48TH CONGRESS, 2d Session. } SENATE. { EX. DOC. No. 20.

LETTER

FROM

THE SECRETARY OF THE INTERIOR,

TRANSMITTING,

In compliance with law, letter of the Commissioner of Indian Affairs, with report upon the coal on the White Mountain Reservation in Arizona.

JANUARY 6, 1885.—Referred to the Committee on Indian Affairs and ordered to be printed.

DEPARTMENT OF THE INTERIOR,
Washington, December 26, 1884.

SIR: I have the honor to transmit herewith a copy of letter of the 6th instant from the Commissioner of Indian Affairs, inclosing copy of the report of the Commission appointed under provisions of the act of July 4, 1884 (Pamph. Laws, 1883–'4, p. 95), to examine coal on the White Mountain Indian Reservation, in the Territory of Arizona.

The law referred to requires that this report shall be transmitted to Congress.

Very respectfully,

H. M. TELLER,
Secretary.

The PRESIDENT PRO TEMPORE OF THE SENATE.

DEPARTMENT OF THE INTERIOR,
OFFICE OF INDIAN AFFAIRS,
Washington, December 6, 1884.

SIR: I have the honor to acknowledge the receipt by your reference November 29, 1884, of the report, dated November 28, 1884, of the Commission appointed to examine and report upon the character, extent, &c., of the coal on the White Mountain Indian Reservation, in Arizona Territory, for examination and preparation for transmittal to Congress.

By act of Congress approved July 4, 1884 (Stat., 23–95), the Secretary of the Interior was authorized to detail a proper person or persons from the employés of the Geological Survey, and to also appoint a suitable person not then in the employ of the Government, "to examine and report upon the character, extent, thickness, and depth of each vein, the value of the coal per ton on the dump, and the best method to utilize the same, and to report their opinions as to the best method of disposing thereof within the limits of the White Mountain Indian Reservation,

in the Territory of Arizona, and the result of said investigation to the Secretary, and by him transmitted to Congress."

Michael Bannon, esq., of Baltimore, Md., and Charles D. Walcott, esq., of the Geological Survey, were designated by the Department to make the examination, &c., under the above authority, and instructions were issued to them by this office on the 8th August, 1884. They subsequently proceeded to Arizona in pursuance of their duties, and having made the required investigation submitted their report as of date above mentioned.

In returning the report to the Department, I beg leave to dissent from the opinion of the Commission, as expressed on page 8 thereof, that the original discoverers should have the right to explore and develop the coal-fields "*free of royalty*, during a period of three years."

I concur in the general plan of leasing upon a royalty system, and also in the suggestion that the original discoverers should have a preference right to lease, but I think the royalty of 10 cents per ton should be required on all the coal mined and taken from the reservation, whether in the development or subsequent working of the mines.

A copy of the report of the Commission, prepared in this office, is herewith inclosed, and also a copy of this report.

Very respectfully, your obedient servant,

H. PRICE,
Commissioner.

The Hon. SECRETARY OF THE INTERIOR.

Washington, D. C., November 28, 1884.

SIR: In compliance with instructions received from Hon. E. L. Stevens, Acting Commissioner of Indian Affairs, dated Washington, August 8, 1884, and approved August 13, 1884, by Hon. M. L. Joslyn, Acting Secretary of the Interior, we have the honor to submit herewith a report of the result of our investigation of the Deer Creek coal-field on the San Carlos or White Mountain Indian Reservation, Arizona.

Very respectfully,

M. BANNON,
CHARLES D. WALCOTT,
Commissioners.

The Hon. SECRETARY OF THE INTERIOR,
Washington, D. C.

DEER CREEK COAL-FIELD, WHITE MOUNTAIN INDIAN RESERVATION, ARIZONA.

HISTORY OF DISCOVERY.

The first discovery of the presence of coal in the Deer Creek Valley, was made by David Anderson, a prospector, who at the time was searching for drinking-water in a small wash near the head of the valley. A dark band of dirt in the side of the wash attracted his attention, and led him to dig into it and ascertain that it was produced by the decomposition of coal. The date of the discovery was the latter part of January, 1881. Anderson notified the members of the prospecting party to which he belonged, and claims were at once staked out along the line of outcrop of the coal-bearing rocks. The work of developing was begun soon afterward, and carried forward as rapidly as the means at hand would permit. Shafts were sunk along the line of the coal-seams first discovered by Anderson, and numerous prospect holes dug wherever the coal "blossom" appeared.

In a letter to the Secretary of the Interior, dated Washington, D. C., February 16, 1884, the Hon. H. Price, Indian Commissioner, states that Indian Agent Tiffany, at the San Carlos Agency, notified the miners that they were within the limits of the

reservation, by posting notices dated March 4, 1881, on the trails leading to the mines, on the works about the mines, and also had the notice read to passers. This did not deter the prospectors, and the work of development went on until ———, 1883, when they were removed by order of the Department of the Interior, by the military under General Crook.

DEVELOPMENT.

Four beds have been worked sufficiently to show their character. One shaft was sunk 200 feet, another 150 feet. A tunnel was run 110 feet along the strike of the bed on which the 150-foot shaft was sunk, and a cross-cut of 40 feet made to a parallel bed. A number of shafts from 10 to 30 feet deep were opened on various beds.

The presence of water in the deeper shafts drove the miners out, and not having pumping machinery the shafts were abandoned; as little care had been taken in timbering, the sides have largely fallen in.

EXAMINATION OF THE COAL DEPOSITS.

When the Commission arrived at the coal-fields they found that nothing had been done towards cleaning out the shafts, and that it was not possible to have it done owing to the caving in of the sides of the shafts, and the presence of a continuous flow of water. A tunnel, cutting through two of the principal coal-beds, had been partially cleaned out by Mr. James Little and his associated prospectors, and gave a very favorable examination. All other coal-beds were examined in prospect holes, and cuts made across the strike of the strata.

The strike of the strata in which the coal-beds occur averages north 70° west (magnetic); the dip of the coal-bearing bituminous shales and overlying and underlying sandstone is 65° at the surface, increasing to 80° 100 feet below; the latter statement given by the miners. In the tunnel which cuts through two of the best beds thus far opened, the coal appears in the form of thin layers, interbedded with bituminous shale.

The section of the first bed cut by the tunnel gives—

	Ft. in.
1. Black bituminous shaly coal, irregular, shining, but not of economic value	3.00
2. Clear bituminous coal	0.10
3. Bituminous shale with parting of coal similar to No. 2	4.02
	8.00

The second bed is 40 feet beyond, 3½ feet in thickness, with 10 inches of clear coal in one body.

A shaft was sunk on the first bed, and the miners stated that the coal thickened up as they went down, but from the fact that they made no distinction between the bituminous shaly matter and the true coal, little reliance can be placed on the statement as proving the existence of a thicker bed of coal. The displacement of the beds during the uplifting of the strata and the intrusion of the dikes of lava has plicated the coal-bearing shales in places and thus given a greater thickness in spots than the beds had originally.

CHARACTER OF THE COAL.

Analysis of coal from the 10-inch layers in the bed opened by the tunnel, as reported by Prof. F. W. Clark, chief chemist of the United States Geological Survey:

Analysis made by Mr. Edward Whitfield:

Moisture	.48
Volatile combustible matter	19.81
Combined carbon	61.01
Ash (pink color)	18.70
	100.00

Cooking properties poor.

A sample from the 10-inch layer in the bed cut out by the cross-cut from the tunnel gave—

Moisture	.56
Volatile combustible matter	17.50
Combined carbon	60.85
Ash (pink color)	21.09
	100.00

Cooking properties fair.

The coal is a hard bituminous, and as tested in the laboratory will make a fair coke, but not as good as that from the Raton district of New Mexico.

Before any expense is incurred in mining or preparing a coke plant, it would be well to have a practical coke-burner make a test at the mines of a considerable quantity of the coal, as the result on a large scale may differ somewhat from that obtained in the laboratory.

EXTENT OF THE DEPOSIT.

As now known, those beds that present the fairest prospect are limited to a narrow area, about 3 miles long, in the upper part of the valley, on what we have called the Anderson field. That they extend beneath the lava to the westward is quite probable, but to what extent or how much they have been broken up by the numerous dikes and masses of lava that traverse the strata is unknown.

Mr. James Little stated that he knew of at least 40 different seams of bituminous shale and coaly matter between the limestone and the uppermost bed containing coal, a distance of 2,700 feet on the surface, and 2,100 feet in thickness of strata. Of those the two seams shown in the tunnel, and the first one beyond and above, alone appear to be of economic importance.

It may be that when the work of development is carried forward, some of the beds not now opened will give thicker beds of workable coal than those exposed by the work done in the Anderson field, but this is uncertain and doubtful.

The strike of the coal-bearing strata is 60° W. (magnetic) in the upper end of the valley or on the Anderson field. The beds are traceable to the westward 5 or 6 miles, but the coal-bearing bituminous shales are largely covered by lava. Towards the lower end of the valley, about 10 miles from the Anderson field, the strike swings around to the east and west, and a few exposures of bituminous beds were observed. With the exception of a few prospect holes, no work has been done towards developing this portion of the field.

THICKNESS AND DEPTH OF EACH VEIN.

The 10 inch layers in the two beds cut by the tunnel are the only good coal-beds known to the Commission. To have ascertained the thickness of each bed carrying coal and the amount of coal was beyond the means the Commission had at its disposal; and from the surface outcrops it did not appear to be desirable or necessary, as only the beds of possible economic importance were considered as worthy of detailed examination.

The depth of the beds it is impossible to state. Standing at an angle of 60° to 80°, it is highly probable from the geologic structure, that they extend downward as far as it would be practicable and profitable to mine the coal if it exists in beds of sufficient thickness to work.

VALUE OF COAL ON THE DUMP.

Coke at the Copper Smelting Works in Globe (50 to 55 miles from the mines) costs from $55 to $65 per ton.

The cost of hauling coke from the Deer Creek coal-field to Globe would probably be from $20 to $25 per ton.

The coke produced from the coal, judging from the samples from the tunnel, will be of an inferior quality as compared with the coke now used at Globe, and of less value.

Placing the value of the coal at $10 on the dump (a value necessitated by the difficulties to be overcome in mining), the coke would cost from $35 to $40 per ton at the Globe smelters.

BEST METHOD OF UTILIZING THE COAL.

As the only market of any extent is the demand from the smelting works, the best method of utilizing the coal appears to be to reduce it to coke at the mines.

BEST METHOD OF DISPOSING OF THE COAL.

The question of the economic value of the coal-field is one of great doubt. The thin beds of coal, their disposition, which renders mining difficult and expensive, and the distance of the market, and that a small one for expensive coal or coke, all unite to discourage the investment of capital.

Whether it will pay to mine the coal is very doubtful, but if there are persons who think it will and are willing to attempt it, it is our opinion that to give the original discoverers the right to explore and develope the coal-field free of royalty during a period of three years, provided work is begun within six months and carried forward continuously, then lease the coal lands for a term of years under a royalty per

ton of ten cents, to the persons who have developed the coal-field, will be the best method of disposing of the same.

If the original discoverers do not lease their prospect-claims under the above conditions, and are not prepared or willing to continue the work of exploration and development, the right to explore and lease the coal lands should be given to such responsible parties as the Department may determine.

APPENDIX I.

By CHARLES D. WALCOTT.

DESCRIPTION OF THE COAL-FIELD.

GENERAL FEATURES.

Deer Creek Valley, situated about 13 miles south of the San Carlos Agency, is between two ridges or spurs of the foot-hills sloping down from Mount Trumbull to the Gila River. Its trend is east and west. At the upper (east) end, the valley is narrow, a semicircle of hills bounding it. It gradually widens from a width of 1 mile to 4 miles at the lower end, ridges from 1,000 to 1,500 feet high rising on each side. The upper portion for a distance of 2 miles is comparatively smooth, the dry water-course cutting obliquely across to the south slope; south of this smoother space, a mass of rounded and irregular lava hills fill the valley from side to side, excepting a narrow strip on the south slope of the north ridge. The drainage is to the south side, where a narrow, rugged cañon gives passage to the waters of Deer Creek during the rainy season. The lower end of the valley is more open, but the lava hills continue and break the surface.

A few springs occur along the lower portion of Deer Creek and lateral cañons entering it. In the dry season of the year most of them dry up and hardly a drink of water can be obtained in the valley, except from the shafts sunk by the miners at the upper end. A few stunted pines, cedars and mesquites occur on the lava hills and cottonwoods along the channel of Deer Creek.

GEOLOGIC CHARACTER.

The interior portion of the valley is eroded in a monoclinal uplift of Carboniferous limestone and Cretaceous or Lower Tertiary sandstone. A section crossing the upper end of the coal-field proper shows on each side, as the outer bounding ridges, great masses of volcanic rock (rhyolite) on the north side and andesite on the south. Within the northern ridge a massive belt of Carboniferous limestone, 1,200 feet in thickness, forms the northern boundary of the valley. South of the limestone, the valley is cut out of a belt of Cretaceous sandstone, sandy shales with clays, shales and coal-seams that is very nearly 3,700 feet thick, and apparently overlying conformably the Carboniferous limestone beneath. A narrow band of Devonian limestone, standing on edge, is separated by a profound fault from a quartzite that forms the lower slope of the south side of the valley at the foot of the lava (andesite) that rises 1,100 feet above the valley and extends along its southern side to the Gila River, corresponding to the limestone ridge on the north side.

After the erosion of the valley, flows of lava, mostly hornblende andesite, filled the central and lower portions, and dikes (rhyolite) cut through the strata at the upper end. The weathering of the lava beds gives the rough rugged character to the central and lower parts.

In the section, the first indications of coal met with are several narrow beds of bituminous shale in the first 900 feet of sandstone above the limestone, but none were observed that appeared to contain coal of economic importance. It is not until a dike of lava (rhyolite) 1,150 feet from the limestone is passed that the thicker beds of bituminous matter containing coal are reached. The dike is 40 feet across, and 360 feet south of it the first large coal-seam is met with. As measured in a tunnel on a fresh surface, the bed is 8 feet in thickness. Strike N. 60° W. (magnetic) dip 65° S. A close examination shows the following section:

	Ft. in.
1. Black bituminous shale, irregular, shining, but not showing true coal.....	3. 00
2. Clear bituminous coal	0. 10
3. Bituminous shale, with parting of coal similar to No. 2.....	4. 02
	8. 00

An analysis of 1, 2, and 3, made by Mr. Edward Whitfield, gave:

Constituents.	1	2	3
Moisture	1.59	0.48	3.27
Volatile combustible matter	13.79	19.31	12.51
Combined carbon	49.72	61.01	5.72
Ash	32.90	18.70	78.50
	100.00	100.00	100.00

The miners who worked in this band stated that the coal (No. 2) thickened up as it went down, but from the fact that they made no distinction between the bituminous, shaly matter and the true coal, little reliance can be placed on the statement as proving a thick bed of clear coal.

A cross-cut of 40 feet through the overlying clay shale and sandstone reaches the second bed of coal, 3½ feet of which is highly bituminous, and includes 10 inches of clear coal. Mr. Whitfield found in this coal—

Moisture	.56
Volatile combustible matter	17.50
Combined carbon	60.85
Ash	21.09
	100.00

A third bed, still higher and further south about 100 feet, exhibits nearly the same condition as in the two described.

Continuing across the strike of the beds 700 feet, a second lava (rhyolite) dike is reached that shows a strike of N. 70° W. and a width of 50 feet. Just beyond it a shaft shows 6 feet of bituminous matter and shale, with thin layers of coal. Other thinner strata of bituminous shale and coal occur in the next 500 feet, but none showed satisfactory evidence of the presence of workable seams of coal.

Mr. James Little stated that he knew of at least forty different seams of bituminous and coaly matter between the limestone and the uppermost bed containing coal, a distance of 2,700 feet on the surface, and 2,100 feet in thickness of strata. Of those the two seams shown in the tunnel, and the first one beyond and above, appear to be of the most importance.

The strike of the coal-bearing strata is 60° W. (magnetic) in the upper end of the valley, or on the Anderson field. The beds are traceable to the westward 5 or 6 miles, but the coal-bearing bituminous shales are largely covered by lava (andesite). Towards the lower end of the valley, about 10 miles from the Anderson field, the strike swings around to the east and west and a few exposures of the bituminous beds were observed. With the exception of a few prospect holes, no work had been done towards developing this portion of the field.

As now known those beds that present the fairest prospect are limited to a narrow area, about 3 miles long, in the upper part of the valley, on what we have called the Anderson field. That they extend beneath the lava is quite probable, but to what extent or how much they have been broken up by numerous dikes and masses of lava that traverse the strata, is unknown.

The study of the coal-beds was not as thorough as could have been wished, owing to the caving in and filling up of the shafts sunk on the line of the coal outcrop, but sufficient was shown in the tunnel and portions of the shafts not filled in to raise a serious question as to whether coal existed in sufficient quantity to be of economic importance.

SECTION OF THE CARBONIFEROUS AND CRETACEOUS STRATA OF THE DEER CREEK COAL-FIELD.

The base of the section is on the north of the ridge forming the north side of Deer Creek Valley, and is best seen in Hog Cañon, about 8 miles southwest of San Carlos Agency.

Archæan, micaceous schists, broken by veins of quartz:

1. Massive layers of quartzite, passing above into thinner beds of indurated sandstone, and again into fine silicious conglomerate, terminating above in massive layers of quartzite that are beautifully shown along Hawk Cañon before the latter enters the Gila Cañon. (Estimated) ..... 1,000.00 feet.

2. Gray limestone in more or less massive layers (6 inches to 2 feet) in places becoming somewhat shaly, and in the massive beds siliceous, the silicious matter appearing as thin, irregular layers, ramifications, and modules in the limestone. Numerous fossils occur in the upper 1,500 feet: *Fusilina cylindrica*, Crinoidal stems, *Zaphrentis*, *Syringopora*, *Productus semireticulatus*, *Spirifera camerata*, *S. Rockymontana*, *Spiriferina cristata*, *Retzia radialis*, *Athyris subtilita*. The lower portion was not carefully examined for specimens, except to determine the presence of Carboniferous species; 400 feet from the summit a bed of argillaceous shale occurs that carries a thin layer of bituminous shale. Entire thickness estimated, and 1,200 feet measured ..... 2,500 to 3,000 feet.

3. Coal-bearing sandstones (Cretaceous?):
   - *a.* Buff-colored sandstones and sandy shales, with several thin beds of black bituminous shale in argillaceous shale, bituminous coal appearing in thin layers ..... 1,200.00 feet.
   - *b.* Bituminous shale and coal with plant remains:
     The plant specimens were submitted to Prof. Lester F. Ward, who determined the presence of the genera *Sequoia*, *Sabal*, *Phragmites*, *Myrica*, and *Viburnum*. Owing to the fragmentary nature of the material, no specific determinations were made.
     Of clear coal 10 inches in one layer (entire stratum) ..... 8.00 feet.
   - *c.* Argillaceous shale and sandstone ..... 42.00 feet.
   - *d.* Bituminous shale and thin layers of bituminous coal, one of which is 10 inches in thickness ..... 3.50 feet.
   - *e.* Shale and sandstone, with several intercalated beds of bituminous shale, with traces of coal ..... 100.00 feet.
   - *f.* Bituminous shale and thin layers of coal ..... 6.50 feet.
   - *g.* Buff-colored sandstone, with several beds of bituminous and argillaceous shale, with a few thin layers of coal in the former .. 750.00 feet.
   - *h.* Sandstones, buff-colored, hard in places, but mostly more or less friable on exposure to the weather ..... 1,500.00 feet.

   3,700.00 feet.

Fault line .....

4. Devonian limestone, with numerous silicified corals, *Stromatopora* sp. (?); *Zaphrentis* sp. (?); *Michelina* sp. undt.; *Heliolites* sp. (?); *Alveolites* sp. (?); *Cladopora* sp. (?); *Aulopora* 2 sp., *Acervularia pentagona* Goldfuss, *Phillipsastrea verneuilli* Milne-Ed.; *Diphyphyllum simcoense* Billings, &c ..... 50.00 feet.
5. Quartz, porphyry dike ..... 200.00 feet.
6. Quartzite or indurated sandstone ..... 450.00 feet.

Lava beds (andesites) .....

No. 3 is broken up by several dikes that cross it a little obliquely to the strike of the strata. The average strike is north 60° to 90° west; dip southward; of 1 and 2, it is 20° to 35° up to the central portion of 2; it then increases 35° to 45° to 65°, and locally is vertical and sometimes slightly overturned.