

Schoolcraft (H.R.) *John G. Silliman, from his friend*

A Memoir,

The author

ON

THE GEOLOGICAL POSITION

OF A

FOSSIL TREE,

DISCOVERED

IN THE SECONDARY ROCKS OF THE RIVER DES PLAINES.



READ BEFORE

THE AMERICAN GEOLOGICAL SOCIETY.

BY HENRY R. SCHOOLCRAFT,

A MEMBER OF SAID SOCIETY.

ALBANY:

PRINTED BY E. AND E. HOSFORD, 100 STATE-STREET.

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1822.

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A Memoir,

On the Geological Position of a Fossil Tree, discovered in the secondary rocks of the river Des Plaines.



THE spirit of enquiry which has recently been excited throughout our country in regard to objects of natural history, and physical research, has in no respect manifested itself in so conspicuous a manner; or been attended with results more important and satisfactory, than in the discovery and investigation of those fossil organized bodies, which are so plentifully imbedded in the rock strata of all our secondary regions: and there is scarcely a meeting of this institution passes without enriching the shelves of our cabinet, with the fossil remains of quadrupeds, plants, shells, insects, and other tribes of creation, who have been involved in the catastrophes which these solid strata have formerly experienced. But in contemplating those organic remains which have heretofore been brought to light, we shall find no object, which from its magnitude,---its complete conversion from the vegetable to the mineral state, and the striking features of its geographical and geognostic position, is so well deserving the consideration of the naturalist, as the fossil tree recently discovered in the secondary rocks at the source of the Illinois river. Having lately executed a desire I had long entertained, of visiting that remote section of country, I had the satisfaction, in company with his Excellency L. Cass, presiding magistrate of Michigan Territory, to examine this interesting object, which has heretofore only served to excite the wonder, and exercise the superstition of the Indian tribes: and I improve the moment while my recollections are still fresh, to communicate the facts and inferences which have occurred to me with regard to its geological era, and the natural features and appearances of the inclosing rock, and contiguous country.

The tract of country separating the southern curve of lake Michigan from the sources of the Illinois river, is a narrow plat of table land, composed of a stratum of compact limestone based up-

on floetz sandstone. This formation, which constitutes the north-eastern angle of the state of Illinois, where the waters of Michigan lake and the Illinois river often approach within a few miles of each other, and actually communicate at Chicago, continues east, and northeast, spreading in its course through Indiana into Ohio, and embracing the entire peninsula of Michigan. It is covered with a deposit of alluvial soil of a productive character, and presents to the eye a series of level prairies, interspersed with occasional forests, and irrigated by numerous small lakes and streams. These features may be considered as peculiarly characteristic of the district of country drained by the rivers Kankakee and Des Plaines, which uniting their channels at the distance of forty miles south of Chicago, produce the Illinois. The junction is effected on the southern slope of table land which confines lake Michigan to the north, at a point where the waters descend with considerable velocity, over a horizontal layer of shelving rock, which produces a series of rapids, and is continually yielding to the action of the water; but there is nothing in the mineral physiognomy of the spot so remarkable as the petrified tree, which is found in the bed of the river Des Plaines about forty rods above its junction with the Kankakee.

This extraordinary species of phytolites occurs imbedded in a horizontal position in a stratum of newer floetz sandstone, of a grey colour, and close grain. There is now fifty-one feet, six inches of the trunk visible. It is eighteen inches in diameter at the smallest end, which appears to have been violently broken off, prior to the era of its mineralization. The root-end is still overlaid by the rock and earth in the western bank of the river, and is two feet, six inches in diameter at the point of disappearance; but circumstances will justify the conclusion that its diameter at the concealed end, cannot be less than three feet. The trunk is straight, simple, scabrous, without branches, and has the gradual longitudinal taper observed in the living specimen. It lies nearly at right angles to the course of the river, pointing towards the south-east, and extends about half the width of the stream. Notwithstanding the continual abrasion to which it is exposed by the volume of passing water, it has suffered little apparent diminution, and is still firmly imbedded in the rock, with the exception of two or three places where portions of it have been disengaged, and carried away; but no portion of what remains is elevated more than a few inches above the surface of

the rock. It is owing, however, to those partial disturbances, that we are enabled to perceive the columnar form of the trunk---its cortical layers---the bark by which it is enveloped, and the peculiar cross fracture, which unite to render the evidence of its ligneous origin, so striking and complete. From these characters and appearances, little doubt can remain that it is referable to the species *juglans nigra*, a tree very common to the forest of the Illinois, as well as to most other parts of the immense region drained by the waters of the Mississippi. The woody structure is most obvious in the outer rind of the trunk extending to a depth of two or three inches, and these appearances become less evident as we approximate the heart. Indeed, the traces of organic structure in its interior, particularly when viewed in the hand specimen, are almost totally obliterated and exchanged, the vegetable matter being replaced by a mixed substance analogous in its external character, to some of the silicated and impure calcareous carbonats of the region. Like those carbonats, it is of a brownish grey colour, and compact texture, effervesces slightly in the nitric and muriatic acids, yields a white streak under the knife, and presents solitary points, or facets of crystals resembling calc spar. All parts of the tree are penetrated by pyrites of a brass yellow colour, disseminated through the most solid and stony parts of the interior,---filling interstices in the outer rind, or investing its capillary pores. There are also the appearances of rents or seams between the fibres of the wood, caused by its own shrinkage, which are now filled with a carbonat of lime, of a white colour, and crystallized.

The conversion of wood into stone---into stone-coal, into lignite, and into a variety of mixed bodies which possess characters intermediate between the vegetable and mineral state, involves the knowledge of facts and circumstances, respecting which, the most able naturalists do not pretend to have satisfied themselves. Generally speaking, these changes are attributable to the chemical action which dissimilar particles of proximate matter exert upon each other; but the actual process of nature in these transformations, is very difficult to be explained. That mineral coal, and coal-fields, which are always the produce of secondary countries, are the result of submerged forests subjected to the effects of heat modified by compression, appears to be conceded by all who admit the vegetable origin of mineral coal; but even here, promi-

nent difficulties are opposed to a satisfactory explication, and the most probable theories rest upon assumed premises. With respect to lapidified wood, or common petrification, which is entirely of local formation, very different causes must operate in the change, but the explanation of which, as less has been advanced on the subject, remains equally problematical. These conversions may be supposed generally to result from the immersion of the subject, before decay, in watery menstruæ, surcharged with silica, or other lapidifying principles, which penetrate the natural pores, and absorbent vessels of the wood, or induce an exchange of atomic affinity favourable to petrification. In cases of rents and fissures, these are manifestly closed by infiltration. The circumstances necessary to local petrifications may be supposed to vary greatly---more or less time may be consumed in the process---various agents employed, and their action so modified by natural causes, as to admit of explanation upon principles nearly as various as the occurrences themselves. There is reason to conclude that the subject under consideration, is the joint result partly of the infiltration of mineral matter into its pores and crevices prior to inclosure in the rock, and partly to the chemical action educated by the great catastrophe by which it was translated from its parent forest, and suddenly enveloped in a bed of solidifying sand. With respect to the difference which exists between its external and internal structure, we may suppose that it had partially submitted to decay, and became hollow, before the process of petrification commenced, and that the interior substance and the calc spar, were deposits from particles soluble, or intimately mixed with water, previous to the inclosure of the tree in its rocky envelope.

At the time of our visit (August 13, 1821,) the depth of water upon the floetz rocks forming the bed of the river Des Plaines, would vary from one to two feet; but it will be recollected that it was at a season when these higher tributaries, and the Illinois itself, are generally at their lowest stage. Like most of the confluent rivers of the Mississippi, and their tributaries, the Des Plaines is subject to great fluctuations, and during its periodical floods may be estimated to carry a depth of eight or ten feet of water to the junction of the Kankakee. At those periods the water is also rendered turbid by the quantity of alluvial matter it carries down, and a search for this organic fossil, must prove un-

successful. But during the prevalence of the summer droughts, in an atmosphere of little humidity, when the waters are drained to the lowest point of depression, and acquire the greatest degree of transparency, it forms a very conspicuous trait in the geology of the stream, and no person, seeking the spot, can fail to be directed to it. Although corresponding in its direction to the apparent course of the formation in which it rests, it forms an acute angle with the natural seams and fissures which chequer the surface of the rock; and from an effect analogous to carbonization, the exterior rind and bark of the tree, have acquired a blackish hue, while the inclosing rock, being a light grey, presents a contrast that is calculated to arrest the attention of the observer.

It has been stated that the table land, separating the waters of lake Michigan from those of the Illinois river, consists of a formation of calcareous rock superimposed upon a stratum of floetz sandstone; but a few remarks may here be added with respect to the latter, which appears to pervade the country in every direction to an immense distance. There is reason to conclude, that it belongs to the same formation which is seen in association with mineral coal near the junction of Fox river with the Illinois, about fifty miles below; and it may be worthy of enquiry, how far the occurrence of petrified wood in the same formation which produces pit-coal, can be supposed to favour the theory of the vegetable origin of the latter. A similar formation of sand-stone is also seen upon the banks of the Wabash, between the Mississiniway village, and the mouth of the Tippecanoe river---a distance in a direct line, due east, of probably one hundred miles. It is also seen around the shores of Saganaw Bay on lake Huron; and at Roche de Bœuf, Rock Fort and other places, along the lower part of the valley of the Illinois. It is probable that the sand-rocks near the Portage Des Sioux, on the Mississippi river, and at Alton, twenty miles below, where it possesses a fine grit, and is quarried for architectural purposes, are likewise referable to this formation. It is every where found in a horizontal position, and differing only with respect to hardness, and colour,---points which do not necessarily imply a different formation. The remains of fossil organized bodies in this stratum, are not abundant, or have not been successfully sought; and it appears to be wholly wanting in the various species of concholithes so plentifully imbedded in the calcareous formation which rests upon it. It is probable that future

observations will prove, that its organic conservata are chiefly referable to the vegetable kingdom. It is certain, that this inference is justified by the facts which are before me, and particularly by the characteristic appearances of the strata in the bed of the river Des Plaines, where the imbedded walnut, is the only species of petrification to be found. At a short distance above, where the bed of the Des Plaines approaches nearer the summit level, limestone ensues, and continues from that point northward to the shores of lake Michigan. In the vicinity of Chicago, where this limestone is quarried for economical purposes, it is characterized by the fossil remains of molluscus, and other aquatic animals.

Lake Erie is five hundred and sixty-five feet above the tide waters of the Hudson river, i. e. above the Atlantic ocean at high tide.* Detroit river, which is twenty eight miles in length, estimating from wind-mill point at the foot of lake St. Clair, to the mouth of the river Huron of lake Erie, may be computed to have a mean fall of six inches per mile, creating a descent of fourteen feet. The river St. Clair, which is thirty miles in length, may be stated to flow over a bed which is an inclined plane, having a mean depression of five inches per mile for a distance of twenty eight miles, and has a strong rapid of two miles at its head, the descent of which cannot be less than nine feet, making the aggregate fall of this river twenty feet eight inches. There is a strong suction above the rapids of St. Clair, extending several miles into lake Huron, which is here drawn out to a narrow strait, and it is generally, but perhaps erroneously, supposed, that lake Michigan is a trifle higher than lake Huron. It will be adding but four inches to the estimate for these descents, to call lake Michigan six hundred feet above the Atlantic ocean. There exists a water communication between the head of lake Michigan at Chicago, and the river Des Plaines, during the periodical rises of the latter, but its summer level is about seven feet lower, at the termination of the Chicago portage, than the surface of the lake. From this point to its junction with the Kankakee, a computed distance of fifty miles, the bed of the Des Plaines may be considered as having a mean southern depression of ten inches per mile, so that the floetz rocks at its mouth, lying on a level of forty eight-feet eight inches below the surface of lake Michigan, have an altitude, which cannot vary far, from five hundred and fifty feet above the Atlantic. There

* Public Documents relating to the New-York Canals, with an Introduction, &c. by Col. Haines.

are no mountains for a vast distance either east or west, of this stream : it is a country of plains, in which are occasionally to be seen alluvial hills of moderate elevation ; but the most striking inequalities of surface proceed from the streams which have worn their deep-seated channels through it ; and an oceanic overflow, capable of covering the country, and producing these strata by deposition, would also submerge all the immense tracts of secondary and alluvial country, between the Alleghany and the Rocky Mountains, converting into an arm of the sea, the great valley of the Mississippi, from the Gulph of Mexico north, to the Canadian lakes. We find in the alluvial soil along the Illinois and Des Plaines, blocks of granite, hornblende, and gneiss, exhibiting the same appearances of attrition, and of having been transported from their parent beds, which characterize the secondary table lands along the margin of the great American lakes, the prairies of Illinois, and the western parts of New-York.

The country along both banks of the river Des Plaines, at the spot where this imbedded fossil tree occurs, is a level and beautiful prairie, covered with a luxuriant growth of grass, and interspersed with small groves of oaks and hickories----the *quercus alba*, and *juglans squarrosa*, of the American forest.

These appearances characterize the river Des Plaines from its source near the Millewacky of lake Michigan to the point of its junction with the Kankakee. The latter stream also flows, in its whole length, through rich and level prairies and savannahs, where there is scarcely a hill to intercept the view. In some places it is overshadowed by scattering clumps of oaks, which throw a refreshing coolness over its banks, but most commonly its waters are exposed to the direct rays of the sun. Such too, is the rural complexion of the banks of the Illinois, from the confluence of its principal tributaries, at the fossil tree, to the lower extremity of Peoria lake, and if we survey the entire valley of the Mississippi, with all its confluent rivers, for that portion of it, which has been distinguished by the hand of nature as pre-eminently beautiful to the eye, it is this ! But it is not alone to the sylvan exterior of the country----to the pleasing variety and succession of prairies, forests, streams, and precipices ; or to the geological arrangement of its strata and soils, that we find our reflections irresistibly directed. Every emotion raised by the contemplation of pastoral and picturesque objects, must yield to considerations of the na-

tional and domestic purposes, to which it is so admirably adapted by its fine climate, and productive soil. We cannot survey, without a feeling of calm delight, a country prepared for the future abode of millions of the human species who are destined to augment our national resources, and to transmit to posterity the blessings of our republican institutions : and perhaps there are few individual scenes along the valley of the Illinois where the observer will partake of a higher gratification from these sources, than those furnished by the region characterized by the confluence of the Des Plaines with the Kankakee, the conspicuous locality of the subject of this paper.

“The knowledge of the general and grand arrangement of nature, observe the London Geological Society, must be collected from a number of particular and minute instances, and on this ground the slightest information relating to the structure of the earth is to be regarded as of some importance. The miner, the quarrier, the surveyor, the engineer, the collier, the iron master, and the traveller in search of general information, have all opportunities of making geological observations ; and whether these relate to metallic productions, the rocks, the strata, the coal of any district, or the appearances and forms of mountains, the direction of rivers, and the nature of lakes and waters, they are worthy of being noticed.”* Not only so, but whatever facts and circumstances can be correctly stated and authenticated, with respect to these topics, become objects of solicitude and importance to the geological inquirer, since it is from these only, that he is surely enabled to arrive at any conclusions of moment, and to separate the sound from the fallacious theory : and perhaps there is nothing in the improvements of modern science which has tended in so great a degree to facilitate, and in some measure to direct, geological research, as the study and investigation of fossil organic relics.

The occurrence of marine exuvia and petrifications at great heights above the ocean, had excited remark at an early period ; but during that era when geology was little more than a series of fanciful theories, and splendid dreams, little attention was bestowed upon such facts. Bernard de Palissy was the first to affirm that calcareous mountains are the result of decomposed shells ; and those who succeeded him, in the study of natural history, for a long time were content to infer, that the ocean had formerly submerged

* Bruce's Mineralogical Journal.

the heights which contained these petrifications. To Sir Isaac Newton, Dr. Maskelyne, Saussure, De Luc, Hutton, La Marck, Cuvier, Maclure, Mitchill, and other eminent philosophers and naturalists, geology is indebted for a mass of valuable information respecting the density and the structure of the earth. But it remained for Werner, who was the first to perceive an order in those strata, in which all who had gone before him, saw nothing but confusion; also, to point out the important application of fossil organic bodies in elucidating the eras of stony strata, and the natural order of their superposition. According to the system of this celebrated philosopher, as taught, and illustrated by Dr. Cooper,* "all the more extensive and universally found strata, or formations of the globe, have been formed, partly by crystallization of substances dissolved, or intimately mixed with the watery fluid that contained them in a chaotic state----partly by subsidence of the particles mixed with the water----and in cases of volcanic strata, by volcanic eruptions. His general distinction of primitive, transition, secondary, alluvial, and volcanic soils or rocks, appears to me too probable to be rejected; nor is it possible for any person who has seen, (as may very commonly be seen,) granite and quartz; also plants and soft shells, surrounded by, and enveloped in, limestone, flint, silicious grit, and argillo-silite, to doubt, but the great majority of rocks and stones, are formed by crystallization and subsidence of particles dissolved or mixt in water."

In proceeding to distinguish and classify the great formations surrounding the nucleus of the earth, in conformity with these principles, the following characters have been chiefly adopted and employed :----

1. The order and relative position of the strata, or formations; whether overlaying, embracing, or subtending: regular or non-conformable.

2. The structure of the formations; whether in beds, or layers; vertical, inclined, or horizontal; crystallized, or amorphous.

3. The imbedded fossil organic remains; whether oceanic or terrestrial, coralline, concholite, phytolite, ichthyolite, &c.

* President of South-Carolina College

The differences in mineralogical character and constituents form the generic distinctions, of which the species are in general few, and well defined. As I am acquainted with no explanation of the principles of the Wernerian arrangement of rocks and soils, which is at once so concise and satisfactory as that furnished by Dr. Cooper, I shall here endeavour to present an outline of it, with as little deviation from his method and language, as circumstances may render necessary.

I. " There appears to be a series of strata, or as Werner calls them, formations, that may be considered as surrounding the nucleus of the earth. The first formed or lowest series always preserve the same situation to each other except where occasional eruptions, or circumstances not of a general nature, make a variety in their situations. These strata are not only the deepest, but they are also the highest that are observed in the crust of the earth; forming the tops of the highest mountains. They are characterized by an appearance of crystallization, and by containing no remains of organic matter, animal or vegetable. The strata or formations that in general constitute this first, deepest, highest, and crystallized series, are, granite, gneiss, mica-slate, clay-slate, primitive greenstone, granular limestone, serpentine, porphyry, and sienite. These formations are so generally found, and in the same situations as incumbent upon or subtending each other relatively, that they may be considered as universal. Their crystallized appearance shews that their particles have either been dissolved or very finely suspended in water, so that the attraction of crystallization has been free to operate: that this water has been deep, so that the lowermost parts of it have not been much agitated during the crystallization, which would otherwise have been more confused than it is: and indeed the oldest formations are the best crystallized. A part of the water covering the nucleus must have been taken up as water of crystallization, in the primitive formations. When these were deposited, there were no vegetables formed: of course no animals: nay even the sea was unpeopled, for there is no trace of any organic remains in these strata. Even the belemnites, the asteriæ, the echini, the entrochi, the most simple forms of oceanic animal life, do not occur until the transition strata appear. Hence the propriety of denominating these formations *primitive*.

II. "By processes of nature, besides the consumption of water by the new crystallized masses, to us unknown, the waters appear to have diminished. The highest parts of the primitive formations became the shores to the water superincumbent on their bases and middle regions; the simplest forms of oceanic animals came into existence, the mosses and lichens of high latitude, would generally occupy the surface of the primitive strata, gradually decomposed by the alternate action of air and water after many ages. During this period, while the strata were in a state of *transition* from the chaotic to the habitable state, other deposites would gradually be made from the waters, now decreased in quantity; and take their place below the summits of the primitive range. Those summits being exposed to the action of the atmosphere, of rains, of frost probably, and to the action also of the waters with their contents still incumbent on the earliest strata, would furnish masses and particles washed away, which would mingle with the deposites of the transition series. This series therefore, will exhibit appearances of mechanical and chemical intermixture of earths and stones such as are found in the silicious porphyries, the graywacks, the silicious and argillaceous hornblende rocks, the elder red sandstone, &c. During the period when these transition formations were deposited, there would be no land animals, for there would be no vegetables for them to feed upon.--- There would be no vegetables unless some few lichens, mosses, or ericas, that would find foot hold upon the slight decomposition that after the lapse of some ages would take place on the surface of the primitive rocks. The sea only would be peopled, and that but sparingly; for in that mass of muddy water, none but the lowest and most inferior grades of animal life, and such as do not inhabit deep water, could exist. Hence we find the transition formations contain in their substances, some belemnites asteriæ, entrochi, echini, &c. but no organized vegetable substance except very rarely in the latest rocks of this series, and no remains whatever of terrestrial animals. Indeed in the high latitudes of the outgoings or summits of the primitive strata, very few vegetables even at the present day can live. No vegetation fit for animal life, could take place until the transition, and most of the next series of *secondary* or *floetz* formations had subsided. These would occupy lower and lower situations, till a rich soil from every kind of intermixture of earth mechanically deposited, would afford a

proper temperature of region, and an easily decomposed soil wherein vegetables could grow.

III. "Next to the transition series, come the *secondary*, or as the German mineralogists call them, the Floetz rocks; so called, because they appear to be more floated or horizontal; though I confess the appellation does not appear to me peculiarly appropriate. These strata, consist principally of sandstone, limestone, sometimes foetid from bituminous impregnations, sometimes shelly; secondary greenstone, graphite, coal, gypsum, rock salt. I have observed that the Alpine heights of the primitive mountains could at no time furnish much food. The same remark, but in a less degree, will apply to the transition range. The low and kindly climates occupied by the secondary series----the soft and decomposable nature of these depositions would furnish the true theatre of vegetable life: and until these regions were filled with vegetables, the race of animals could not have been produced; for on what could they subsist? Gramenivorous animals therefore must have succeeded the various forms of vegetable existence, and carnivorous, the gramenivorous. The vegetable matter imbedded in the substance of the secondary strata, will consist of the remains of vegetables that grow in the transition strata; and the animal remains will consist chiefly of such animals as were produced in the early stages of animal existence, particularly the smaller aquatic animals; and of these chiefly shell fish, as shells are not so soon decomposed as mere animal substance."*

It is to the latter class of depositions----to the secondary series, and to the latest, deposits of this series, that we must refer the sandstone of the river Des Plaines, in which we find a walnut, of mature growth, enveloped by, and imbedded in the rock, in the most complete state of mineralization: and since all geological writers who subscribe to the Neptunian origin of the earth, are constrained to employ the agency of oceanic depositions of different eras, in explaining the structure of the earth's surface, it is one of the most obvious and important conclusions, to be drawn from the fact, that such submersions and depositions of rock matter have taken place subsequent to the existence of forests of mature

* Emporium of Arts and Sciences.

growth; and that the rock strata and beds composing the exterior of the earth are the result of different geological epochs, and of successive subsidences of chaotic matter---positions which have been so severely attacked and so often denied, particularly by the disciples of the Huttonian school, that it is not without a feeling of lively interest, I communicate a discovery which appears so conclusive on the subject.

I have dwelt more minutely upon the appearances which indicate the locality of this fossil organic body, and the natural features of the surrounding country, under an impression that these observations may be found useful and acceptable as a guide in conducting to the spot the naturalist and the traveller who may hereafter be penetrated with a desire, or stimulated by a curiosity to explore that remote and uninhabited region.

Considerations arising from the frontier position of the country, and the infrequency of the communication, have also induced me to draw from incidental sources, a corroboration of the facts advanced; and I here introduce a correspondence with governor Cass, of Michigan, which, while it confirms the preceding account in all its essential details, contains several pertinent observations, characteristic of the subject under review, that had escaped my notice.

TO HIS EXCELLENCY LEWIS CASS.

Chicago, September 17th, 1821.

DEAR SIR,

I consider the petrified tree, discovered during our recent journey up the Illinois, so extraordinary an object in the natural history of the country, and calculated to lead to conclusions so important to the science of geology, that I am anxious to avail myself of your concurrent testimony as to the fact of the existence of the tree in a mineralized state, and the natural appearances of the spot where it lies imbedded. I feel the more solicitude on this subject, as I am aware that any description of this phenomenon which I may be induced to communicate to the public, will be received with a degree of caution and scrutiny which it is the province of the naturalist to exercise, whenever any discovery is announced affecting the existing theories of the natural sciences, or tending to increase the volume of facts, upon which their advance-

ment and perfection depend. I am aware, also, that whatever degree of caution and vigilance it may be proper to exercise to prevent errors from mingling with the sound doctrines of the physical and other sciences, still more care and circumspection is requisite in examining facts which affect the progress of geology.

It is, with respect to this science, as it has been with some others, whose progress has been slow, and clogged with many erroneous theories, which it has required the genius and sagacity of succeeding centuries to disprove, and eradicate. But however visionary speculations may have retarded the advancement of other branches of human knowledge, they have been multiplied with an unfortunate fecundity upon this, and for a long period it continued to be the theme upon which philosophers have rather employed their fancies than their judgments. It behooves us now, that we begin to see the mist clearing away before us, and a stately edifice rising from a splendid heap of rubbish, to be extremely scrupulous with regard to the theories we may advance, and to authenticate with a cautious exactitude, the facts and appearances, which our rock strata present for consideration. Among these appearances, I conceive the discovery in question, to be one of the most important which has, as yet, been announced ; and you will readily perceive, from the tenor of the foregoing observations, the propriety of the course which I have adopted on this occasion.

You are the only person, whose opinion would carry with it any weight, that accompanied me, in order to explore and examine this organic fossil ; and as the extra tour, which it was necessary to make, was performed under circumstances of great personal fatigue, the public will consider your conduct on this occasion, as another proof of that zeal which you have heretofore manifested in the promotion of scientific objects. To me, this proof was wholly unnecessary, because I have been long sensible of the deep interest which you take in the progress of American science and literature---in the exploration of the geography of our country---in the development of its natural resources---in the history and condition of its aboriginal tribes, and in the general prosperity and advancement of our republican institutions and national welfare : and I embrace the present occasion to tender to you my acknowledgments for the alacrity, with which you have, during the several expeditions in which I have had the honor to

be associated with you, afforded me every facility to collect information respecting the natural history of the regions explored.

I am, with great respect, and regard,

Your most obedient servant,

HENRY R. SCHOOLCRAFT.

GOVERNOR CASS IN REPLY.

Washington, October 25th, 1821.

DEAR SIR,

Your letter of Sept. 17th, did not reach me until a few days since.

I cannot believe that any testimony of mine will be necessary to corroborate the account, which you may present to the literary world, of the petrified tree, seen by us in the bed of the river Des Plaines. But I can have no objection to state the facts, connected with this unexpected discovery, leaving to others, such speculations as may arise from them.

The Illinois river is formed by the junction of two streams, the Kankakee proceeding from the northeast, and the Des Plaines from the northwest. This junction takes place at the computed distance of sixty miles from Chicago; but probably within forty miles of that post.

About forty rods above the confluence of these streams, and in the bed of the Des Plaines, this singular instance of the transmutation of a large tree into a solid mass of stone, is found. The branches of the tree have disappeared, but the trunk agreeably to our mensuration, is fifty-one, $\frac{6}{12}$ feet in length, from the small end to the bank of the river. It is here covered by the earth, and how much further it extends we had not the means of ascertaining. The appearance of the wood and bark indicates, that it was a black walnut, the *juglans nigra* of our forests. We computed its original diameter at the place where it is concealed in the earth, to have been three feet, and at the other end eighteen inches. The texture of the wood, and the bark and knots, are nearly as distinct as in the living subject, and the process of decay had not commenced previous to the commencement of this wonderful conversion. Every part of the mass which we could examine, is solid stone, and readily yields fire by the collision with steel.

When we visited the spot, the water of the river was at the lowest stage; but there was no part of the tree within some inches of the surface. The rocky bed of the stream, was formed round, and upon it. We raised from it pieces of the rock, which were evidently in situ, and which had been formed upon the tree posterior to the period of its deposit in its present situation. This rock is a species of sandstone, whose characteristic features must be well known to you.

There are no mineralized substances, of vegetable origin, in the vicinity of this specimen, nor are there any appearances which indicate, that its present condition has been caused by any peculiar property in the waters of the Des Plaines.

These are all the facts, which occur to me, and which are important in the examination of the subject, or capable of guiding the geologist in his pursuit of the investigation to which this discovery may give birth.

The collection of the materials must precede the construction of the edifice. Theories founded on gratuitous assumptions, or on facts erroneously or falsely reported, cannot stand the test of time and investigation. In those sciences which depend upon a knowledge of facts, and of the operations of nature, patient and laborious research and observation are our first duties. Crude and hasty speculations present formidable obstacles to the march of science, by distracting the attention of the observer, and by producing and cherishing a disposition to bend the facts to the theory.

A habit of generalization may be important in every department of life but the boundary between imagination and reason, in the application of this power, is so obscurely defined, that great caution should be observed, lest the brilliant suggestions of the one, be mistaken for the sound deductions of the other.

With much respect,

I am, dear sir,

Your obdt. Serv't.

LEWIS CASS.

