

*Stated Meeting, January 18, 1867.*

Present, twenty-four members.

Dr. WOOD, President, in the Chair.

Letters were read from the Royal Society of Sciences at Göttingen, October 13; from the Society of Natural Sciences at Altenburg, October 8; from the Society of Natural Sciences at Riga, 9th and 31st May, announcing donations. Also, from the Royal Society at Göttingen, October 10; from the Society of Natural Sciences at Emden, October 1; from the Society of Natural Sciences at Riga, May 31; from the Smithsonian Institution, Washington, August 2d, acknowledging receipt of publications.

Donations for the Library were announced: from the University of Kharkof, Russia (five treatises in the Russian language); from the Society of Natural Sciences at Riga; from the Royal Society of Science at Göttingen; from the Royal Society of Science at Leipzig; from the Royal Prussian Academy of Science at Berlin; from the Society of Natural Science at Emden; from the Royal Library at Munich; from the Imperial and Royal Geological Society at Vienna; from the Royal Academy of Sciences at Belgium; from the Society of Naturalists at Mannheim; from the Society of Natural Sciences at Bremen; from the Society of Natural Science at Altenburg; from F. Zantedeschi; the Annals of Mines; from the Royal Geographical Society of London; from the Essex Institute, Salem, Mass.; from the American Pharmaceutical Association; from the publishers of the American Journal of Medical Sciences, and the Medical News and Library, Philadelphia.

The death of Gen. Lewis Cass, a member, was announced by Prof. Trego, as having occurred June 17, 1866, aged 82 years.

The death of William Norris, a member, was announced by Mr. Fraley as having occurred.

Dr. Hayden made some remarks and observations in regard to the lignite beds of the country on the upper tributaries of the Missouri.

He stated that he had recently received a number of interesting letters from various parts of the far West, communicating important geological discoveries which he was anxious to have recorded in a scientific journal as soon as possible, that the attention of other explorers might be directed to them. Although the great Valley of the Missouri and its tributaries has already yielded so many important facts to geological science, it does not seem even yet to have given up half its wealth.

1. Dr. Curry, an intelligent surgeon, now of Baltimore, Maryland, formerly of the United States Army, and stationed at Fort Sully, on the Missouri River, writes as follows: "I received a letter a few days ago from Fort Rice (Captain Irvine), who says, 'While in charge of the herd a short time since, I discovered the bones of some huge extinct Behemoth. The dimensions of the largest is as follows: from head of femur to inner condyle, forty-two inches; from head of femur to trochanter major, twenty inches; long axis of femur, thirty-nine inches; short axis of femur, eight inches; from condyle to condyle, fifteen inches. Other bones in vast quantities were found, but were so crumbled by exposure to the elements, that it was difficult to arrive at any correct conclusions in reference to them; enough, however, is known, that this region once abounded in tropical plants and animals, and the remains thereof will yet afford vast treasures of geological interest to the student both of Europe and this country, and the day will come when the spectacled antiquarian will make annual pilgrimages to the Bad Lands of Dakota.'"

Fort Rice is located at the mouth of Cannon-ball River, a tributary of the Missouri, which rises in the prairie near the eastern base of the Black Hills. The bones referred to were found on the southern rim of the Great Lignite Basin, a district of the highest interest. These bones are distributed in greater or less abundance south and southwestward, even to the east base of the Black Hills. In Dr. Hayden's explorations in former years, he discovered the remains of several extinct animals along this southern rim of the Lignite Basin, which have been described by Dr. Leidy in the Transactions of the American Philosophical Society, 1859. The first one described, Dr. Leidy called *Ischyrotherium antiquum*, and says, "We

cannot positively determine the affinities of the animal represented by these bones, but from their solidity of structure, and the cylindrical form of the ribs, we suspect *Ischyrotherium* to be more nearly allied to the Manatee than to any other known animal."

"Though I have supposed the remains above described to indicate the former existence of a mammal allied to the Manatee, they yet appear to me of such singular character, that I have suspected they may have belonged to an aquatic reptile, unlike any known, and perhaps foreshadowing in its constitution the sea-cows, just as *Iguanodon* appears to have foreshadowed the herbivorous pachyderms of the Eocene tertiary period." A huge saurian has been indicated by Dr. Leidy by remains found in this region, to which he has given the name of *Thespesius occidentalis*. "Several vertebral, together with a first phalangeal bone, from Nebraska, appear to indicate a deinosaurian as colossal as the *Iguanodon* of England, or the *Hadrosaurus* of New Jersey. Two of the specimens are exceedingly like mammalian lumbar vertebræ, especially those of the elephant or mastodon, and might readily be taken for such, were it not that they possess well-marked processes for the articulation of chevron bones."

The remains of two species of turtles were discovered not far from Fort Rice, *Compsemys victus* and *Emys obscurus*. Dr. Leidy also describes some very interesting fish remains from this portion of the Lignite Basin, under the name of *Mylognathus priscus*. "The very singular-looking fish, *Chimara*, of the European seas, was represented during the Miocene period in Nebraska, by a genus for which the above name has been proposed. Its former existence is indicated by specimens of dental plates, like those of *Chimara*, adapted to the crushing of mollusca and crustacea used as food. The specimens, consisting of an upper maxillary and a premaxillary plate, were obtained by Dr. Hayden from the Great Lignite Basin, near Long Lake, Nebraska (now Dakota)." Dr. Hayden remarked that he referred to the fossils mentioned above, in order that the attention of travellers might be directed to them, and that more abundant and better specimens could be secured, that all doubtful points in regard to their affinities might be cleared up.

2. Dr. Curry describes what he calls a "Moss Rock." "This rock can be found at a place known as Spring Lake, situated about ten miles south of New Fort Sully, near the road leading from thence to the old fort, and about three-fourths of a mile from and in sight of the river (Missouri). It is about twenty feet high, and stands out

rather prominently from the side of the hill looking toward the south. A number of large springs have their origin in the hill above it, and their streams uniting, fall over the summit of the rock, forming a very beautiful little cascade, and at its base Spring Lake, the best drinking-water and the coldest I found in Dakota.

"The rock appeared to me the result of successive growths of moss, each petrifying in its turn, and forming a base for the next growth, as with my knife, the only instrument I had with me at the time, I raised several layers of different thicknesses, each one showing well-defined tendrils of moss, reaching through the whole substance. The upper layer shows very beautifully the moss in different stages of petrification, the process seemingly complete at its base or one side as you may please to term it, while the same moss is green and growing upon the other. How much of this rock is thus constituted I cannot say, but I think the probabilities quite strong that a large portion of it is petrified."

3. "The rock upon which are found the foot-prints is about ten miles east of New Fort Sully near the right bank of a creek called there the Wá-ka-bó-zhu, lying upon the side of the hill. Some six or eight feet square of the rock is exposed upon which the foot-prints, six in number, are seen. From their size, I presume they were made by a child five or six years of age, and with a well-formed foot. The prints are perfect and distinct, and if natural, must of course have been made while the rock was yet in a plastic state."

Dr. Hayden remarked that the spring referred to above was of interest to him, from the fact that he did not know of one of a similar character in the Valley of the Missouri. The tracks were first seen by General Harney in 1826, when as a lieutenant he ascended the Missouri under General Leavenworth. Dr. Hayden had spent much time in endeavoring to find the locality in former years, but had failed. The causes of these phenomena are plain, and will be apparent to all scientific men.

4. Dr. Hayden also said that he had received a number of interesting communications in regard to the geology and natural history of Colorado Territory from Mr. E. L. Berthoud, a civil engineer, residing at Golden City, now Speaker of the Colorado Territorial Legislature. Mr. Berthoud is a good botanist and mineralogist, and in his statements he placed great confidence. In a recent letter, bearing date of December 18th, 1866, he had communicated to him some very interesting facts in regard to the lignite beds near Den-

ver City. When we reflect that these Western plains are almost destitute of forest trees, and that the great Pacific Railway is soon to pass near this region, or perhaps through the basin itself, the value of these lignite beds cannot be too highly estimated. Accompanying the letter was an interesting geological section showing the connection and inclination of the lignite beds with reference to the mountain ranges. It is frequently referred to in Mr. Berthoud's letter, but cannot be reproduced in this notice. "Our coal seams extend, to my knowledge, sixty miles due east from Pike's Peak in one direction, south to Raton Mountains and the Raton Pass, and northward to near Denver, on Cherry Creek, and on the west side of the South Platte as far north as near the Cache la Poudre, and to the foot of the main mountain range. Here in Golden City we have a large outcrop of coal, which has been opened successfully, and which inclines toward the mountain next the town. The following sketch, No. 1, will give you an idea of the relative superposition, and the curious succession of the modern deposits in regard to the erupted feldspathic, granitic, talcose, and hornblende rocks of the main mountain range. In one of the newly opened mines on the same outcrop of the Golden City vein, which lies north on Coal Creek about nine miles from Golden City, I saw in 1861 the trunk of a tree taken out of the eleven foot vein, there opened and mined, which trunk, though turned into coal of a good quality, exhibited carbonized bark, knots, and woody fibre, with concentric rings of growth, such as our present dicotyledenous trees plainly show; indeed, one of the miners remarked that from the bark, and the grain or fibre of the coal, it was very much like bitter cottonwood (*Populus angulata*), examples of which grow close to the mine. In 1862, while on a scout east of Pike's Peak sixty-five miles, I found a bed of coal almost identical with the Golden City bed, nine feet thick, lying almost horizontal, with bluffs one and a half miles north, containing fine specimens of belemnites. Again, in November, 1866, I went north-east of Golden City to see the coal beds on Rock Creek, sixteen to nineteen miles distant. I found beds of coal fourteen to eighteen feet in thickness, almost horizontal, or dipping eastwardly at a small angle; above them ferruginous sandstone, and vast beds of bog-iron ore and clay-iron stone in nodules, with numberless fragments of bones. In the sandstone I have obtained fossils like *Hippurites*. But in none of the beds so far have I found a single marine or fresh-water shell, with the exceptions I have before mentioned. Every-

thing that I have so far seen points out that the coal is either cretaceous or tertiary, but I believe it to be tertiary, or of the same age as the coal near Cologne, on the Rhine; but I am perplexed at the inversion of the dip of the coal, sandstone, and the iron ore which here incline toward the mountain instead of away from it, and nothing else that I have observed can compare with these tilted up beds. I have not time now to follow up this subject, nor to give you all the data that I have gathered so far; I shall report to you in full in regard to the points you mention, but will give you as soon as time permits a full report, with elevations, profiles, &c.; also, some specimens to prove the relative age of the strata shown in my sketch."

Mr. Berthoud has forwarded several newspapers published in Colorado Territory, with advertisements of coal for sale at so much per ton at the mines, or so much delivered. It is somewhat strange that since so many practical geologists have travelled over this country for the purpose of examining mines, no definite statement, substantiated by the proper proofs, has ever been placed on record with regard to the age of these coal beds. It only shows that while a man may be a good mineralogist and theoretical geologist, he fails in attempting to work out the structure of a country over large areas.

By permission of the Commissioner of the United States Land Office, at Washington, Dr. Hayden had an opportunity, a few days since, of examining five or six specimens of the brown coal from the Denver Basin, and they have precisely the appearance of the lignite on the Yellowstone and Missouri Rivers, which has long since been shown to be of tertiary age. During the autumn and winter of 1859-60, while connected with the expedition to the head-waters of the Missouri and Yellowstone, under the command of Colonel William F. Reynolds, United States Engineers, Dr. Hayden traced the lignite tertiary formations of the Missouri River to a point near the base of the Laramie Mountains, about eighty miles northwest of Fort Laramie. Here the lignite beds are overlapped and hidden from view by the white marls and clays of the White River Tertiary basin. During the winter Dr. Hayden traced these White River beds along the foot of the mountains southward a short distance beyond Cache la Poudre Creek, but did not observe that the lignite beds reappeared. At Platte Bridge, on the north fork of Platte River, about one hundred and twenty miles northwest of Fort Laramie, a bed of quite pure lignite, four feet thick, is revealed by the river.

During the winter of 1857-58, a company of United States soldiers were stationed at this point, and as wood was very scarce and difficult of access in this region, the soldiers erected temporary grates, and used this lignite for fuel all winter with success.

The following notes in regard to the lignites in this locality, are taken from my journal, recorded on the spot in the winter of 1859-60:

“December 10th, 1859.—Left the bed of the little stream that empties into the Platte River about three or four miles below the Platte Bridge. All of the right side of the Platte River to the foot of the mountains, about eight miles, is covered with cretaceous formation No. 5. The river then makes a bend up towards Richard's Trading Post and Red Buttes. At the Platte Bridge, on the left side of the Platte, the river cuts the bank, giving a vertical section, showing the lignite. The following section is exposed by the river from the water's edge up. The strata have evidently been disturbed, and the cut shows a dip down the Platte eastward of about 5°.

1st. Steel-gray sands, portions quite ferruginous. About eight feet exposed above water at the upper end of the bluffs.

2d. A thin layer of indurated carbonaceous sand, six inches; passing up into an indurated carbonaceous clay, eight inches; passing up into a bluish ash-colored clay, ferruginous, but with comparatively little vegetable matter, twelve inches.

3d. Thirty feet alternate beds of lignite, clays, and marls, the lignite beds varying from two to four feet in thickness, mostly impure, but containing seams four to six inches thick of quite pure lignite, with a shining jet fracture; then above dull yellowish, rust-colored concretions, full of fragments of vegetable matter, as portions of leaves, stems, wood, &c. The clays and marls vary much in color, from a dark brown to a light yellow. At the summit of the cut, near the upper end of the bluff, is a layer of yellow marl, which a few yards down is changed into a yellow laminated calcareous rock, apparently deposited in disturbed waters. Still above are layers of impure lignite and ash-colored clays and marls.

The above gives a pretty good idea of these bluffs as revealed by the river; but in many places near the Platte Bridge the soldiers made excavations and were unsuccessful in their search, finding only an impure material, but in one excavation they found a layer about twelve inches thick, which they appear to have used as fuel successfully. At the most favorable locality I took the measurement with

a tape-line, fourteen inches of lignite, best quality, four and a half feet of indurated carbonaceous clay with numerous irregular local seams of pure coal, like cannel coal. These small seams vary from two inches to two feet in length, and from one-eighth to two inches in thickness. This carbonaceous clay gradually passes up into a light ash-colored indurated clay with some calcareous matter, with oxide of iron, which colors the seams of the fractures on exposure. Thickness, five and a half feet. The layer of pure lignite is underlain by impure, but I could not tell to what extent, though its character is like that which lies above the pure bed. This pure bed of lignite is underneath the yellow bed before mentioned, and the yellow bed when indurated into compact rock contains impressions of the leaves of a species of *Populus* identical with one so abundant on Tongue River in the lignite clay. There are also a few *Unios* in a friable condition. The lignite burns with a quiet, steady, red flame, gives out a good degree of heat, leaves comparatively little ash, ignites very readily with no breaking in pieces, no snapping, no bitumen. Fragments of turtle shells, and small pieces of a gum-like resin, like the common resin of commerce, were found at this locality. The whole bluff is thirty-five feet high, but taken with the dip of the beds there are probably forty or fifty feet of strata exposed, and only one seam of lignite which is pure enough for fuel."

The lignite of the cretaceous beds, so far as Dr. Hayden has observed it, is entirely worthless for economical purposes. It may be more pure where it is not exposed to the atmosphere. It was first noticed along the Missouri River, near the Omaha Indian reservation, in the sandstones of the Dakota group. It extends about forty miles up the Big Sioux River, never attains a thickness of more than two feet, and is very impure. It is barely possible that by sinking a shaft, that portion which is concealed from the atmosphere may be of some value for fuel. Near Smoky Hill, along the line of the Union Pacific Railroad, the Dakota sandstones again reveal a thin lignite bed. This, too, is very impure, and gives no promise of being useful as fuel. The lignite beds at Raton Mountains are regarded as a continuation southward of those at Denver and vicinity. Prof. J. W. Bailey, as far back as 1848, expressed the opinion that this Raton coal was probably of the age of the "Brora" coal. Since, therefore, we find no well-marked pure beds of lignites in the cretaceous rocks of the West, and throughout the Lignite Tertiary Basin of the Upper Missouri, extending southward nearly to Fort Laramie, and since we



find a large number of beds, some of which are quite pure, and may be used as fuel, it seems very probable that the coal of Denver and vicinity is of tertiary age, and that the formation is a continuation southward of the lignite tertiary beds of the Upper Missouri.

Dr. Le Conte spoke with regard to the lignite of the same region.

Prof. J. P. Lesley was elected Librarian for the ensuing year, and Thomas P. James was requested to continue his administration of the duties of Librarian until the determination of Mr. Lesley with regard to accepting the office be communicated.

The Standing Committees were then appointed as follows :

*Finance.*—Mr. Fraley, Mr. John F. James, and Mr. Marsh.

*Publication.*—Mr. T. P. James, Dr. Carson, Prof. Trego, Mr. Price, and Mr. Tilghman.

*Hall.*—Mr. Peale, Mr. P. E. Chase, and Mr. S. W. Roberts.

*Library.*—Dr. Bell, Dr. Coates, Mr. Price, Mr. Barnes, and Mr. Briggs.

On motion, the reading of the list of surviving members was postponed until the next meeting.

Pending nominations, Nos. 552 to 554 and 557 to 567, were read, and after discussion the Society proceeded to ballot for the candidates for membership.

All other business having been completed, the ballot boxes were opened, and the following named persons were declared elected :

Ralph Waldo Emerson, Concord, Mass.

Charles Sumner, United States Senator from Mass.

Hon. John Cadwalader, Philadelphia.

Dr. Harrison Allen, Philadelphia.

Andrew Mason, New York.

George F. Dunning, New York.

Dr. B. F. Shumard, St. Louis, Mo.

Dr. J. S. Newberry, Columbia College, New York.

Rev. M. B. Anderson, Rochester, New York.

Prof. Henry Morton, Philadelphia.

Prof. Charles J. Stillé, Philadelphia.

Dr. J. H. Packard, Philadelphia.

Prof. John F. Frazer, Philadelphia.

Rev. Henry S. Osborn, Easton, Penna.

And the Society was adjourned.

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*Stated Meeting, February 1st, 1867.*

Present, seventeen members.

Dr. WOOD, President, in the Chair.

Judge Cadwalader, a recently elected member, was presented and took his seat.

Letters were read from Hon. Charles Sumner, dated January 26, 1867, and from Dr. Harrison Allen, January 31, 1867, acknowledging the receipt of notice of their election, and acceptance of membership. Also, from William Procter, Jr., Corresponding Secretary of the Philadelphia College of Pharmacy, dated January 31, announcing the transmission of thirty-seven volumes of the American Journal of Pharmacy; and from the Historical Society of Philadelphia, acknowledging receipt of publications.

On motion of Judge Sharswood, the thanks of the Society was tendered to the College of Pharmacy for so valuable a contribution to the Library; also ordered, that the College of Pharmacy be placed on the list of Corresponding Societies.

Donations to the Library were announced as follows: From the Royal Norwegian University at Christiania; from the Literary and Historical Society of Quebec; from the Public Library of Boston; from the Editors American Journal of Sciences and Arts, and the Franklin Institute; from the New Jersey Historical Society; from the Wisconsin Historical Society, and the College of Pharmacy of Philadelphia.

The death of G. W. Featherstonhaugh, a member, was announced by Thomas P. James, as having occurred September 28, 1866, in his 80th year.