,000,000, an amount which might and ought to be saved to the State, because with our fertile soil, these articles should be exported instead imported.

#### HORSES AND MULES.

Texas has many fine horses of imported breeds. Were it not for the thieving Indians and bad white men, large numbers of horses could be profitably raised on the prairies of western Texas. The number of horses reported for the State in 1874, was 720,000, and of mules 101,000.

#### CATTLE.

Texas has more cattle than any State in the Union. The number reported in 1874, was 2,367,400. Most of the large cattle owners have their cattle under the care of

herdsmen who on horseback, go with the cattle here and there over the plains. Some in the southwestern part of the State, in addition have large tracts of land surrounded by fence to keep their cattle on their own land, and keep off the cattle of others, because there are many who have little or no land, yet own many cattle.

Improved breeds of cattle have been largely imported into the State during the last few years.

In 1875, the number of milch cows in the United States, was 10,906,800. Of these, Texas has 526,500, yet she imports annually large quantities of butter, cheese and condensed milk. During the last eight to ten years, butter has been sold largely in Austin at fifty cents or more per pound, and cheese at twenty-five cents per pound. These are winter prices.

#### SHEEP.

Western Texas has great advantages for the successful keeping of sheep, with its mountains and valleys, and abundant pasturage, joined with a delightful and healthy climate.

I have often said, and say again, that a beginning with 1000 sheep, properly and well cared for, will in a well chosen place in western Texas, (and there are thousands of such places) amount to an independent fortune in ten years. By an independent fortune, I mean an income of from \$3000 to \$5000 a year. I know of those who with such beginnings in this business, continued for ten years, have realized and now have greater incomes. But this business needs care, energy and judicious management. Some, lacking these things, have been unsuccessful in the sheep business, even in Texas, and others, during the same time, have acquired independent fortunes.

One advantage which the country west and northwest of Austin has, is the almost entire absence of burr weeds (*Xanthium strumarium*), so injurious to the wool of some portions of the State.

The wages of shepherds in western Texas vary from \$5 to \$10 per month, without board. These are the prices paid Mexicans, who are fond of the business. The better way is to have a Mexican family, furnished with a small house and garden. A Mexican, with a sheep dog, will take care of from 1000 to 1200 sheep, which is as large a number as ought to be in a flock.

Sheep west of the Pecos are said to be free from scab. Mr. Corbit, who has a flock at Fort Stockton, told me that when he obtained about 1200 from the vicinity of San Antonio, some of them were diseased with the scab, but all have now become well and in good condition, without the application of any remedies. This may be on account of the waters of that region being slightly mineralized, joined with the good pasturage and pure mountain air. Fort Stockton has an elevation of 3000 feet above the sea, and many of the mountains of that region are a few hundred feet higher.

Several thousand sheep are kept along the Rio Grande above Fort Quitman; also about 7000 are pastured in the Chinati mountains, in Presidio county. In 1874, there were said to be about 1,445,700 sheep in Texas.

During the last three years many thousands of sheep have been introduced into the State, especially in the counties west and southwest of San Antonio. About 70,000 sheep are now on the prairies, valleys and hills of Kinney county. Uvalde county has 50,000 or more. Mr. John Kennedy, living on the Savinal, in the eastern part of Uvalde county, has lately sold several thousand cattle for \$10,000, preparatory to engaging in the sheep business. About 4000 of these cattle were driven last fall (1875) up into the valley of the Pecos, where they have better pasturage.

In western Texas there is an area of more than 50,000 square miles suitable for sheep, affording more than sufficient pasturage for all the sheep in the United States. In 1874 the number of sheep in the United States was 33,783,600. It is said that an acre will keep three sheep. Suppose that one acre in western Texas will only keep half that number, still it will keep more sheep than are now in the United States.

At present California has the most sheep of any State. 4,683,200 were there in 1874. A gentleman who left California last spring and went through Arizona and New Mexico into Texas, told me last August that 10,000 sheep were on their way from California to Texas over the route which he came. The following is from a late newspaper :

*American Wools.*

There is still a large opening for the profitable employment of labor and capital in sheep growing, in those portions of this country best adapted to the business. A large amount of wool is still imported from abroad, and the demand grows with our growing population, while some of the old States are not able to compete with the new regions of the Southwest in the production of sheep and wool at remunerative prices. From an article in a leading business publication of New York, it appears that the finer classes of wool are not as profitable to the producer as those of the more common kind.

In this country our finest and best clothing wools are grown in West Virginia (especially the Pan Handle district), Ohio and Pennsylvania. Next in order follow New York, Vermont and Michigan; then Illinois, Iowa, Missouri, Wisconsin and Minnesota; next, California, Texas, Georgia, Louisiana, North Carolina, Alabama and Florida. The New England States, excepting Vermont, do not raise much wool, and in that State sheep are raised more for breeding than wool growing purposes, and some of our best and purest blooded merino stock are bred there. Maine, New Hampshire and Massachusetts raise a few sheep, principally, however, of the Southdown and Leicester cross breeds. The very finest fibred wool is grown in the Pan Handle district, West Virginia, where the sheep are mostly of the Saxony breed; this stock, originally from Silesia, being noted as the finest wool in the world. The sheep, however, are delicate and small, and require careful attention and wintering to keep from degenerating. The fleeces are small, and, as a rule, it does not pay the farmers to raise this breed. The wool is used in making the finest cloths, coatings, flannels and cassimeres.

Ohio used to be the most prominent wool growing State, but now shows a material decrease in production, the land having become more valuable for other purposes. The sheep raised in Ohio are chiefly of the merino breed, either pure or crossed with native stock.

In New York, Michigan and Pennsylvania considerable fine wool is raised; to the last named State is conceded the credit of growing the best, being of more even texture and less greasy than that from the other two. These wools are not so valuable as the Ohio and West Virginia.



The Iowa, Illinois, Wisconsin, Indiana, Missouri and Minnesota wools are chiefly of mixed grades, running into medium. From Georgia, Alabama, Louisiana and Florida the clip is all of a medium to low medium description.

Finally, Texas and California, two large and important wool raising States, produce wools of distinctive character, and adapted for peculiar goods. In these States there are two clips each year, spring and fall. The spring wools are used in connection with Ohio and other better classes, to cheapen stock, and as filling wool, and when of long growth they are spun into warp yarns. The fall clip is employed in making satinets, feltings, and to mix with long stapled wool.

The clip of the United States is principally from sheep either pure or mixed merino breed, and in quality averages from three-quarters to half blood—that is, three-quarters to half merino breed, and one-quarter to one-half native. They thrive well, as they can be kept in large flocks and in comparatively wild pasturage, and our far Western States and Territories—Texas, California, Nevada, Colorado, Kansas and Utah are destined to become the great wool raising country.

Short-stapled fine wool is largely absorbed by the hat-ting and felting trade, who select generally the fall or spring California or Texas and Cape wool. The goods made are wool hats, seamless clothing, piano and table covers, felt skirts and a variety of domestic goods. The low medium and coarser wools from Northern and Western Texas, Kansas, Colorado, Nevada and Utah, are used for the manufacture of blankets and low hosiery.

In 1873 the amount of wool raised in the United States, according to Mr. James Lynch's report, was 174,700,000 pounds, of which California alone produced upwards of 32,000,000. There was imported about 47,000,000 pounds of foreign wool of all descriptions, the bulk being "carpet." This makes a grand total of 221,000,000 pounds of raw material, or about half that quantity when scoured and ready for the cards. Value about \$65,000,000 gold. In addition to wool, we imported in 1873 about \$38,000,000 worth of woolen goods, gold value.

## BUTTER AND CHEESE.

During the past few years there has been a large increase in the quantity of butter made in the State. There has also been a marked improvement in its quality, showing that Texas cows and Texas grasses will make a first class article of butter. Many of the grass lands at the north, used for dairy purposes, are valued at more than fifty dollars per acre, and with these high priced lands, large profits are realized in the dairy business; hence there can be no doubt but that still greater profits can be made in Texas in the same business.

At the north they have a co-operative system in the large dairy districts, the cheese and butter being made in factories, which is a decided advantage, it being a great saving of labor and expense. But here similar factories can be established, and in Texas the cost of keeping cows, both summer and winter, is much less than at the north.

From the last data at hand, the make of butter in the entire country, for 1875, was 600,000,000 pounds, averaging this at thirty cents per pound, and it amounts to \$180,000,000. Of cheese there was made about 200,000,000 of pounds, which at twelve and a half cents per pound, amounts to \$25,000,000, or the aggregate sum of \$205,000,000, marketed in one year from the dairy. This of course does not include the quantity consumed on the farm. 120,000,000 pounds of cheese were exported from the country, and of butter 5,000,000 pounds.

## FENCES.

Westward from Fort Mason, as far as El Paso, we found few fences, generally no more than sufficient to restrain stock at night. By day the stock are in charge of herdsmen. This course is found to be much cheaper and better than to endeavor to fence lands for crops. The general absence of fencing material, excepting rocks and adobes, both of which are used for fencing to a small extent, has compelled people to adopt this course.

Were such measures prevalent throughout the prairie region of the State, it would bring more land into cultivation and be better for all parties.

## FIBROUS PLANTS, GROWING IN WESTERN TEXAS.

Western Texas has a large wealth of these, which is little known and little appreciated. Its wild mountains, hills, valleys and plains are in many places thickly planted with them, but nature has done the planting.

Of these there are three species of *Dasyilirion*, a genus of the natural order Bromeliacea, to which order of plants also belongs the pine apple (*Annanas*), and our long "gray moss" (*Tillandsia*), pendent from trees in the low cotton country. The *Tillandsia* is used to make mattresses, called hair mattresses.

To return to the *Dasyilirion*: *D. tenuifolia* has dagger shaped leaves, from twelve to eighteen inches long, armed with serrated edges. These leaves are many and near the surface of the ground, and from the center rises the flower stem to the height of six or more feet. This species grows near Dead Man's Hole, on the Pedernalis, also on the head waters of the Guadalupe and on the hills along Devil's river. The two other species of *Dasyilirion* are common throughout a large portion of the region between the Pecos and Rio Grande. They resemble the preceding species, but differ in their longer and more numerous leaves, which are often three feet long. The stem of one of these species is enlarged, cabbage head like, near the surface of the ground, thickly covered with long leaves. I was assured by some Mexicans and others that this head was roasted and eaten as food, and also, that muscal, a whisky-like liquor, was made from its pulp, the fermented juice being pressed out. The Apache Indians, who dwelt in the region between Fort Stockton and the Rio Grande, made the same use of this plant, and from this custom one branch of the tribe was called Muscallaro-Apaches. At San Salomon springs, on the head waters of the Toyah, I was shown the rocky remains of furnaces used by the Apaches for roasting, for the manufacture of muscal, and for food. Such remains are quite common at the old camping grounds of the Indians throughout that country.

The fibres of the leaves of the *Dasyilirion* have great strength, and they probably are also very durable. An allied plant, *Bromelia sagenaria*, is used in Brazil for cordage, and the following is related in proof of the strength of the cordage made from it: A rope of it had been in constant use during many years upon the wharf of the city

of Paraiba. The heavy anchors belonging to a line of battle ships were hoisted on board a vessel with this same old rope, after hemp cables of a larger diameter had been found inefficient for the purpose. The serrated sharp edges of the leaves of the Dasyliiron has prevented them from being used for their fibres; besides the Yucca or Spanish dagger abounds in that region, and so does the Agave or maguey.

The Agave heteracanthé, the leaves of which are used for making coarse cloth, bagging, ropes, etc., in western Texas, near and at Presidio del Norte, in Mexico, is common on and around limestone mountains and hills along the Pecos and westward to the Rio Grande. In many places it is so thick as to make walking among it a careful study, to avoid injury from its sharp pointed leaves. It is called *lechuguia* by some of the Mexicans; others also call a Dasyliiron by the same name.

Of all these plants, the Yuccas or Spanish dagger, are the most common. These, joined with the Dasyliirions, give a singular beauty to some of the western landscapes.

One species of Yucca, the *longifolia*, often has very long leaves, some of which I brought home from near Muerto springs, are five feet long; others, found near Devil's river, are five feet six inches, but the ordinary length of the leaves of this species is from three to four feet.

I append the following communications regarding these plants. The two first are from the Rural Carolinian, of Charleston. S. C., and the last from Our Home Journal, of New Orleans:

#### *Texas Istle in England.*

The object of this communication is to stimulate as much as possible the growth and collection of this valuable fibre, and to promulgate amongst the producers in Texas the exact state of our European market, as demonstrated in Liverpool. Unlike the past, the present and future are replete with encouragement.

Hitherto, our largest supply of Istle, Isle, Pita de Tampico, or Mexican Fibre, (as it is variously designated), has been drawn from Mexico, and within the last fortnight 1000 bales thence, about two hundred tons gross, have been sold here. The only Texas Istle that we have received so

far, has come *via* New York, and, though most of it has been quite equal to the Mexican in quality, some of it, it is to be regretted, has been "cooked" in New York; that is, the superior long fibre has been extracted and the inferior re-shipped here as the genuine article.

In Europe, we use this product enormously for brush and broom making chiefly, for which purpose it is a large auxiliary or substitute for piassava. We can take thousands of tons of it. The supply of both, however, is at present quite inadequate, and piassava has advanced thirty to fifty, and Istle ten to twenty per cent.

The value to-day of ordinary to fine Texas Istle is £41 to £42 10s., equal to \$197 to \$204 gold per ton of 2240 pounds, at which the Mexican sold. There is no duty, and it sells readily, ex quay, as it arrives:

It is hoped that the agriculturalists of Texas will see to this Istle, and also to its direct shipment to Europe. The Mexicans are getting rich upon it, and, as the river Rio Grande del Norte alone divides the United States and Mexican territories, it is difficult to imagine that there can be any geographical or physical reasons to prevent the Americans going ahead in its increased production with characteristic enterprise.

The last Texas shipment that we are advised of was one of one hundred and four bales, exported by the "Clara Woodhouse," from Brazos, Texas, to New York, which lot is expected here. Interested parties can have samples of the exact thing required, and further information at any time, by writing to the undersigned.

ALEX. S. MACRAE,

*Anglo-American Produce Broker, Liverpool, England.*

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### *The Ystle and Maguey.*

The enclosed communication on the Ystle and Maguey was written by Mr. Hastings, an intelligent American gentleman of Tamaulipas, Mexico, for the Brownsville *Sentinel*, of Texas. Last summer I saw Col. Ford, of the *Sentinel*, and requested him to send me some of the Ystle, and all the information he could about the plant, and here you have the result. The large Maguey (*Agave Ameri-*

*cana*) is hardy in the open air at Austin, and I think it would thrive in all of the warmer portions of the Atlantic and Gulf cotton States. S. B. BUCKLEY.

*Austin, Texas, Oct. 15, 1871.*

I see by some of the Northern periodicals that the Ystle plant is attracting some attention, or it may be but curiosity as regards the source from whence is derived the fibre called Ystle, that is being shipped, to some extent, to the United States from Northern Mexico. The plant from which this fibre is extracted is of the *Agave Americana* family, and is called here where it grows, *lechuguia*. It is an evergreen; the leaves are broad at the base, gradually narrowing to the point, which is armed with a strong or sharp thorn or spike; they are slightly concave on the upper side, and armed among the edges with cat's claw thorns. It grows in bunches without trunk or stem, but while it flowers it sends up from the centre of the spreading leaves a stalk of some ten or twelve feet in height, on the top of which comes forth the flower. It flowers but once and then dies. New plants spring forth from the roots of the old one, and thus the supply is continuous.

The above description would answer in every respect for the "Maguey" (*Agave Americana*) plant. The only difference perceptible are, that the latter plant has leaves four or five times as long as the former, are much thicker, of a darker green, and is a larger plant. Ystle is extracted from both of these species, although the "lechuguia" is the legitimate Ystle plant. The fibre of the Maguey is superior to the other, being longer, finer and whiter, and of course commands a higher price.

The manner of extracting the fibre of these plants here is quite primitive, no machine having as yet been found that will give satisfactory results. The work is most all done by hand, the only instrument used being a wooden knife, which serves to scrape off the fleshy parts from the leaf; the fibre is then separated by whipping it around a post, then dried in the sun, and the process is complete.

There are thousands of acres of lechuguia in the State of Tamaulipas. It literally covers the ground where it abounds, rendering it entirely useless for anything, except a secure refuge for snakes and armadillos.

The Maguey is a much more useful plant, and is also a beautiful one. At present the chief use of it is to distill

an alcoholic liquor from it called "Vina Mescal," by the natives. The leaves (*pencas*) are trimmed off from the lower part and thrown away, being most undoubtedly the most valuable part of the plant. The head, or, as it is called, the *pina*, is then roasted, pressed, and the juice thus obtained is allowed to ferment; it is then distilled, and *mescal* is the result. A small portion of the leaves are utilized by the *mescaleros* in thatching their houses, but nine-tenths of them are left in the woods to rot. This plant also yields a sap or juice while standing, from which is made the great Mexican drink known as *pulque*. To obtain this, the centre of the plant is cut away, and a saucer-shaped cavity is made in the solid part that remains below, into which there filters a whitish sap of rather a disagreeable taste to one who is unaccustomed to its use. This sap is called *agua miel*, (honey water), and is highly medicinal in its crude state. When allowed to ferment it becomes *pulque*. It is also subjected to another process, that of slow evaporation over fire, until it becomes of a syrupy consistence. This syrup is very sweet, and is an excellent substitute for molasses.

A good-sized *Magüey* is very productive. The *agua miel* is drawn off from the cavity above mentioned twice a day, and it continues to yield for several months. From the fibre ropes, bagging, matting, and a variety of useful articles are made; the *pina*, after being roasted, is eaten with relish by the workmen at the distilleries, and is very nutritious, sweet, and has not an unpleasant flavor. The flower stalk is used for rafters for the houses, being from twenty to twenty-five feet in length, and of great strength and durability.

Thus it will be seen that the *Magüey* is a useful plant, as it gives food and drink of different kinds, and houses to live in, besides other useful articles.

The time may come when these plants will be more protected than they are at present, and, perhaps, cultivated for the fibre which they yield,

I have heard that most of the *Ystle* shipped to the United States is converted into an imitation of horse hay, and mattresses, sofas, chairs, etc., stuffed with it, and sold as the genuine article.

*Bear Grass and Spanish Dagger—(Yucca Filamentosa and Yucca Aloefolia.)*

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ITS VALUE AS A FIBRE AND ITS MODE OF CULTURE.

It is a native of India, described by Royles in his work on "Fibrous Plants of India," page 57, published in London in 1875; also "Squire's Tropical Fibres, their production and economic extraction," page 61, and is now found growing in all the Southern States and Mexico, is a large spear leaved growth, dark evergreen, the blades or leaves from a half inch to two inches broad, generally about fourteen inches long, and by cultivation can be grown to six feet in length, and contains very valuable fibre for the purpose of making ropes, bagging, matting and all species of coarse cloths. The fibre can be readily obtained by means of a machinery constructed by the undersigned, by means of which the green leaves are thoroughly mashed, and then passing through a process of washing which removes all extraneous substances, leaving the fibre as white as Irish linen and ready for market; the waste by cleaning is less than one-tenth.

SOIL FOR YUCCA.

The plant thrives best on rich soils, growing to a greater length and stronger fibre, but coarser, and in sandy and poor clay soil, grows shorter and of a finer quality, and is known to grow on the highest "piney woods" hill, and in the lowest bottom lands. The cocoa or wire grass has no effect on its growth whatever, neither is it affected by overflow. Anywhere south of thirty-one degrees the first year of planting it will produce two crops per year and yield from fifteen to twenty-five hundred barrels marketable fibre per acre at each crop.

HOW PLANTED AND PROPAGATED.

The yucca is propagated by planting the roots or seed any time in the fall, winter or spring. The yucca aloefolia also may be propagated by planting the stalk cut in pieces and planted like Irish potatoes. The yucca filamentosa has a bulbous root resembling sweet potatoes, and



may be planted similar, and needs no replanting for one hundred years. There are patches of the yucca now growing in Louisiana and Mississippi in the woods and briers, where the sun has not shown on them probably for sixty years, and there are others growing on lawns known to have been planted more than one hundred years ago. The older it gets the thicker and more thrifty the growth; it is not only an evergreen, but grows the entire year, needs no enclosure, and is without enemies.

#### HOW HARVESTED AND PREPARED FOR MARKET.

The green leaves are stripped from the stalk, either by hand or by means of a spud, then run through the yucca cleaner green as they are stripped, then the fibre is ready for baling and the market.

#### HOW ONE MAN CAN CULTIVATE FIFTY ACRES

A man with a mule can plant and cultivate twenty acres in drills, similar to sugar cane, from the 1st of September to the 1st of January, and from the 1st of January to the 1st of May he can plant and cultivate twenty acres more, and during the months of May and June ten acres more. The experience of the writer is that it will require but slight or no cultivation after the first year, when planted as a farm product.

The clean or marketable fibre and materials manufactured therefrom were never known to be introduced into commerce, until introduced by the writer of this article in 1867.

Very respectfully,

A. STONER.

Stony Point, E. Baton Rouge Parish, La., February 19th, 1876.

REMARKS.—Our correspondent is mistaken as to his being the first to introduce it to commerce. We have some of the fibre in the office, of which we sent samples to several rope and cordage dealers, calling their attention to it, and some of whom offered to buy the article by the bale, but we could find no one who would gather and prepare it for market. The sample was furnished us in 1872, by Mr. Waterman, of this city, who was the first to call our attention to the value of the fibre. Since that time we have had

frequent calls for the fibre by dealers and manufacturers of cordage, and we are pleased to know that our correspondent is taking steps for its culture and manufacture, as it will prove highly profitable, the fibre being superior to Manilla, and will find a ready sale at from 10 to 15 cents per pound.

#### TANNING MATERIAL—SUMAC, OAKS, MESQUITE, ETC.

There are several species of sumac indigenous in Texas, which abound in tannin, viz: *Rhus typhina*, *R. glabra*, *R. copalina*, *R. pumila*, *R. aromatica*, *R. virens* and *R. microphylla*. The first four of these grow in the eastern and central portion of the State, the three last in the central and western part. In the east, *R. copalina* is the most abundant, where it and the first species are often associated, both having the common name of sumac and both being used for tannery. *Rhus glabra*, or the smooth sumac, abounds in swamps, and is poisonous to some people, to others it is harmless. *Rhus virens*, or the evergreen sumac, grows on limestone hills in the vicinity of Austin and westward to the Rio Grande. It is a short or small tree. *Rhus microphylla*, or the small leafed sumac, is common on some of the hills of San Saba county, from which it also extends westward to the Rio Grande. It is a large and much branched shrub. *R. aromatica* is a shrub growing in thickets on hills near Austin and westward to the Rio Grande.

Sumacs abound throughout the larger portion of the State, apparently so common as to seem to be sufficient to supply tannin for all the tanneries in the United States.

In my last report, page 106, a large tannery at Dallas is noticed. This tannery was reported by one of its proprietors, Mr. Dodge, to be making \$160,000 worth of leather annually, using largely for tanning purposes the Texas sumac, paying about \$20 per ton for its dried leaves and leaf stems. This company report the Texas sumac to be the cheapest, and to make leather equal to the best.

The following analysis of American sumac is taken from the report of the chemist of the Agricultural Department, at Washington, D. C., for 1869 :

## 1. SUMAC FROM GERARDSTOWN, WEST VIRGINIA.

Tannin .....	20.80
Vegetable fibre.....	79.20
	100.00

## 2. SAMPLE FROM GEORGETOWN, D. C.

Tannin ... ..	18.25
Vegetable fibre.....	81.75
	100.00

## 3. SAMPLE FROM FREDERICKSBURG, VA.

Tannin .....	23.50
Vegetable fibre.....	76.50
	100.00

4. TWO SAMPLES FROM R. T. KNOX & BROS., FREDERICKSBURG,  
VIRGINIA—AVERAGE OF BOTH.

Tannin .....	28.20
Vegetable fibre.....	71.80
	100.00

These sumacs are of the *R. copalina* and *typhina* species, which also grow abundantly in Texas.

These analyses show a great richness in tannin, although some of the samples were not of the first quality, yet they show that we can compete in the foreign markets with the best sumacs.

For the purpose of comparison, I give some analyses of European sumacs, as made by European chemists :

Sumac, first quality, tannin.....	16.50
Sumac, second quality, tannin.....	13.00

Gauhe gives us an average of six analyses of European sumac from the countries on the borders of the Mediterranean, 13 per cent. of tannin.

Fine samples of Palermo sumac yield from 22 to 24 per cent of tannin.

Sumac is also used for its coloring matter in dyeing and calico printing. It gives, with a mordant of tin, a yellow; with acetate of iron, a gray or black; and with sulphate of zinc, a brownish yellow. The bark of the smooth sumac (*R. glabra*) is used as a mordant for red.

The sumacs richest in tannic acid are said to be those which have small dark-green leaves; hence our small leaved western sumac (*R. microphylla*) must be richer in tannin than any other known American species, because its leaves are very small and also of a very dark green.

Of late years Virginia has had quite a large trade in sumac. It is now demonstrated and admitted by consumers in our own country and dealers in Europe, that American sumac, well prepared, is superior in tanning material to most of that in Europe. An importing house, having branches in New York, Philadelphia and Savannah, in a circular to the trade, dated Dec. 31st, 1869, states:

“We would call the attention of the trade, to a very fine Virginian sumac, now being received by us, equal in every respect to the finest Sicily. We recommend its use from the following comparison in the analyses:

Finest Sicilian marked with a lead seal. . . . .	Finest American from Virginia. . . . .
ne plus ultra.	
Tannin . . . . . 23.65	Tannin . . . . . 30.00
Sand . . . . . 1.00	Sand . . . . . .50
Vegetable fibre. . . . . 75.35	Vegetable fibre . . . . . 69.50
100.00	100.00

Alexander Macrae, a produce broker of Liverpool, England, in his Importers' and Exporters' Circular of January 10th, 1870, says:

A great revolution is about to be witnessed in this tanning and dyeing material. Supplies have commenced to arrive from Virginia, the quality of which is the best that has ever reached Great Britain. The official analysis (Huson), shows that the finest brand of Sicilian, the “ne plus ultra,” gives twenty-four and a half per cent of tannin, but the best samples of American (same analysis), yield thirty-one per cent. of tannin.

Yet tons of sumac are wasted annually in Texas, for want of gathering, drying and grinding.

The Dallas Tanning Company have paid \$110 per ton for Sicilian sumac. This was before they knew the value

of the Texas sumac. For tanning they use Gambier or Terra Japonica, and an extract of oak bark.

Gambier or Terra Japonica, is an astringent substance, sometimes called catechu. It is made by boiling and evaporating the brown hard wood of the acacia catechu, until the juice acquires a proper consistency when strained, and when cool, coagulates. Imported from the East Indies.

The importance and great value which would result to the State, if the hides which are annually exported were tanned in Texas, leads me to dwell on this subject, and append the following article on the tanning properties of the mesquite tree (*Algarobia glandulosa*), a genus belonging to the same family as the acacia. The wood of the mesquite has a resemblance to that of the acacia catechu, from which the Terra Japonica is made. The article is from the pen of the Rev. J. M. Wilson, who has during many years, been principal of high school at Seguin. It was originally published in the Texas Almanac.

#### *Mesquite a Superior Tanning Material.*

Besides the value of mesquite for various purposes indicated, it is destined to be a source of vast wealth to Texas and the world, *as one of the best known materials for tanning and manufacturing leather.* During the war, when we were shut out from the world and cut off from the sources of our supply of the necessaries and comforts of life, we found ourselves under the necessity of meeting these wants from our own resources. Leather was an urgent necessity. Dr. J. Park, then of Seguin, an intelligent gentleman of a scientific turn of mind, directed his attention to the examination of the materials for tanning to be found in Western Texas. He tested the various barks usually used, and found the black jack the richest in tannic acid, live oak the next, and post oak to have the least of the oaks. He then examined the mesquite, and found that the whole body of the wood was rich in tannin. He ascertained that the wood was fully equal to the bark of the black jack in quality and quantity—that it abounded in tannic acid. This was an unexpected and very important discovery. He made practical tests of it, and found it promptly acted in converting the hide into leather of a good quality. He improvised a chopping machine by which he reduced the wood and put it into a form to have

the tannin extracted by boiling, and established a tannery, and successfully carried it on for some time after the war. He was so fully satisfied of the value of the mesquite as a tanning material, that he took out a patent for his discovery. The points established by the experiments made with the mesquite are the following, viz :

1st. It is rich in tannin.

2d. It is cheap, and of inexhaustible abundance.

3d. By suitable machinery, it may be readily reduced into a form favorable for the extraction of the tannin by boiling or steaming.

4th. It is prompt and effective as a tanning agent in precipitating the gellatin of the hide and converting it into leather. It forms good leather in a shorter time than the tannin of the oak barks.

5th. The quality of the leather is superior.

6th. Its operation is such, from some peculiarity of the tannic acid it yields, that it prevents the decomposition of the hide, so that the tanning process may be successfully carried on during our hot season as well as during the winter.

The difficulty of tanning successfully in this climate during the hot months, with the ordinary tanning materials, is the liability of the hide to decompose or spoil in the centre before the tanning, which is a powerful anti-septic, can reach it so as to preserve it. With other materials the tanning process begins on the external surfaces of the hides, and gradually progresses toward the centre. Hence the liability of the hide to decompose in the middle and become spoiled before it is tanned. The operation of the tannin from the mesquite is different. When a hide is examined, by cutting it after it has been subjected for a sufficient time to the action of the mesquite ooze, it is found that the tannin has penetrated through and through it, and the tanning process has affected its centre as well as its surface. The whole body of the hide is thus preserved, so that there need be no loss from this cause, no matter how hot the weather is. Western Texas has in the mesquite an agent which will exert a very important influence on her future—a source of exhaustless wealth which will enable her to manufacture all her millions of hides into the best of leather—a material in sufficient quantity to manufacture leather for the whole country. Let tanneries, then, spring up. It is a business, properly conducted, highly

profitable. And boot and shoe and harness manufacturing should follow, saving in our own country the immense sums we are now paying to enrich other sections and impoverish our own State.

J. M. WILSON.

[The great importance of the valuable properties of the mesquite, as stated above by Dr. Wilson, induced us to ask him, if possible, to furnish us with some corroborative evidence in confirmation of his statements, and in reply, he kindly sent us the following letter, inclosing the one from Mr. Coopender.]

ADDITIONAL EVIDENCE OF THE SUPERIOR TANNING PROPERTIES OF THE MESQUITE.

NEAR SEGUIN, July 20, 1869.

*W. Richardson, Esq.*—*Dear Sir*—Yours of the 2d inst. came to hand during my absence, or I would have answered sooner.

In your letter, after a favorable notice of my article on the mesquite, you mention: "But when you say the *wood* itself is superior to the best oak bark, and that it (the tannic acid) penetrates to the middle of the thickest hides simultaneously with its effect on the surface, I fear the assertion may challenge incredulity with many scientific readers." The statement, I confess, in both its parts, seems extraordinary, and if true, it invests the mesquite with great value and interest as a tanning material. The experiments made with the mesquite were confined to Dr. Park, who discovered it. He established a tannery, and conducted it successfully until the close of the war. It then passed into the hands of Mr. R. Coopender, near Seguin, who carried it on for some time, but was finally compelled, by the difficulty of getting skilled labor, to abandon it. The proof, then, is confined pretty much to the developments of this single tannery, conducted first by Dr. Park and then by Mr. Coopender. I am sorry I am unable to give a statement from Dr. Park himself; it would be interesting and satisfactory. He is now living somewhere in Tennessee. I was with him a good deal while he was making his experiments, and we discussed freely the scientific principles involved, and I am well acquainted with the facts and results. He always stated to

me that even with his imperfect mode of extracting the tannin—the chips being coarse and his boiling apparatus imperfect—he found the mesquite wood equal to the best black jack bark, and superior to all others. When properly comminuted and extracted, the yield would be larger than from the best bark. The sap of the mesquite, on exposure to the air, becomes tannic acid. In splitting the wood, frequently the tannin or tannic acid, will be met with in circular crystals occupying small cavities in the body of the timber. From experiments made by Dr. Park in making an extract from the mesquite, he was satisfied that the richness of the wood in tannin was such that, with proper appliances, it would be a profitable business to make catechu from it. The catechu of commerce is made from a tree of the same family with the mesquite, the acacia catechu of India.

With regard to the action of the mesquite tannin in striking through and through the hide, instead of beginning on the external surfaces and gradually carrying the tanning process into the interior, I learn that it is a process which marks some other tanning materials. In a conversation with Dr. Lyon, of San Antonio, an intelligent gentleman who is engaged successfully in the tanning business in a small way, he told me that the bean used in Mexico for tanning, the name of which I have forgotten, and also some other article—perhaps catechu—operated in the same way. It is a highly important quality of a tanning material in the southern country, as it pervades the whole body of the hide with its antiseptic virtue and prevents decomposition. The experiments made during the war in tanning with the barks of the country during hot weather were attended with great loss from the hides spoiling in the middle before the tannin reached it. In cutting the hide, the external surfaces are affected by the tannin, but the middle was decomposed, and the hide would split open. Dr. Park, to show me the manner of the action of the tannin of the mesquite, cut into the hide, and the section revealed plainly that the process had passed entirely through, affecting the centre as well as the surface. It is not to be understood that the whole body of the hide was perfectly tanned, but that colored fibrous lines developed in a few days passed from surface to surface, showing that the whole body of the hide was penetrated by the agent, and secured it against all danger of decomposition. Dr. Park lost no hides after



adopting the mesquite, and was satisfied that, with ordinary care and skill, all danger of failure from that source was removed, even in the hottest weather. All the facts revealed respecting the tanning properties of the mesquite convince my mind fully of its excellence—of its special adaptiveness to our climate, and that it offers exhaustless resources for the manufacture of all our hides into leather, and indeed, all the hides of the United States. Farther, I think it will be found that our country, with this material, has advantages over the north in the manufacture of leather, as far, and perhaps in a greater degree, than it has in the manufacture of cotton and woolen goods. The warm temperature of the climate the year round will hasten the perfecting of the chemical process of making leather, while our climate is also equally in our favor in cotton and woolen manufacture; but the cheapness and abundance of the raw material gives us advantages that must make these manufactures more profitable here than they can be where the raw material has to be imported at great expense. All we want is capital and skilled labor, and these cannot much longer be kept from our country when they can be so profitably employed.

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LETTER FROM MR. COORPENDER.

RIVER SIDE, NEAR SEGUIN, July 20th, 1868.

*W. Richardson, Esq.*—*Dear Sir*—The Rev. Mr. Wilson read me his reply to your communication calling for additional statements and explanations by way of corroboration of his description of the mesquite as a tanning material. I am happy to be able to state that my experience in the use of the mesquite as a tanning agent confirms in the fullest degree all that Mr. Wilson has written as to its qualities and even more

I will remark that I was connected as a partner with Dr. Park for two years in the tannery. When he left, I carried it on myself for a year, and only abandoned it from the difficulty of procuring skilled labor to carry it on. I will give, under different heads, my views of the mesquite, derived from experience and observation.

1st. As to its richness in tannic acid, according to actual test, it is richer than the best of bark. When

properly comminuted, and the tan well extracted, its amount is enormous. The whole body of the tree, limbs, twigs and all, are used.

2d. The tannin is different in its qualities and its energy as a tanning and antiseptic agent from other tanning materials. Its mode of operating is different from most others. Instead of being confined to the surfaces, it strikes through and through the hide very promptly. In less than five minutes, a thick hide will show that it has been pervaded by its influence. A simple fact will illustrate its peculiarity in this respect. A negro man who was a practical tanner was asked by Dr. Park, while at work with his material in tanning, how he liked it. "Why," says he, "massa, it differs from anything I ever saw. Other things tan as they go, but this strikes right through the hide." This peculiarity was manifest to the negro, and struck him with force. When I stopped operations, I had a few hides on hand. They were about half tanned, and have lain in a very weak ooze for eighteen months without any addition of tan. They are as sound now as the day they were put in. There is no difficulty at all in tanning hides during the hot months. The preserving property of the article is so strong there is no danger of decomposition. Neither Dr. Park nor myself ever lost any hides, although worked in during the hottest months, while others using bark lost largely.

3d. With regard to the quality of the leather, I regard it as decidedly better than that made from the usual materials. Workmen in leather pronounce it superior. It is remarkably firm and durable, outlasting northern leather. This fact is so generally understood, that I could sell any amount of it if I had it on hand.

4th. Another peculiarity of mesquite ooze is, that no matter how strong it is when the hide is put in, it never burns the leather or causes the grain to crack. Other strong oozes would ruin the leather. We employed an old tanner, who was raised in a tan-yard, and had worked for thirty-five years at the business; he was greatly delighted with the material, and looked upon it as being the best he ever knew.

The foregoing statement of facts I feel fully authorized to make, from my own observation and experience. I do not feel that they give anything more than a truthful view of the merits of the mesquite. I am fully satisfied it

offers to Texas an inexhaustible source of wealth; and it should be a source of large profit to Dr. Park, who has brought it out to a knowledge of the public, and has placed it before the country.

Yours respectfully,

R. J. COORPENDER.

This and my communication were read to General J. R. Jefferson, of Seguin, an intelligent and practical gentleman. He brought the mesquite to the notice of Dr. Park. He fully sustains the representations made of the mesquite as a tanning agent. He has used and is now using the leather made from it, and regards it the strongest and most durable he ever saw.

J. M. WILSON.

Texas has more than fourteen species of oak, all of which have more or less tannin. Experiment shows that oak bark cut in the spring has more tannin by four and a half times than when cut in the winter. It is also more abundant in young than in old trees.

When at Isleta; in El Paso county, Mr. Blanchard of that place showed me a plant used by the Mexicans for tanning. It flowers in early spring, and I did not see its flowers or fruit, but judging from its leaves and roots, it is a species of *Rumex*; some of which are called "dock." *Polygonum amphibium*, which belongs to the same family of plants, has lately been used for tanning in some of the Western States. This plant abounds in wet places in eastern and northern Texas.

#### FRUITS AT THE WEST.

The grape noticed elsewhere is the chief fruit in the valley of the upper Rio Grande. At El Paso, and down the valley to Elcearia, pears, apples, plums, apricots and peaches are also grown; all being in common cultivation.

I never saw such large pear trees as grow there, in any other county. At Elcearia, are several, some of which I measured, which have a circumference of from 8 to upwards of 9 feet at 3 feet from the ground. Such trees are on the grounds of Mr. Ellis, in the town. Mr. Ellis also has a large vineyard, also apple trees and other fruits. One apple tree which he says is an excellent winter fruit, keeping in good condition, through winter even until July. There I saw strawberries, raspberries, blackberries and

even currants and gooseberries, but these two last do not do well.

Elcearia has a few acres of various kinds of fruit around many of its dwellings

There Col. Jno. M. Moore, measured a pear tree, which is called by him the Caroline pear tree, in honor of a little daughter of its proprietor, whose name I have forgotten.

The tree has a circumference of ten feet at the height of six feet from the ground, a spread of limb of more than sixty feet and estimated height of about fifty feet. It is pyramidal in shape.

All things considered, this valley seems to be one of the best fruit regions in the State.

#### TREES AND PLANTS.

The "Siempre vivre," of the Mexicans, or the "Resurrection plant" of the florists (*Selaginella lepidophylla*), grows on limestones, at or near the tops of hills and mountains, from the Pecos river, near old Fort Lancaster, westward to the Rio Grande.

It has the remarkable property of reviving when placed in water or in a moist soil, after having been dry and apparently dead for months or years.

Some of the western grasses are almost equally tenacious of life: during drouths they are dry, withered and apparently dead, losing their green color; but when rains come and thoroughly wet the ground, these same grasses become green and begin to grow again, imparting additional beauty to the landscape, and afford nutritious food for herbivorous animals.

The buffalo grass (*Buchloa sesleroides*), is a well known example.

There is a plant which is a native of Palestine and Arabia, which also will recover its original form, however dry it may be, on being immersed in water. It is called the rose of Sharon, or rose of Jerico. Its botanical name is *Anastatica*, of the natural order crucifera. The following somewhat exaggerated notice of it appeared in a late publication:

The rose of Sharon is one of the most exquisite flowers in shape and hue. Its blossoms are bell-shaped, of many mingled hues and dyes, and its history of legendry are romantic in the highest degree. In the east, throughout

Syria, India and Arabia, it is regarded with the profoundest reverence. The leaves that encircle the round blossom, dry and close tight when the season of blossom is over, and the stock withering completely away from the stem, the flower is blown away at last from the bush on which it grew, having dried up in the shape of a ball, which is carried by the sport of the breezes to great distances. In this way, it is borne over sandy wastes and deserts, until at last, reaching some moist place, it clings to the soil, where it immediately takes fresh root and springs to life and beauty again. For this very reason, the orientals have adopted it as the emblem of the resurrection. The dried flower is placed by the Judeans in a vase of water beside the beds of the sick, and if it expands by moisture, the omen is considered to be favorable. If it does not, the worst at all times is feared.

#### FORSYTHIA SPLENDENS.

This is a large shrub, having a cactus-like appearance, and is by many supposed to be a cactus. It grows on table lands and mountain tops, on limestone rocks or in limestone soils. It is a prominent feature, and gives a singular appearance to many a landscape between the Pecos and Rio Grande. It grows to the height of from ten to fifteen feet, sending out numerous and nearly straight branches from the top of its stem or bole, which is only about six inches long above the surface of the ground. These branches are generally unbranched, having dense clusters of deep green leaves placed at short intervals along the stem. At the bases of the leaves is one and sometimes two spines about half an inch long. Its flowers are trumpet shaped, of a red and scarlet hue, in quite dense clusters at the ends of the branches. The branches ascend at various angles, diverging and forming an open top.

Mr. Spencer, who lives on the Rio Grande, about twelve miles above Presidio del Norte, in Presidio county, has a door yard fence, made picket fashion, from the limbs of the Forsythia, which is called "ocotea" by the Mexicans. He intends to make a hedge of the ocotea by planting it a few feet apart and train its limbs into the line of the fence. These limbs are when grown, two or three or more inches in diameter and sufficiently strong to turn cattle. The ocotea grows vigorously.

## STROMBOCARPUS,

Called "screw bean," and by the Mexicans *tornilla* or *tornea*, is common in the valley of the Rio Grande from Presidio to El Paso, extending upward into New Mexico. It grows in clumps, having stems three to six inches in diameter and a height of from ten to fifteen feet, numerous branches and many thorns of a grayish-white color and about one and a half inches long; has acacia-like flowers, colored yellow, and dense clusters of pods twisted like the threads of a screw; hence its scientific and common name. It has finely pinnate leaves. I have sent seeds of it to several nurserymen, who wish to introduce it into cultivation.

There is a pine growing in the mountains of Presidio and El Paso counties which is probably the *Pinus cembroides* of Mexico. On the headwaters of the Limpia, fourteen to twenty miles from Fort Davis, are several hundred acres of it, valuable for its timber. It has a height of about fifty feet and a diameter of from twelve to eighteen inches. East of El Paso about fifty miles, there is a large pinery, extending (so said), several hundred miles. Its trees are often two or more feet in diameter.

At El Paso, furniture made of it is quite largely used. When grained, it has a fine finish of a light yellow and brown shade.

## MESQUITE (ALGAROBIA),

We found westward along nearly our entire route to the Rio Grande. West of Fort Concho it becomes dwarfed into a shrub of very large roots. At Fort Stockton and other places, its roots are used for fuel, for which they answer an excellent purpose. They are dug up by the Mexicans and sold at a moderate price, the large roots or underground stems being near the surface.

In central Texas and southward beyond San Antonio the mesquite sometimes has a diameter of two or more feet. Its wood is very durable, makes good fuel and has large tanning properties. A decoction of its roots is said to be a good remedy for bowel complaints.

It exudes a gum during the dry summer time, which much resembles the gum acacia.

In going westward from the headwaters of the Concho, at Centralia, we found no trees to the Pecos, and none in

the Pecos valley near the bridge at the El Paso stage crossing, but shrubs of the mesquite (*Algarobia*) and several species of *Acacia* were quite common. Beyond the Pecos, on the Fort Stockton road, at and near Escondido springs, we again found small trees of the Texas china tree (*Sapindus*) and *Chilopsis lineata*, the last of which is cultivated at Austin.

At Fort Stockton there is but one tree more than six inches in diameter. This is a cottonwood (*Populus*) of a diameter of about eighteen inches, and height of fifty feet. This is at the Government gardens. This will not long be so, for many cottonwoods have been planted, and these are rapid growers.

At Fort Davis, we found wood selling at about seventy-five cents a "burro" load. These are large packages tied on the back of a jack or burro, in charge of a Mexican.

About twelve miles beyond Fort Davis, westward, is Skillman's Grove, a beautiful valley amid fine mountain scenery, shaded with large spreading live oaks and an undetermined species of oak. Beyond the Barrel spring, westward, to Muerto, no trees are seen; but shrubs are not rare until within three or four miles of the stage stand, and beyond this for several miles there are no shrubs. Not knowing this, we had to go supperless one night at the Muerto springs, and go nine miles westward next morning to breakfast, because we had no wood or fuel.

Westward we saw but a very few small trees along the road, until we came to the Rio Grande, where we were cheered with the sight of trees again. Shrubs abound along the route, giving a sufficiency of fuel to travelers for cooking purposes. This is only near the El Paso stage road from Fort Davis. Amid the mountains, on either side, oaks, cedars and pines abound. These I saw in the vicinity of Eagle springs, at Van Horn's well, and also at the Muerto, showing that there is a sufficiency of fuel for the domestic use of a large agricultural population—stock-growers chiefly, for this is eminently a stock-growing country.

Cottonwoods and willows are the principal trees in the valley of the Rio Grande. These trees along the ditches or seches used for irrigation, add beauty to the landscape.

## EUCALYPTUS GLOBOSUS.

This Australian tree has been planted quite extensively at the South, including Texas. It will not endure more cold than the orange; hence it will not thrive in the open air in the interior of the State. In its native land it has a moist and warm climate.

China tree (*Melia azederach*) is very hardy throughout the State. It grows rapidly, and will thrive in almost every variety of soil. Its wood is durable, making good fence posts. A writer in one of the cotton States east of the Mississippi river has lately recommended the china tree for hedges, saying that live fences of it can be made with one-fifth the expense that would be required for any other fence. There is no doubt but that live fence posts can be had in from three to five years by sowing the seed in a drill where the fence is wanted. In Texas it will be necessary to protect the young plants from cattle.

## TREE PLANTING

Ought to be encouraged throughout a large portion of the western part of the State. Much has been written during the last few years of the effect of trees on the rain fall, some saying they increase it, others that they do not. Experiments to test the question, lately made in France, seem to show that trees do really increase the rain fall. If the leaves of trees attract and diffuse moisture, so also do the leaves of growing plants, cotton, corn, etc. In central and western Texas, there has been a large addition to the cultivated area during the last fifteen years, and so also has there been an increase in the rain fall.

## EFFECTS OF FORESTS ON HEALTH.

It seems to be generally known by scientific observers, that forests or even a few trees are beneficial by checking miasmatic vapors. In certain localities in Europe, especially Italy, screens of trees have protected the inhabitants from fevers, which were prevalent near marshes on the other side of them. Certain commissioners in Tuscany advised the planting of rows of white poplars to intercept the currents of air from malarious districts. Large plantations have been planted in the alluvial soils



in Italy, with favorable results in preventing the spread of noxious exhalations from the marshes. The healthful influence of the piney woods of the States bordering on the Gulf of Mexico has long been known; hence, many owners of plantations on the alluvial soils of rivers and streams have their homes in pine woods, sometimes two or three miles distant from their farms. Lieutenant Maury believed that a few rows of sunflowers planted between the Observatory at Washington and the Potomac marshes, had saved the inmates of the Observatory from the intermittent fevers to which they had been liable.

The uniform temperature and humidity of forests, except in tropical climates, are considered to be favorable to health.

Fifteen years ago I went from Austin by way of San Antonio to Corpus Christi, and returned by a different route passing over much prairie land. Again last spring (1875), I passed over a large portion of the same country, and was surprised to find many of the prairies of 1860, thickly overgrown with a large growth of mesquite trees. These trees may be and probably are one cause of the increased rain fall of that region.

#### GRASSES.

Both central and western Texas are peculiarly rich in nutritious native grasses, good for both hay and pasturage. A small mesquite grass, which is common in central Texas, extends westward to the Pecos, beyond which I only saw it in one place in the Escondedo valley, on the Fort Stockton road. It is the *Buchloa* of botanists, and the buffalo grass of the western plains outside of Texas. It is about six inches high, forms a dense turf, often has stolons or runners one to two feet long, by which it is mostly propagated, its seeds being few and on different plants from those having the male flower.

West of the Pecos there are two or more species of "grama" grass (*Chondrosium*), valuable for their hay and pasturage; a large species (*Chondrosium foenum*), having height of from two to three feet makes an excellent hay, being said to be almost as good fodder as oats. It is common in Presidio and El Paso counties. Another species of grama grows in tufts about twelve inches high, on the gravelly uplands of the Rio Grande valley. This is also useful

for fodder and pasturage. Besides, there are twenty or more species of grass between the Pecos and Rio Grande, clothing the valleys and many of the mountains with green, specimens of which we collected for the State collection, which now has more than one hundred species which are natives of the State.

Higher rents are received for the grass lands of Liecestershire, in England, than for other lands cultivated for grain or vegetables in that region. Even in Texas, in the vicinity of Austin, as high as from forty to fifty dollars per acre have been received from lands in one year, on which the Colorado grass (*Panicum Texanum*) was grown. Hay from this same grass is worth at Austin (March, 1876) twenty-five dollars per ton. There are millions upon millions of acres of fine grass lands in Western Texas now lying idle, giving no profit to man. Here is undeveloped wealth, not subject to the uncertainties of mining and many other occupations.

Last summer, in some of the valleys of Presidio and El Paso counties, the grass was more than six feet high, but only in small patches of one species.

#### LUCERNE OR ALFALFA, (*Medicago Sativa*.)

There is another species of *Medicago*, the *lupulina*, which is also sometimes called lucerne. It has yellow flowers. The alfalfa (*M. sativa*) is more extensively cultivated in Europe and America. It was introduced by the Spaniards into Mexico many years ago, and is now largely cultivated in California. Its top roots going down from two to three or more feet render it well adapted to endure drouth. It yields largely of forage, and makes a very good hay. It should not be pastured close, because it is liable to be destroyed by stock biting off the top of its roots. It is cultivated to some extent in El Paso county.

#### WILD ANIMALS.—BUFFALO.

In the winter thousands of them pasture in the upper valleys of the Concho, in Tom Green county, coming as low down as the Twin mountains. This is the farthest south of their range in Texas. They do not go west of the Pecos, which may partly be owing to the steep banks and swift, deep waters of that stream.

## DEER

Are not as numerous as they were fifteen years ago, when large herds of them were quite common on the prairies and in the open woodlands. It is said that a disease, called the black tongue, has killed large numbers of them.

## ANTELOPE,

Which were formerly quite scarce, are now quite common (much more so than deer) in the unsettled and thinly inhabited regions of the north and northwest.

## BEAVER.

We saw a beaver dam on the Concho, in Tom Green county.

CIVIL CAT OR CAT SQUIRREL (*Bassaris astuta*)

Are quite common in Llano and the adjoining counties, where they are sometimes tamed for pets.

## WOLVES

Are few and far less numerous than formerly, thousands of them having been killed with strychnine, etc., stock men having waged war upon them on account of their depredations upon young cattle and sheep.

## PRAIRIE DOGS

Are extending their boundaries and increasing in numbers. Fifteen years ago we saw them only a few miles south of Camp Colorado; now their towns are in the northern part of San Saba county.

## RACCOONS

And Opossums are common.

## SKUNK.

Of these there are two species. The common northern one and the little striped one (*mephitis bicolor*).

## BEARS, PANTHERS,

American tigers and wild-cats are occasionally met in the unsettled regions.

Flying squirrels and several other species are also here.

Jack rabbits are less numerous than formerly, and so are also two smaller species, once very common on the prairies and elsewhere.

I have thus glanced hastily at a few of the prominent animals of the State, without attempting to group them into families or give their scientific names.

GAME AND OTHER BIRDS OF TEXAS—PRAIRIE HEN, PINNATED GROUSE (*Cupidonic Cupido*).

In some of the northern counties (Clay, Wichita, etc.,) the prairie hen abounds. There we saw large numbers of them in the autumn of 1874. Last summer, did not see any on our route to El Paso and back to Austin.

QUAIL, PARTRIDGE.

Of these there are five species known in Texas. Bob White, *Ortyx Virginianus*, is quite common in nearly every part of the State. Last summer, in going from Fort Quitman down the Rio Grande to the Hot springs, I heard his well known call.

Another species, *Ortyx Texanus*, much resembles Bob White, and is common in southwestern Texas and in the southern valley of the Rio Grande, and northward to the Pecos. It is so like Bob White that it is often supposed to be him.

Gambel's partridge, *Lophortyx Gambelii*, is occasionally seen on the upper Rio Grande, in the neighborhood of El Paso.

Blue partridge, *Callipepla Squamata*, breeds in the lower valley of the Rio Grande, and northward to Presidio county.

Massena partridge, *Cyrtonyx Massena*, is occasionally seen on the hills of Travis county, and extends northward to the Rio Grande in El Paso county. Common on the Pecos and westward.

WILD GEESE—CANADA GOOSE, (*Bernicla Canadensis*).

Large flocks of wild geese spend their winters in Texas.

#### DUCKS

Of various species are numerous in a large portion of the State in the winter time. Some species breed and remain through the summer in the unsettled regions.

WOODCOCK (*Scophax Minor*),

Is sometimes seen in the wooded region of eastern and central Texas, but it is not abundant.

#### PLOVER.

At least one (perhaps more) species of plover stay in Texas throughout the year. These birds are very common on prairies and in fields in the winter time, and in summer in the vicinity of water. There is no doubt but that there are several species here during winter.

WHITE CRANE—WHOOPIING CRANE, (*Grus Americanus*).

These are our largest birds; at least they are the tallest; when full grown and erect, five feet high, and weighing about fifteen pounds. In the southern part of the State, I have seen them in Matagorda county.

SAND-HILL CRANE (*Grus Canadensis*),

Is common in small flocks on the prairies in the winter. A white heron and a brown heron both breed and stay in the State during summer.

#### WILD TURKEYS.

Was disappointed in not seeing wild turkeys between the Pecos and Rio Grande.

On our return we saw a few in the valley of Devil's river, but failed to secure any. In the Wichita region, in the northern part of the State, they are very numerous, from

whence they live, and are more or less common southward to the Gulf of Mexico.

Below is a notice of a few other birds.

#### CROWS

Stay and breed here, but I have not seen them west of Llano and Mason counties.

#### RAVENS

Come eastward as far as the mountains of Llano and Mason, and dwell westward and northwestward to the Rio Grande and El Paso. Last summer we often saw them at our camp to get the crumbs as soon as we left to go onward.

At Austin we are cheered, both summer and winter, by the songs of two of the best native songsters in the United States, the mocking bird and cardinal bird, both of whom delight to dwell here. The mocking bird goes westward and southwestward into Mexico. I do not remember to have seen any cardinal birds west of the Pecos.

#### BARN SWALLOWS.

Adobe houses, with their wooden supports for cement and clay roofs, form comfortable and convenient places for the nests of these birds, and large numbers of them nestle there, they being so cheerful and good natured that they are seldom if ever molested.

Cliff swallows build their nests and live in communities on and under the high precipitous rocks of rivers and streams. They are noisy and active, full of life and fun.

#### MANUFACTURES.

Although strictly speaking they do not belong to the geological and agricultural department, yet they have such an intimate connexion with it, and are so essential to the mining and agricultural prosperity of the State, that a brief summary of the advantages which Texas has for manufacturers seems to be very appropriate.

## FIRST TANNERIES.

Texas has hides, a great abundance of tanning material, as has been shown elsewhere, and a home market. Now she exports hides, and imports leather, boots, shoes, harness, etc.

## IRON.

Of iron ores Texas has an inexhaustible supply in its eastern, central, western and northwestern parts; ores as good as those of any country, and superior to many ores which are smelted and manufactured in other States and countries. She also has an abundance of suitable materials for the manufacture of iron, coal, wood, etc., and a home market for railroad iron and iron wares of every description, because she now imports largely of these things.

## AGRICULTURAL IMPLEMENTS.

For the manufacture of these, eastern and some parts of western Texas have great advantages. In the eastern part of the State excellent timber for these purposes abounds; ash, oak and pine. On Little river, in Milam county, and also in some places on the Colorado, below Austin, large trees of the "bastard white oak," (*quercus durandii*).

The wood of this oak is tougher and better than that of the common white oak.

## WOOLEN FACTORIES.

The trial of these at the South has proved successful. There are a few in operation in the State. One which we visited at New Braunfels, last fall, is said to do a large and profitable business. The advantages for the manufacture of woollen goods in Texas are like, in many respects, to those for cotton.

## COTTON FACTORIES.

Cotton factories have proved to be profitable at the South, many factories giving from twenty to thirty or more per cent. profit on the investment.

Great Britain buys nearly three-fourths of the entire cotton crop of the South, and is said to make more profit

from its manufacture than is realized by the South from its sale.

England paid the United States last year for cotton \$180,000,000, and by making it up into fabrics, she added \$188,000,000 of value to it as a profit—more than double her money.

True, England has superior machinery and cheap and skilled labor, but Texas has other advantages which may be made to overbalance these. She can import the best of machinery suitable for making the best and finest goods, and also import laborers to run the works; and to make these laborers efficient, they should have a share in the business in order to make them interested in its success. The advantages which Texas has over Old England and New England are, a superior climate. Here it will cost less to heat the factory buildings; here living is cheaper; fuel is also cheaper, both wood and coal; the brown coals or lignites of Bastrop, Robertson and other counties, being good to run the engines of the factories, as has been tested at Bastrop. The buying the cotton from the farmer would save the profits—and they are not small—which are now realized by middlemen. Transportation would be saved. The best of water power abounds in nearly every part of the State. The proprietors and operatives of factories will buy a large portion of their food from the farmer, and thus give him a home market, not only for his cotton, but also for his surplus grain, meat and vegetables. With such advantages, Texas can manufacture cotton cheaper than either New England or Old England, and she may have as much or more profit from its manufacture than she now receives from the growth of the staple. Texas can be made one of the most independent and pleasant countries in the world, with her delightful climate, varied scenery, fertile soil, and advantages for manufactures.



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