UNIVERSITY OF TEXAS

BULLETIN No. 4.

Contributions from the Chemical Laboratory.

EDGAR EVERHART,

PROFESSOR IN CHARGE.

PETROLEUM OF TEXAS.

For many years it has been known that there were various localities in the State where an oily substance exuded from the ground. These places were generally denominated "tar springs." Mention is frequently made of these springs in the various histories of Texas. Ex-Gov. Roberts, in his "Description of Texas," states that on the Gulf coast not far from Sabine Pass so much of this tarry matter issues from the ground that during storms the water of the Gulf is frequently calmed by the floating oil.

The tar spring near San Augustine has long been known, and utilized to some extent for various purposes, principally as a lubricant.

Near Burnet there are several places where this tarry substance issues from the ground, forming at times considerable springs. One of these places is situated near the top of a high hill overlooking the town, while in the valley below on the banks of a small creek there are also several springs.

Near Palestine there are said to be strong indications of petroleum, but nothing definite regarding them has been heard here.

In the vicinity of Austin, near Walnut Creek, prospecting for oil is going on, probably with some hopes of success. About one and a half miles north of Austin, a gentleman, in sinking a well, at a depth of fifty feet struck water which is strongly impregnated with petroleum. The water is unfit for drinking purposes. A sample of the water was examined in the laboratory, and an oil was found in small

quantities which resembles the crude oil of Pennsylvania. These are probably only a small fraction of the number of places in the State where petroleum may be found. No doubt when the geological survey of the State is made the coal oil area will be accurately determined and mapped out. Now only isolated localities are known where the oil may be found.

Although the existence of these "tar springs" has long been known, as I have stated above, still no effort has been made to develop the springs until about one year ago. In the early part of last year a company in Nacogdoches was formed to develop the petroleum deposits that were known to exist near that place. The springs are situated about thirteen miles from the town of Nacogdoches. Efforts have been made to learn something of the geological formations of the locality about the springs, but without success. The only thing in that connection that could be ascertained was with regard to the nature of the ground through which the wells were sunk. In driving the wells sand was encountered almost entirely. At some stages of sinking them the borers were troubled with quicksand, but not to a very great extent. In the deepest well, which goes to a depth of 360 feet, very hard rock was met with. The character of the rock is unknown to me. Probably the petroleum exists in the Tertiary formation.

Since beginning the work the company have sunk eight wells, which vary in depth from ninety to one hundred and twenty feet, except in one instance where a depth of 360 feet has been attained. Owing to a want of facilities for handling and storing the oil, only two of the wells are at present in operation, the rest being securely capped. The daily yield of these two wells is, as I am informed, 250 barrels each.

The wells that have been sunk will flow to some extent, but in order to increase the yield pumping has been resorted

to. To increase their facilities for handling and storing the oil, a pipe line is now in process of being laid from the wells to the town of Nacogdoches. When this is completed the daily yield will probably be largely increased.

With regard to the value of the oil obtained from the Nacogdoches oil field, it is interesting to know that it sells in the town for thirty cents a gallon wholesale. Such a price as this renders it much more valuable than the crude oil of any of the Northern oil fields. Crude oil is now selling in New York for less than seven cents per gallon.

The Texas oil is not adapted to the production of illuminating oil—its value consists in its use as a lubricant. There is probably no better lubricating material manufactured than this crude oil as it is pumped from the well.

In order to investigate some of the properties of this oil a quantity was obtained from Nacogdoches and submitted to various tests in the University laboratory. The work was assigned to Mr. P. H. Fitzhugh, who conducted the tests under my direction.

The oil has a brownish red color. The odor is peculiar, but not so offensive as the crude petroleum of Pennsylvania. At ordinary temperature the oil is mobile, but not so much so as ordinary petroleum. Submitted to an extreme cold the oil still retains its liquidity, but naturally becomes less mobile. The temperature of the oil was reduced to less than zero (Fahrenheit) without its losing its flowing qualities. At no temperature attainable in the laboratory by artificial means could any solid paraffine be separated.

The oil does not gum on exposure to the air.

Mr. Fitzhugh subjected about four pounds of the oil to distillation over the naked flame, in a retort connected with proper condensers. The temperature was carried up to 680° Fahrenheit. At intervals of 45° Fahr. each distillate was removed and its weight determined. The results of the distillation were as follows:

1.	Below 300° Fahr.	the	distillate	amounted to	0.04 per cent.
2.	300°—345°	"	"	"	0.37 per cent.
3.	345°—390°	"	"	"	1.38 per cent.
4.	390°—435°	"	"	"	2.09 per cent.
5.	435°—480°	"	"	"	3.14 per cent.
6.	480°—525°	"	"	"	6.25 per cent.
7.	525°—615°	"	"	"	7.07 per cent.
8.	615°—680°	"	"	"	5.63 per cent.
Remaining in the retort					74.03 per cent.

A consideration of the above figures shows in the first place that the crude petroleum of Nacogdoches is practically free from naphtha. Naphtha distils off below 250° Fahr. Four pounds of this oil carried to a temperature fifty degrees higher yielded only a few drops of a light oil, amounting to but 0.04 per cent of the total amount taken. In the Pennsylvania crude petroleum the illuminating oil comes off between 250° and 500° Fahr., and it on an average amounts to about 55 per cent. The Nacogdoches petroleum between the same degrees of temperature yields only a little over 7 per cent.

Three-fourths of the oil does not boil until a temperature above the boiling point of mercury is reached. To give some idea of this temperature it may be said that if such metals as lead, or bismuth, or tin be thrown into the oil they will instantly melt.

Above 400° Fahr., and even lower, the distillate is not pure white, but is somewhat colored. This color deepens on exposure to the atmosphere. The distillates exhibit a beautiful fluorescence. Attempts were made to render the distillates colorless by refining them with oil of vitriol, etc., as is done with the ordinary petroleum, but the results obtained were not satisfactory.

Some of the crude oil was subjected to distillation until but a small residue was left in the retort. This residue had the consistency of thick pitch, and was of a black color. As the temperature increases during the distillation the

distillate becomes more and more colored. All attempts to separate paraffine, whether from the crude petroleum, the various distillates, or the residue in the retorts, were fruitless.

The density of the petroleum at 62.6° Fahr., is 0.9179 compared with water as unity. The density of the Pennsylvania petroleums is usually about 0.794—0.840.

From the books and journals at my command nothing can be found of an oil at all comparable with this of Texas. It is likely, however, that it resembles the oil obtained from the so-called shallow wells which sometimes overlie the ordinary crude petroleum.

One of the remarkable properties of the Nacogdoches petroleum is its great coefficient of expansion. On heating the oil in a retort the contents expand to such a degree that it is necessary to only partially fill the vessel, since otherwise it will overflow. The coefficient of cubical expansion as determined by Mr. Fitzhugh is 0.02568.

Although the oil is not fit for the making of illuminating oil, it is extremely valuable as a lubricant. Its weight, its high boiling point, its non-solidification by cold, and its property of not gumming, make it a splendid lubricating material. The practical tests that have been applied to it confirm this opinion.

KAOLIN.

This valuable mineral is found in several different parts of the State. In some localities the quality is not sufficiently good for the manufacture of the finest grades of porcelain ware, but in at least three or four places large beds of kaolin are found which are not surpassed, if indeed equaled, by any like deposits in the world. So far as can be judged from samples brought to this laboratory for analysis, it would appear that the central and eastern portions of the State yield kaolins that are of medium quality only, while

in the western portion the finest grades are found. With the present cost of fuel and the great difficulty of securing skilled workmen it would perhaps be unprofitable to manufacture this fine clay here in Texas, but the wonderful quality of the kaolin will more than justify its shipment to Europe or to New Jersey. Even with the present freight rates, a deposit of kaolin, such as is found in Edwards County, would be more profitable than an ordinary gold or silver mine.

The following kaolins were obtained from the central part of the State. They are of medium quality. Their composition as determined by analysis is:

	A	B	C
Water	5.45 per cent	3.20 per cent	2.69 per cent
Alumina	13.83 per cent	13.46 per cent	12.71 per cent
Oxide of iron	2.70 per cent	2.01 per cent	3.60 per cent
Silica	68.25 per cent	72.31 per cent	72.56 per cent
Lime	1.23 per cent	0.82 per cent	1.00 per cent
Magnesia	0.47 per cent	0.30 per cent	0.10 per cent
Potash	3.52 per cent	3.07 per cent	3.44 per cent
Soda	3.96 per cent	4.07 per cent	2.62 per cent
Sulphuric acid	0.30 per cent	0.35 per cent	0.10 per cent
Oxide of manganese	.....	.....	1.00 per cent
	99.71 per cent	99.59 per cent	100.02 per cent

The two kaolins whose analysis are given below are very fine. They are pure white in color, somewhat greasy to the touch, and are infusible in the hottest blowpipe flame. Being practically free from iron they are adapted to the making of the best grades of china. They are free from grit and every other objectionable impurity.

One of the deposits at least is said to be of great extent.

KAOLIN FROM NUECES CANYON.

Water	4.53 per cent
Alumina	33.66 per cent
Silica	46.60 per cent
Lime	0.43 per cent
Magnesia	0.96 per cent
Soda	1.65 per cent

KAOLIN FROM EDWARDS COUNTY.

Water	6.05 per cent
Alumina	43.17 per cent
Silica	48.41 per cent
Lime	0.38 per cent
Magnesia	0.10 per cent
Alkalies	1.78 per cent

The industrial uses of kaolin are not limited to the manufacture of porcelain alone. Within recent years many applications for this useful mineral have been discovered and employed.

SILVER AND GOLD.

It has long been known that both gold and silver exist in Texas in quantities sufficient to repay working. Without thorough and systematic geological surveys it is at present impossible to state definitely the extent or value of these deposits. Of the various rumors that from time to time go the round of the State press with regard to the discovery of valuable gold or silver mines, probably not one in a thousand is worthy of credence. That there are such valuable deposits in the State, however, there can be no doubt, and analyses of gold and silver ores found in Texas of even great value have been made in the laboratory of the University. So far as my experience goes the ores of both gold and silver are much more valuable in the western and northwestern portions of the State than in the central. Of many ores examined from Llano and the adjacent counties none of

great value were found, although some were fair low grade ores. There are many traditions of Spanish mines having been worked in this part of the State, but so far as I have been able to find out none of these reports have any more foundation than mere rumor. It is possible, and even probable, that there may be valuable deposits of the precious metals there, but as yet they have not been found. In some of the streams of Llano County it is possible to pan out gold in even paying quantities, and it is to be hoped that the time is not far distant when competent geologists will be able to locate the source of this metal in that portion of the State.

One of the most remarkable deposits of gold ever found is near Austin. It is remarkable from the fact that the gold is found in a kind of rock which has hitherto been supposed to be free from gold. The metal seems to be very unequally distributed through ordinary limestone, and does not occur in any well defined veins at all. This will probably prevent its successful working, for while one ton of the rock might yield $50 of gold, still the next ten tons would be likely to yield not a cent.

From the extreme northwestern part of the State some very fine indications of gold have been found. A small nugget about as large as a pigeon's egg has been received at the laboratory. It is said to have been found in Oldham County. A ton of such samples would be worth from $50,000 to $75,000.

A few examples of the ores assayed for gold and silver are given:

Silver ore from Northwest Texas showed 150 oz. of silver to the ton of 2000 lbs.

Gold ore found in limestone contained: Silver, 6 oz. to the ton of 2000 lbs.; gold, $17 to the ton of 2000 lbs.

ARGENTIFEROUS GALENA.

No. 1 contained 15 oz. silver to the ton of 2000 lbs.
No. 2 contained 20 oz. silver to the ton of 2000 lbs.
No. 3 contained 120 oz. silver to the ton of 2000 lbs.
No. 4 contained 10 oz. silver to the ton of 2000 lbs.
No. 5 contained 23 oz. silver to the ton of 2000 lbs.

One of the richest silver ores it has ever been my lot to assay was found in this State, and it contained according to the analysis over 5000 oz. of silver to the ton.

IRON ORES.

There is a fascination about gold and silver that is apt to make one attach a fictitious value to their discovery; while in the case of iron deposits, though they are much more valuable to the country at large, yet they do not produce nearly the excitement and stir as do the former. Texas is rich in her iron. In nearly every portion of the State are to be found large quantities of iron ore of exceptional richness and purity. In nearly every sample of iron ore analyzed in the laboratory of the University, there was found to be only small traces of such deleterious impurities as would prevent the manufacture of the best grades of iron and steel. The Llano County ore, to which special attention was first called in University Bulletin No. 1, some three years ago, is not by any means the only pure and valuable iron ore in the State. In the past three years many analyses of these ores have been made in the laboratory, and nearly every one has been found to be valuable. There is only one thing that can prevent Texas from competing with any other State in the manufacture of iron and steel, and that is the question of fuel. Unfortunately there is not that abundance of coking coal here that is so necessary to the successful working of iron ores. There is not a total lack of true coal in the State, but the coal beds hitherto found are not large in area, nor are they of great thickness. More

will be said of this under the head of "Coal." There is one solution of the difficulty which is being tried to some extent in Rusk, and, I believe, with fair success—that is the use of charcoal as fuel, instead of coal or coke. Charcoal iron is superior to iron reduced by either coal or coke. The utilization of the immense forests of Texas in this manner might prove of great advantage. In the manufacture of charcoal from wood by heating the latter in closed retorts many very valuable products may be obtained, whose sale will nearly, if not quite, pay for the making of the charcoal. These products — such as wood spirits, pyroligneous acid, acetone, etc., etc.,—always have a ready sale and command such prices as will enable the iron manufacturers to obtain their fuel almost without cost. In some parts of the Adirondacks wood is distilled not for the sake of the charcoal that is made, but only for the sake of these products mentioned above. If such is the case there, no reason can exist why such should not be so here.

The following partial analyses of iron ores from different parts of the State will give some idea of their value:

BURNET COUNTY ORES.

	No. 1.	No. 2.
Sulphur	0.002 per cent	0.10 per cent
Phosphorus	0.001 per cent	0.08 per cent
Silica	4.65 per cent	2.46 per cent
Oxide of iron	86.40 per cent	87.43 per cent
corresponding to		
Metallic iron	60.48 per cent	61.00 per cent

GILLESPIE COUNTY.

Sulphur	0.01 per cent
Phosphorus	0.05 per cent
Silica	3.86 per cent
Oxide of iron	84.41 per cent
corresponding to	
Metallic iron	59.09 per cent

SOUTH-EASTERN TEXAS.

Sulphur	0.002 per cent
Phosphorus	0.47 per cent
Silica	8.62 per cent
Oxide of iron	75.71 per cent
corresponding to	
Metallic iron	53.00 per cent

CENTRAL TEXAS.

	No. 1.	No. 2.
Sulphur	0.008 per cent	0.09 per cent
Phosphorus	0.12 per cent	0.22 per cent
Silica	27.68 per cent	8.85 per cent
Oxide of iron	75.47 per cent	85.52 per cent
corresponding to		
Metallic iron	52.83 per cent	59.67 per cent

NORTHEAST TEXAS.

	No. 1.	No. 2.
Sulphur	0.22 per cent	0.23 per cent
Phosphorus	0.04 per cent	0.19 per cent
Silica	1.87 per cent	6.83 per cent
Oxide of iron	87.69 per cent	84.91 per cent
corresponding to		
Metallic iron	61.38 per cent	57.44 per cent

OCHRES.

There are quite abundant deposits in the State of a kind of iron ores that are usually called ochres. They are characterized by being easily pulverized, soft to the touch, and freedom from grit, and by their containing considerable quantities of alumina. They find considerable use in the preparation of the so-called mineral paints, and are quite valuable for such and other purposes.

Analyses were made of the following samples:

OCHRES FROM NORTHWEST TEXAS.

Silica	53.79 per cent	53.53 per cent	18.64 per cent
Alumina	20.03 per cent	18.69 per cent	13.13 per cent
Oxide of iron	11.60 per cent	13 25 per cent	35.81 per cent

CENTRAL TEXAS.

Silica	61.31 per cent
Alumina	9.94 per cent
Oxide of iron	18.29 per cent

COAL.

One of the greatest needs of Texas is first class coal. There are in various parts of the State immense deposits of lignite or brown coal, but only small quantities of good bituminous coal have as yet been discovered and no anthracite at all. As long as we have to carry our fuel long distances from other States, paying large freight rates, just so long will manufactures be retarded and the working up of our mineral products into articles of trade be checked. Those countries are the most prosperous where manufacture most abounds.

For obtaining an ordinary degree of heat, such as for the generation of steam and the like, lignite is pretty well adapted, its heating power, though less than that of bituminous coal, being greater than that of wood. In order however for the lignite to be so utilized profitably it is necessary that it should be used near the place it is mined. In other words, lignite does not bear transportation nor storage. On exposure to the atmosphere, especially in damp weather, or to the rain, this coal crumbles and slakes almost like caustic lime. This property of the brown coal is a serious if not an irremediable drawback to its extended use. It being a fuel of comparatively low heating power, it will hardly pay to attempt to counteract this crumbling tendency by the use of such methods as have been suggested—for instance, compression and the like. The successful utilization of lignite as a fuel will probably have to be sought for in a different way. This coal contains as a general rule a large percentage of sulphur, although it some localities that substance does not contaminate it very much. A characteristic

phenomenon exhibited by the lignites is that when they are held for a moment in water they will emit a very distinct crackling sound and will crumble in the hand like slaked lime. This property enables any one to identify a lignite without any difficulty.

Lignite as such can not be used in any metallurgical operations that require a very high temperature. Nor can it be used for the purpose of making good illuminating gas. Its low heating power is due to the comparatively low percentage of carbon and to the large percentage of oxygen and ash. Its low value for the purpose of making illuminating gas is because of the small amount of available hydrogen and of the presence of other useless gases.

Not very much work of real value has been done upon the lignites in trying to coke them, probably from the reason that where coke is mostly used good coking coal is found. In Texas, however, our immense lignite beds, our valuable mineral deposits, and the lack of coking coal, present an entirely different state of affairs. It is of the greatest moment to us that a method be devised for coking this kind of coal. It is impossible to coke it when ordinary methods are employed, but it is very reasonable to suppose that science will reveal a way when her aid is invoked. In my opinion the whole difficulty of fuel in Texas will be removed as soon as the successful coking of lignite is an accomplished fact. Whether the investigation be undertaken by the State or by private enterprise its successful completion will prove an invaluable blessing to our trades and manufactures.

Although the principal coal deposits are lignite, yet that true bituminous coal does occur in the State is certain. In the northern and also the northwestern portions of the State some geological investigations of a more or less desultory nature have been made of the coal fields, but on the whole no systematic survey has ever been attempted. It

may be that unexpected coal areas will be discovered. In Llano County there have been identified the true coal measures, and even a vein of good bituminous coal discovered. Some prospecting has been done there by practical coal miners, but as might be expected nothing has been accomplished. A geological survey will have to be made before any real information can be gained with regard to the extent and value of these deposits.

A sample of true bituminous coal from Llano County was analyzed at the laboratory. It contained:

Water	3.44 per cent.
Volatile matter	37.00 per cent.
Fixed carbon	43.32 per cent.
Ash	16.24 per cent.

The sample analyzed was taken just off the surface and was weather-beaten. It coked well.

A very good sample of bituminous coal from Palo Pinto County, near Gordon, yielded on analysis:

Water	0.86 per cent
Volatile matter	32.64 per cent
Fixed carbon	63.64 per cent
Ash	2.86 per cent
	100.00
Sulphur	0.25 per cent

The following analyses were made of lignites from different parts of Texas:

Locality.	Water.	Volatile matter.	Fixed carbon.	Ash.	Total.	Sulphur.
Robertson County	15.86%	44.89%	29.34%	9.91%	100.	.....
Cherokee County	16.42	18.80	28.75	36.03	100.	.....
Milam County	18.79	45.17	30.65	5.39	100.	1.04%
Hopkins County	22.92	50.28	21.66	5.14	100.	0.67
Northwest Texas	16.48	43.40	36.87	3.25	100.	0.75
North Texas	20.46	31.11	40.77	7.66	100.	1.82
North Texas	17.77	30.98	37.19	14.06	100.	2.36
North Texas	15.88	29.66	42.03	12.43	100.	2.90
Burnet County	4.38	38.97	43.03	13.62	100.	4.14
Burnet County	4.13	39.89	40.40	15.58	100	5.22

MINERAL WATERS.

Many portions of Texas are becoming famed as health resorts. The dryness of the atmosphere and the general salubrity of the climate attract many invalids and others who desire to regain or to preserve their health. Besides these climatic inducements, many fine mineral wells and springs occur in various places. The waters of these springs are often of exceptional quality and have proved very efficacious in the treatment of various diseases. In comparing the analyses of the various mineral waters of the State with those of other countries, it is seen that they are equal to some of the most famous and are superior to the vast majority. Proper advertising will no doubt place these waters before the public and will do much towards attracting visitors and immigrants.

The character of the mineral constituents varies in different parts of the State. Nearly all classes of mineral waters are represented—chalybeate, alum, saline, sulphur, etc., etc.

During the past year or two a good many analyses have been made of these waters, some of which are given below:

CHALYBEATE WATER—FRANKLIN, TEXAS.

One gallon of the water contains:

Sulphate of lime	20.965	grains
Sulphate of iron	75.952	"
Sulphate of alumina	2.228	"
Sulphate of magnesia	13.063	"
Sulphate of soda	7.109	"
Sulphate of potash	0.752	"
Sulphate of ammonia	trace.	
Chloride of sodium	9.715	"
Silica and insoluble matter	2.041	"
Total grains per gallon	131.825	

The water has a slight acid reaction.

CHALYBEATE WATER—FRANKLIN.

One gallon of the water contains:

Sulphate of lime	10.42	grains
Sulphate of iron	8.61	"
Sulphate of magnesia	5.42	"
Sulphate of soda	2.64	"
Chloride of sodium	3.11	"
Chloride of potassium	0.11	"
Alumina	trace.	
Manganese	trace.	
Silica and insoluble matter	1.38	"

CHALYBEATE WATER—FRANKLIN.

One gallon of the water contains:

Sulphate of lime	37.095	grains
Sulphate of iron	144.903	"
Sulphate of alumina	4.998	"
Sulphate of soda	14.148	"
Sulphate of potash	2.560	"
Chloride of sodium	9.035	"
Silica and insoluble matter	2.244	"
Total grains per gallon	235.015	

ALUM WATER—DENISON.

One gallon of the water contains:

Sulphate of lime	30.652
Sulphate of alumina	26.850
Sulphate of iron	0.239
Sulphate of magnesia	3.312
Sulphate of potash	0.286
Chloride of sodium	4.222
Chloride of magnesium	0.140
Silica and insoluble matter	2.735
Total grains per gallon	68.436

ALUM WATER—FRANKLIN.

One gallon of the water contains:

Chloride of sodium	3.942
Sulphate of soda	0.898
Sulphate of potash	0.548
Sulphate of lime	6.217
Sulphate of magnesia	2.624
Sulphate of iron	5.651
Sulphate of alumina	30.005
Silica and insoluble matter	2.887
Total grains per gallon	52.772

ALKALINE SULPHATIC WATER—GEORGETOWN.

One gallon of the water contains:

Chloride of sodium	58.720 grains
Bicarbonate of soda	1.225 "
Carbonate of lime	23.414 "
Carbonate of iron	0.811 "
Sulphate of alumina and potash	8.363 "
Sulphate of potash	5.931 "
Sulphate of soda	201.197 "
Sulphate of magnesia	62.925 "
Sulphate of lime	17.548 "
Silica and insoluble matter	0.991 "
Total grains per gallon	381.125

Free carbonic acid gas per gallon, 39.6 cu. in.

SULPHUR WATER—LAMPASAS.—"HANNA SPRING."

One gallon of the water contains:

Hyposulphite of soda	0.775 grains
Hydrosulphate of sodium	0.111 "
Chloride of sodium	555.869 "
Chloride of potassium	10.287 "
Chloride of magnesium	50.049 "
Chloride of calcium	48.905 "
Carbonate of lime	34.465 "
Sulphate of lime	0.951 "

Bromide of magnesium	trace.
Alumina	2.286 grains
Silica and insoluble matter	1.673 "
Organic matter	trace.
Total grains per gallon	705.371
Free sulphuretted hydrogen gas, per gallon	5.82 cu. in.
Free carbonic acid gas, per gallon	11.80 cu. in.

The water has a faint acid reaction.

The temperature of the water in the spring is 70° F., and its specific gravity is 1.0074.

SULPHUR WATER—LAMPASAS.—"COOPER SPRING."

One gallon of the water contains:

Hyposulphite of soda	0.227
Hydrosulphate of sodium	0.827
Chloride of sodium	346.974
Chloride of potassium	3.586
Chloride of magnesium	21.857
Chloride of calcium	48.147
Sulphate of lime	4.461
Carbonate of lime	11.372
Bromide of magnesium	trace.
Alumina	3.540
Silica and insoluble matter	0.565
Organic matter	trace.
Total grains per gallon	441.556
Free sulphuretted hydrogen gas, per gallon	2.07 cu. in.
Free carbonic acid gas, per gallon	45.11 cu. in.

The water has a faint acid reaction. The temperature of the water in the spring is 70° F., and has a specific gravity of 1.007.