# SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.
VOL. XV. No. 385.

NEW YORK, JUNE 20, 1890.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

## THE CHEROKEES IN PRE-COLUMBIAN TIMES.

### IV.

HAVING traced back the tribe by the mound evidence thus far along the traditional line of migration with strong probability of being correct, we are prepared to take another backward step. As will be observed by the careful reader, reliance has been placed in this investigation upon what appear to be indications of peculiar customs. Connection with the group of which the great Grave Creek tumulus forms a prominent feature seems to be established, thus verifying the ancient "oration," or tradition, of which Haywood speaks. Allusion has also been made to the similarity, in some respects, of the works of the Kanawha group to those of Ohio, but there is more to be added on this point. Not only does it appear that it was a custom in both these sections to enclose the bodies of the dead in bark, to bury in wooden vaults, and to form at the bottom of mounds basin-shaped clay masses which have received the name "altars," but also to arrange wooden vaults the same way in the tumuli, and to build other structures similar to each other in form.

In confirmation of the statement in reference to the wooden vaults, attention is called to the description by Mr. H. L. Reynolds, in a recent bulletin of the Bureau of Ethnology, of a mound he explored in Paint Creek valley, Ohio. This is the "square truncated mound" shown on No. 1, Plate XXI., "Ancient Monuments," which, by its close proximity to the combined square and circular enclosures known as the "Baum Works," is supposed to bear some intimate relation thereto.

As the description has been published, it is only necessary here to allude to such portions as have a bearing on the question before us.

At the time it was measured by Messrs. Squier and Davis it was a hundred and twenty-five feet in diameter, and fifteen feet in height. Since then its annual disturbance by plough and freshet has reduced the height to twelve feet, and increased the diameter to a hundred and forty. The same agencies have likewise destroyed its pyramidal form, so that now it resembles an upturned basin. It was composed, for the most part, of clay mottled with black loam, and in some places with patches of a grayish, plastic lime. The prominent feature is the evidence that two large wooden vaults, or structures of some kind, had been built here, one above the other, as in one of the Kanawha mounds heretofore described. Both of these structures had been built of upright posts, five inches in diameter and ten inches apart, forming a regular circle thirty-six feet in diameter. The lower circle consisted of a single series, but the upper of two, eighteen inches apart, the outer series standing directly over the posts of the lower structure.

Separating the two structures was what the explorer terms "a thin, sagging streak of burnt clay," but which reminds us strongly of the basin-shaped clay beds found in the mounds of East Tennessee and Kanawha valley. Here and there upon its surface were traces of black wood-ashes and a small quantity of white bone-ashes. Horizontal timber moulds, smaller in size than the posts, filled, in places, with charcoal, could be seen distinctly lying against the inside of each line of posts. These appear to have been cross-beams or stays used for bracing-purposes. On the east side there was a break in each circle, of three feet two inches, in which there were no post-moulds. Within each circle, at different depths, and placed without any apparent regularity, were several skeletons Lying on the natural surface of the ground, running from the base of the lower series of posts toward the centre of the circle, were the remains of logs about eight inches in diameter. Directly over these timbers was a horizontal layer of decayed and burnt wood or bark, averaging half an inch thick. Notice should also be taken of the fact that this mound is on the lower level near the creek,—in fact, is one step or terrace below the bridge landing,—and is almost yearly surrounded by water from the overflow.

It is true that this mound shows some indication of being comparatively recent: in fact, Mr. Reynolds found in it a small piece of bone which he thought had been shaped with a steel knife. This supposition, if accepted, would seem to be incompatible with the theory that attributes works of this type to the Cherokees. We give the data, however, as they are, and will present our explanation further on.

We observe in this mound the somewhat unusual arrangement of one wooden structure above another, seen elsewhere only in the Kanawha and Grave Creek groups; we also notice that in each case the walls of these structures are formed by standing the timbers upright. There is, however, one particular worthy of note, in which those of the Ohio mound differ from the others; to wit, the much larger size of the former, suggesting the possibility that they were council-houses, and not vaults. But should this conclusion be adopted, we find parallels in the customs of the Cherokees and mound-builders of the Cherokee district.

Mr. Lucien Carr of Cambridge, Mass., explored a mound in Lee County, Va., in which were found indications of a large circular or oval wooden structure. From his description, as given in the "Tenth Annual Report of the Peabody Museum," we take the following extracts:—

"The mound in question, a truncated oval in shape,

stands alone on a gentle slope; and, having been in cultivation for many years, the wear and tear of the plough and the gradual weathering-away of the summit made it impossible to get at its exact measurements. A careful examination, however, showed it to be about three hundred feet in circumference at the base, and nineteen feet in height. . . . On the top was a level space, oval in shape, the diameters being respectively about fifteen and forty feet. At a distance of eight or ten feet from the brow of the mound, on the slope, there were found buried in the earth the decaying stumps of a series of cedar-posts, which, I was informed by Mr. Ely, at one time completely encircled it. He also told me that at every ploughing he struck more or less of these posts, and, on digging for them, some six or seven were found at different places, and in such order as showed that they had been placed in the earth at regular intervals and according to a definite plan. On the top, in the line of the greatest diameter, and near the centre of the mound, another and larger post or column, also of cedar, was found. . . . The location and regularity of these posts, and their position with reference to the central column, would seem to show that the summit of the mound at one time had been occupied by some sort of a building, possibly a rotunda or council-chamber, as the ground plan answers to the description of one which Bartram found in the town of Cowe on the 'Tanase' River among the Cherokees, the very people who formerly held all this section of country."

In the mound, and within the circle of posts, several skeletons were found placed irregularly and at different depths, as in the case of the mound opened by Mr. Reynolds. Mr. Carr further remarks that "there were found scattered about everywhere, throughout the whole of the upper half of the excavation, in different places and at various depths, beds of ashes, burnt earth, and charcoal,—usually cedar or chestnut,—sometimes one above and overlapping the other, with an intervening stratum of earth of greater or less thickness."

This is an important and interesting fact in comparing the works of the different sections alluded to.

Indications of similar structures were found in some three or four mounds explored by the bureau assistants in East Tennessee. In one case the series of posts was found at considerable depth, showing that earth had been added subsequent to its erection.

Adair says that "every town has a large edifice which with propriety may be called the mountain house in comparison of those already described. But the only difference between it and the winter house or stove is in its dimensions and application. It is usually built on the top of a hill, and in that separate and imperial state-house the old beloved men and head warriors meet on material business, or to divert themselves and feast and dance with the rest of the people."

The winter houses referred to were, according to his statement, made as follows: a sufficient number of strong, forked posts were fixed deep in the ground "at a proportional distance, in a circular form, all of an equal height, about five or six feet above the surface of the ground; above these they tie large pieces of the heart of white oak. . . . In the middle of the fabric they fix very deep in the ground four large pine posts in a quadrangular form."

According to Mr. Mooney,—who has furnished the writer with some particulars on the subject in addition to what are found in his paper heretofore mentioned,—on account of the sanctity attached to the location in the minds of the people, a new town-house was usually built upon the site of the old one. The Cherokee town-houses were necessarily located in the immediate vicinity of a stream, and where there was about it a level area. The reasons for this were (1) that the dances were held around and about these public houses, frequently beginning inside, and ending on the level area around them; and (2) ceremonial bathing formed an important part of the proceedings connected with their sacred dances, such as the green-corn dance and the medicine dance, where the whole body of the performers came out of the town-house to the water, and, after certain ablutions, returned thereto. It was necessary, therefore, that the building should be near a stream. As the level areas in their narrow mountain valleys are often overflowed, it is quite probable that in order to place these sacred houses above the floods, they were, as stated in tradition, located on artificial mounds. "Moreover," adds Mr. Mooney, "the town-house was the depository of numerous ceremonial objects which could not readily be removed in a sudden emergency. And, as it is said traditionally that a sacred fire was kept burning on a peculiar hearth excavated in the centre of the earthen floor, this could not be removed from the hearth-place, and hence some provision for its protection was necessary."

Whatever may be the opinion entertained in regard to the relation of the mound-builders of the different sections to each other, or be thought of Mr. Mooney's suggestions, it must be admitted that the above statement gives a satisfactory reason for placing the pyramidal mound of the Baum Works, Ohio, on the lower level near the creek, rather than on the higher level occupied by the square and circle.

In confirmation of Mr. Mooney's statement, we find the following in Adair's "History." Speaking of the Cherokees, he says, "Their towns are always close to some river or creek, as there the land is commonly very level and fertile, on account of the frequent washings off the mountains, and the moisture it receives from the waters that run through their fields. And such a situation enables them to perform the ablutions connected with their religious worship."

Another respect in which the Kanawha works resemble those of Ohio is the presence among them of enclosures, some of which are approximately true circles. There is also among the former a true "hill-fort," located on the top of a bold and partially isolated headland, overlooking the valley for some miles up and down the river.

We have now, as before stated, travelled back along the path of migration to the Ohio region, the mound testimony agreeing substantially at every step with the traditions. As we now enter a well-known field which has been somewhat thoroughly cultivated by archæologists, and which is considered, in the minds of many antiquarians, sacred ground, we are aware that we must move with cautious steps, as any attempt to bring forward a new theory in regard to the ancient works of this region is attended with more than ordinary risk. It will therefore be appropriate to introduce at this point some general considerations which have a bearing on the questions at issue.

One result of the more recent explorations and study of the ancient works of the mound region is the conviction that the mound-builders were divided into numerous tribes, though belonging substantially to the same culture state, which was of a lower grade than that attained by the people of Mexico and Central America, and apparently somewhat less advanced than that of the Pueblo tribes of New Mexico and Arizona. However, there are no data to justify the belief that they pertained to different "races," using this term in its broad and legitimate sense. This assertion will, of course, be questioned by some of our archæologists who base their conclusions in reference to this subject on the forms of the skulls. Without entering into a discussion of this question, which would draw too heavily on our space, and is not appropriate at this point, it may be asserted, with the assurance of being sustained by the facts, that the study of the forms of mound-builders' skulls has not been productive of any satisfactory results bearing upon the question of races or nationality. This is shown by the remarks of Mr. Lucien Carr, in his paper on the "Crania from Stone Graves in Tennessee," published in the "Eleventh Annual Report of the Peabody Museum:"—

"Names, however, are of but little import: the one central fact is to be found in the presence in these graves of skulls, which, after excluding those tabulated as distorted or much flattened, are shown by their measurements to belong to the two extremes of classification, and which cannot be brought into the same group without doing violence to all ideas of craniology. If the terms 'dolichocephalism' and 'brachycephalism' mean any thing, then these two forms of skulls are to be found here, and there is no method of measurement sufficiently elastic to include them both under one head. This fact is by no means new or novel, though it has not been many years since Dr. Morton and anthropologists of his school stoutly maintained the uniform brachycephalic type of crania among all the American aborigines except the Eskimo. Of late years, however, the contrary opinion, so ably advocated by Dr. D. Wilson, has been steadily gaining ground, and to-day there is little hazard in saying that it is generally received. But the evidence furnished by this collection seems to lead still farther; and we are required not only to admit the existence of different forms of skulls, as there well might be in different tribes, but also to conclude that they are to be found among the same people or peoples living under the same tribal organization, much after the fashion in which they are to-day known to exist among the composite peoples of our great commercial cities. This is hardly in accord with the opinion generally held as to the purity of race in prehistoric times; but it seems impossible to avoid the conclusion, if it be admitted that the fact that these skulls were found buried together indiscriminately in the same style or set of graves in the same mound, and so far as we can judge at or near the same time, is any proof that they belonged to people of the same tribe and race."

It will be seen from this conclusion of one best qualified to express an opinion on this subject, that a classification of the mound-builders upon the forms of the skulls is not only unsatisfactory, but is misleading and valueless. That the people found inhabiting the continent at the time of the Columbian discovery may have been, and probably were, derived from different races, is not denied. Possibly the mound-builders of the section herein designated the "mound region" may have been derived from different races; but, if so, this cannot be determined by the crania found in the mounds of the Mississippi valley. Indications of tribal peculiarities, of variations in local customs depending on environment, and perhaps traces even of customs peculiar to certain stocks or families, are observed in the ancient works of the region indicated, but nothing whatever to suggest different races. This is a bold and venturous statement to make, in view of what has been published on this subject; nevertheless the writer feels justified in making it, and believes that the data, when thoroughly studied, will sustain him.

The evidence of division into tribes is found in the numerous indications of intertribal warfare, such as the works of defence of various kinds met with in different sections. For instance, there are the hill-forts of Ohio, of which Fort Ancient is a well-known example. No one has ever doubted that these were constructed for defence. Nor is it likely the other enclosures, such as the circles, squares, and octagons, would have been ascribed to any other object but for the introduction of the theory of a semi-civilized, mound-building race, with its priesthood and religious ceremonies. Assume that the authors were the ancestors of the Indian tribes found inhabiting the country, and the idea of this overpowering religious influence vanishes at once. The enclosures of New York, Michigan, Kentucky, Tennessee, south-eastern Missouri, and the Gulf States, are admitted to be defensive works. In addition to these, there are in many places defensive walls and embankments across projecting spurs, peninsulas, and river bends. Village sites are also often found in positions which could have been selected for no conceivable reason except that they might be easily defended against attack.

The only reasonable explanation of these facts, and of the evidences of different customs found in the mounds, is that the mound-builders consisted of different tribes. Even in the comparatively limited area of Ohio are found abundant evidences of the presence of different tribes, and of successive occupation by different peoples. The same thing is true also of the areas embraced in eastern Iowa, Wisconsin, Illinois, Indiana, and Kentucky; but, on the other hand, western New York, a strip along the lake border of Ohio, and the Cherokee region of East Tennessee and western North Carolina, appear to be exceptions to this rule.

As the connection indicated between the works of the Kanawha valley and those of Ohio relates primarily to the sepulchral and so-called "sacrificial mounds," and secondarily to the geometric enclosures of the type found in the Scioto valley, attention is called to the latter.

Forty years ago, Messrs. Squier and Davis, while admitting that some of the enclosures of this State were built for defence, advanced the theory that a large number of the earth-works were designed for sacred or religious purposes, and places for performing superstitious rites,—a view which has generally been adopted by subsequent writers. That this theory was based upon a preconceived notion held by these authors, is apparent from the following statement in "Ancient Monuments:" "We have reason to believe that the religious system of the mound-builders, like that of the Aztecs, exercised among them a great, if not a controlling,

influence. Their government may have been, for aught we know, a government of the priesthood,—one in which the priestly and civil functions were jointly exercised, and one sufficiently powerful to have secured in the Mississippi valley, as it did in Mexico, the erection of many of those vast monuments which for ages will continue to challenge the wonder of men."

Dr. Daniel Wilson not only takes the same view in his "Prehistoric Man," but expands and emphasizes it. He even goes so far as to assert that the earth-works of the Iroquois present, in some respects, a greater contrast to those of the mound-builders (of Ohio) than the latter do to the elaborate architecture of Mexico and Yucatan. "They form groups," he continues, "of symmetrical enclosures, square, circular, elliptical, and octagonal, with long connecting avenues suggesting comparisons with the British Avebury, or the Hebridean Callernish; with the Breton Carnac, or even with the temples and sphinx avenues of the Egyptian Karnak and Luxor."

If we lay aside all preconceived notions of a highly cultured race of mound-builders with a priestly hierarchy, and study these remains in the light of such data as we possess, instead of looking at them through the halo of a finely wrought theory, the inappropriateness of such comparisons becomes apparent. What shall we say of the attempt to compare the dirt walls of these groups of combined circles and squares with the great temple of Karnak, termed by Fergusson "the noblest effort of architectural magnificence ever produced by the hand of man"? of likening the simple earthen parallels, thrown up perhaps with wooden spades, to the avenue of crio sphinxes, and the magnificent, columned hall of the Egyptian temple? In what respect do these earth-works of the mound-builders resemble the palace at Palenque, or Casa del Gobernador and House of the Nuns at Uxmal? It is only necessary to put the question: the reply is self-evident. Yet the writer just quoted, who may be taken as the leading representative of the school to which he belongs, sees, in some respects, less contrast between these two classes of structures than between the earth-works of the Iroquois and those of the mound-builders of Ohio.

Omitting, perhaps, a dozen geometrical works, the enclosures of Ohio, New York, and other sections, are admitted to be for defensive purposes, and are of a character conformable to savage life. And in reply to Dr. Wilson it may be truly affirmed, that if we compare the larger work on Plate XIX. of "Ancient Monuments"—which is in the immediate vicinity of the celebrated "Mound City," Ross County, O.—with that on Plate II. of Squier's "Aboriginal Monuments of New York," the similarity is so marked (except in size) that one might be substituted for the other without bringing into, or omitting from, the former group any important character. Yet here is what was considered by the authors of "Ancient Monuments" pre-eminently the sacred or religious city of the Ohio mound-builders; and, what is worthy of mention, the accompanying enclosure, so like that of New York, has a central mound, which was examined by Messrs. Squier and Davis, and pronounced by them "clearly a place of sacrifice."

A number of such general resemblances between the works of the two sections could be pointed out; yet it is admitted that the two classes of remains bear evidence of being the works of different tribes, but not of different races, or of peoples in such widely different culture states as to justify Dr. Wilson's extravagant statement.

The complicated group, consisting of circles, a square, octagon, and parallels at Newark, is unquestionably the most noted, as well as the most extensive, of its class in the mound section. As these cover an area estimated at two miles square, what, it may well be asked, must be the estimate of the size and population of the village that required such an extensive system of works devoted to religious services and superstitious rites? The great circle at Avebury, England, the most extensive of the so-called druidical structures of Europe, embraces only about thirty-six acres; while here is an octagon enclosing fifty acres, one circle including twenty, another thirty, and a square embracing twenty acres. The race-track, buildings, and other appurtenances of the Fair Association of a county containing probably a hundred thousand inhabitants are enclosed in a single one of these circles. If these were but places where games were held and religious ceremonies performed, where are we to find the indications of the immense village that required such vast amphitheatres?

It is remarkably strange that the mound-builders of central and southern Ohio alone, of all the ancient peoples of the mound region, should erect such extensive structures devoted to religious observances; that here alone the priestly influence should have been sufficiently powerful to produce such results. How is the development of this sacerdotal element in this limited area to be accounted for?

It is true that a few of these enclosures are remarkably correct geometrical figures, and present a puzzling question to the archæologist; but the usual explanation, that the authors were a people in a much higher state of culture than the Indians, serves but to increase the difficulty. On the one hand, it is only necessary to suppose that they were built for defence, and that the Indians of a certain tribe and era had learned the art of laying off correctly circles of large size, and the problem is solved. But, on the other hand, the supposition of a highly cultured race, capable of forming these figures by means not within the reach or capacity of the more advanced Indians, introduces a host of still more troublesome questions. That the ancient works of the Southern States and of New York are to be ascribed to the Indians, is too clearly established by historical and other evidence to be longer denied; and it is even admitted, that associated with the prehistoric monuments of the valleys of the Muskingum, the Scioto, Brush Creek, the Little Miami and Big Miami, are mounds and works of later times, some of which were made by the historic tribes or their immediate ancestors. Notwithstanding this supposition of a much earlier occupation by a veritable mound-building people of advanced culture, there are works here ascribed to this people which present no indications of greater age than some of those attributed to Indians. How is this to be accounted for on the latter theory?

The fact, well known to all archæologists, that minor works of art are found in these typical monuments of the same character as those obtained from mounds attributable to the Indians, presents another question difficult to answer on this theory. The "Monitor" pipe, or pipe with broad base running out in front and behind the bowl, is considered

typical of the people who built the "sacrificial mounds" and "sacred enclosures" of Ohio; yet, according to Adair, the Cherokees made pipes of precisely this pattern, as he says "the fore part of each commonly runs out with a sharp peak, two or three fingers broad and a quarter of an inch thick, on both sides of the bowl lengthwise; they cut several pictures with a great deal of skill and labour." This seems not only to connect the builders of these typical Ohio works with the Indians, thus presenting a difficult problem for the advocates of the above theory to solve, but forms another strong link in the chain of Cherokee history we are trying to follow. There are other difficulties in the way of this hypothesis which our limited space will not permit us to present. There are other questions, however, relating to these enclosures, which require notice here, as they have some bearing on the theory advanced in this paper, and must affect to some extent the conclusions reached.

This is probably implied in the Walam-Olum, where it is stated that "the Talega towns were too strong."

If the enclosures are defensive works, they present nothing incompatible with the theory herein advanced, but rather tend to confirm it. Even supposing they were intended for sacred or superstitious uses, they must have been constructed for the purpose of defending the gathered assemblies from sudden attack by enemies. Take, for example, the Baum Works shown in Fig. 1, Plate XIX., of the "Ancient Monuments," and copied in our Fig. 9. For what purpose were the walls built, except for defence? Is it to be supposed that they were intended solely as sitting-places for the spectators? Those around the square alone would have seated eight or ten thousand persons, and the wall of the circle as many more; yet the remains present no indications of an extensive village. We may also ask, with good reason, why one enclosure was square and the other

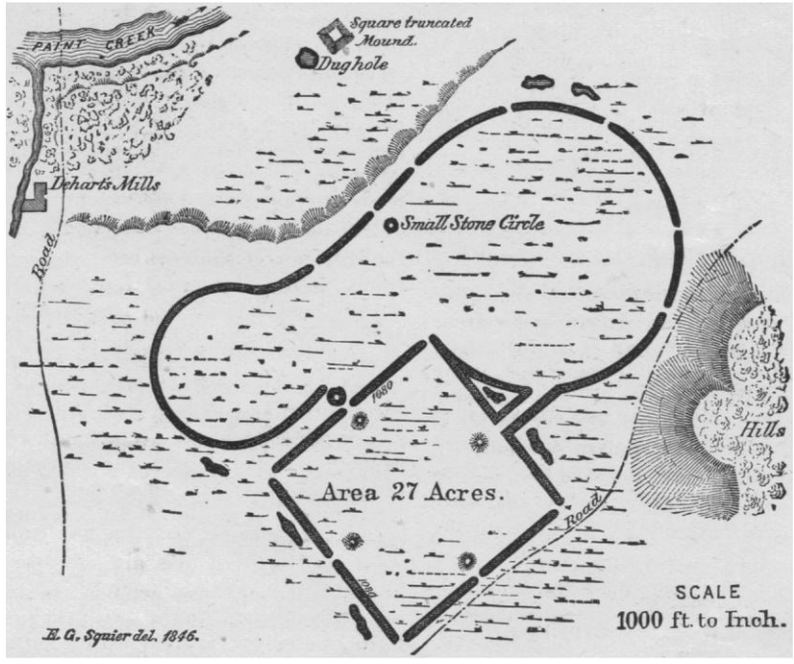


FIG. 9.

It is believed that the evidence presented will be accepted as sufficient to justify the supposition that the Tallegwi of tradition must be identified with the Cherokees, and that they formerly lived in the Ohio valley. Having shown that the people of this tribe built mounds in their historic seat, and were in all probability the authors of the Kanawha and Grave Creek works, it is reasonable to conclude that they built mounds and constructed other works during their residence in Ohio. If this be admitted, their identification with the Tallegwi would indicate that, during their long contest with the Delawares and Huron-Iroquois, they built defensive works, as it is stated in Heckewelder's version of the tradition, that "the enemy [the Tallegwi] fortified their large towns and erected fortifications, especially on large rivers and near lakes, where they were successively attacked, and sometimes by the allies" (the Delawares and Iroquois). Although it is to be presumed that this is somewhat colored to conform to the interpretation of the narrator or author, there can be little doubt that the Tallegwi erected defensive structures in order to resist their enemies.

circular, when the builders must have known that the latter afforded the better chance of observing the ceremonies. Are we to assume that different enclosures were made for the different kinds of rites and games? The only reasonable conclusion, even under the supposition that these were "tabooed" or sacred places, is, that the walls were built for defence, and, as Atwood judged from his discoveries, were stockaded. But this brings up the inquiry, "Why were the sacred grounds enclosed, while the village remained without defensive walls?"

Although it is not probable that all the mystery connected with these structures will be explained away, yet the supposition that they were defensive works of people in the same culture grade as the Indians simplifies the problem, and enables us to present at least a partial explanation which is consistent with other data susceptible of interpretation.

Referring again to the Baum group shown in the figure, what is more likely than that the square enclosed the village, and the circle the maize-field? On the pyramidal mound was the council-house, within and around which the cere-

monial dances were held: and near by was the creek in which the ablutions were performed. The council-house in this case was not in the village; the latter being built near the hills, contiguous to cool springs of water, thus rendering the distance from it to the creek too great for the convenience of the bathers. The writer is aware that this explanation will not apply in full to all the enclosures of this type, as the conditions are not the same in all the localities; and it is more than likely that the customs of the villages varied to some extent, although pertaining to the same tribe. The probable differences in the age of the villages, and the modifications of customs, are also to be taken into consideration; nevertheless this supposition gives us a key that will unlock most of the mystery of these works. They are in most cases located near a stream, and consist of a square or octagon with its gateways and protecting mounds surrounding the village, and a circle enclosing the corn-field. As a rule, the small circles, which may have been places of amusement and ceremony, are outside of the large enclosures. Even at Fort Ancient, which no one doubts is a defensive work, the supposed race-track and principal mounds are outside, though the crescent, in front of which the ceremonial rites were performed, is within the fort.

[Continued on p. 372.]

## NOTES AND NEWS.

SOME curious electrical phenomena were observed, according to a writer in the *Chemische Zeitung*, in a stearin and ceresin manufactory in Italy. One evening four vats of white ceresin (which is a paraffine obtained from ozokerite) containing about 500 kilograms each, were being stirred to cool. When the point of solidification was nearly reached, the electric light of the place accidentally went out; and, to the surprise and alarm of the rather ignorant workmen, the mass of ceresin was observed to give pale sparks on the slightest motion. If the hand was brought near, loud sparks nearly two inches long were obtained. The phenomenon lasted over half an hour.

— Some interesting explorations have been made in connection with the famous Adelsberg Cave. The Vienna correspondent of the London *Daily News* says that various citizens of Adelsberg, wishing to ascertain whether the Ottoker Cave, discovered a year ago at some distance from Adelsberg, was in any way connected with the great cave, followed the course of the subterranean river Poik. It was known that forty years ago a party of explorers had their progress barred by a large lake, and the present adventurers therefore carried with them a boat. Having successfully crossed the body of water mentioned, they came to lofty galleries through which the river flowed. It was possible to walk on the banks of the stream, but at intervals it expanded into small lakes, and the boat had to be used. At last the gallery branched into two corridors, one of which the stream rendered impassable, while the other was high and quite dry. The boat was dragged up, and the party proceeded. After crossing a fourth lake, the largest they had met, they found that the Ottoker Cave had been reached. The journey through the galleries lasted six hours. The explorers saw that they had by no means penetrated to the remotest parts of the grotto, and there is evidently still a wide field for discovery.

—We learn from *Engineering* of May 30 that the Chatillon-Commentry Steel Company have for some time past been experimenting with gun-tubes, projectiles, and armor-plates of steel tempered in lead. The process is simple, the steel being raised to a red heat and then plunged in a bath of molten lead, where it is allowed to cool gradually. The beneficial effects of this treatment are very marked, the elastic limit, breaking stress, and percentage elongation of the material being all increased. Actual tests of an armor-plate thus tempered, 10 8 inches thick, which was tested at St. Jacques by firing at it with a 3.75-inch gun, showed that the penetration in the tempered plate was much less than in an untempered one. The value of this test is, however, somewhat discounted by the fact that the power of the gun was much below that required for penetrating the plate, as the striking velocity of the shell was only 1,300 feet per second, and its penetration in wrought iron would therefore be only about 4.85 inches.

—At the instance of Professor Otto Pettersson of Stockholm, a hydrographic expedition has been arranged; the professor himself and Baron Oscar Dickson finding the necessary funds, with some assistance from two Swedish marine insurance companies. The expedition, which will start from Gothenburg, comprises the salvage steamer "Skandinavien," the gunboat "Alphild," the pilot steamer "Goteborg," and the two steamers "Themis" and "Iris." Men of science will be found on board all these steamers, and samples of water and measurements of temperature will be taken. The Skagerak and the Kattegat, which are to be the places of operation, have been divided into different sections. The appliances were tested at Stockholm the other day, says *Engineering* of May 30, and gave great satisfaction. They comprise an apparatus constructed by Professor Ekman for bringing up water from a depth of up to three hundred feet, furnished with a warmth-isolator; a turbine apparatus by the same gentleman for bringing up samples of water from any depth, and fitted with one of Negretti and Zambra's deep-water thermometers; and several appliances for similar purposes constructed by Commander Arwidsson, very quick in their mode of operating, but not intended for any great depth nor for very large samples.

— Some sea-urchins are known to live in cavities in rock; and the diameter of the cavity is often wider than that of the entrance, so that the animal could not leave its home or be taken out without injury. On the French coast of Croisic (Lower Loire) may be seen thousands of urchins thus ensconced in the granite rock, which is rich in felspar and quartz. The animals, it is not doubted, make and widen the holes for themselves; but the question how has not been satisfactorily answered. Chemical solution of the rock seems excluded, considering both the nature of the latter, and also that no acid which could be thus used has been proved to exist in the urchin. The matter has been studied lately by M. John, and in an inaugural dissertation he explains the effects by mechanical action. With the so-called "lantern of Aristotle," as given in *Nature* of May 29, the animal probably bites the rock. The sucker feet are also attached, and a rotatory motion is imparted to the body; the prickle points, with the lantern, gradually wearing down the surface. These cavities afford a shelter to the urchins against the action of the waves. An attempt is made to conceal them by means of mussel and other shells. The rocks in which the cavities occur are in general thickly covered with calcareous algæ. It has been thought that possibly these decompose the rock, and so facilitate the work of the urchins. M. John, however, finds no such chemical relation; but atmospheric agencies, he considers, may help the work of boring. A number of other animals are known to penetrate rock, and it is supposed that they do it also in a mechanical way. M. Forel described to the Vaudois Society of Natural Sciences how, in the hard limestone of Constantine, Algiers, *Helix aspera* was found in holes four to five inches in depth.

— It was natural to suppose, that, as heat weakens the strength of a steel magnet, the susceptibility of a magnetic substance would increase with a fall of temperature, as also that bodies which in ordinary thermal conditions are neutral to magnetic influence, would exhibit magnetic properties if cooled down sufficiently. This point, says *Engineering* of May 2, was dwelt upon by Dr. Hopkinson in his remarkable address to the Society of Electrical Engineers, and was also made the subject of experimental demonstration by Mr. Shelford Bidwell in his recent discourse on magnetic phenomena at the Royal Institution. The substance used was an alloy of nickel and iron. Both these metals are magnetic at ordinary temperatures, but the alloy is perfectly neutral. A permanent magnet is unable to lift a strip of it; but, if cooled a few degrees below zero, the strip is at once strongly attracted by

# SCIENCE:

*A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.*

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada..... $3.50 a year.

Great Britain and Europe..... 4.50 a year.

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VOL. XV. NEW YORK, JUNE 20, 1890. No. 385.


CONTENTS:



## THE CHEROKEES IN PRE-COLUMBIAN TIMES.

### IV.

[Continued from p. 370.]

In some cases, as at the Liberty Township Works ("Ancient Monuments," Plate XX.), a special arrangement seems to have been made for this purpose. Here we see a connected third circle, much smaller than the other two, in which is a crescent and mound; there is, however, a little exterior circle. We notice here that the square or village site is near the bluff from whence springs issue.

The square of the Seip Works ("Ancient Monuments," No. 2, Plate XXI.) and of that figured in No. 3 (same plate) are next the stream, as there were no springs in reach.

The complicated group at Newark, of course, presents features difficult to explain; but it is apparent that there were two villages, probably established at different times, but both occupied from the time the latter was built until the whole was abandoned. The octagon is near the creek, but its position was doubtless selected on account of the spring near its northern corner. The southern circle, *E*, was possibly a place devoted chiefly to ceremonies and games. One line of parallels seems to have been a passage-way from one village to another. It is apparent from their courses and the topographical features of the area that none of these guarded ways were intended for race-tracks. That the small, circular enclosure *F*, known as the "Observatory Circle," was not sufficient in extent to supply the villages with bread, is admitted: hence it was necessary to assume that there were unenclosed fields, probably on the land north of the group, between the parallels running east and west, and in the area east of the pond. It is possible that the space between the two lines of parallels, running east and west, was partially occupied by dwellings, especially that portion on the upper, level land. These suggestions are of course largely speculative; nevertheless, if there be any truth in the tradition of the Tallegwi, it is probable that here they made their first determined stand after defeat in open battle. The people of other villages, not enclosed, probably fled thither, and joined in erecting fortifications and defensive walls. Be this as it may, it is apparent that they belong to the same type as those in the Scioto and Paint Creek valleys, and may be ascribed to the people who built the latter. That they were defensive seems to be established by the considerations presented, and others which might be urged did space allow us to offer them. It is apparent to any one not biassed by a preconceived theory, who will study these works carefully, that their characteristics are essentially aboriginal: in other words, there is nothing in their form or construction contradictory to the theory of their Indian origin, except it be the single fact that a few of them approach very nearly to true geometrical figures. That it was a custom among the Indians north and south to build circular enclosures and forts, is fully attested by the historical records; it is also known that some of the Indian forts in the northern section were polygonal, especially those built by the Iroquois tribes. Numerous instances can be cited where villages were surrounded by fortifications in both these forms.

The suggestion that the circles adjoining squares were built around maize-fields is not original with the writer, as it had already been presented by Lewis H. Morgan, in his "Houses and House Life of the American Aborigines." He remarks, that "with respect to the large circular enclosures, adjacent to and communicating with the squares, it is not necessary that we should know their object. The one attached to the High Bank Pueblo contains twenty acres of land, and doubtless subserved some useful purpose in their plan of life. The first suggestion which presents itself is, that as a substitute for a fence it surrounded the garden of the village in which they cultivated their maize, beans, squashes, and tobacco. At the Minnitaree village a similar enclosure may now be seen by the side of the village, surrounding their cultivated land, consisting partly of hedge and partly of stakes." Whether these dirt walls were mere supports to stockades is a question not yet settled; nevertheless it is probable they were surmounted by stakes, or supported a wooden fence or screen of some kind. The fact that the ditch is here usually on the inside cuts but little figure in the discussion, as we find this to be the case in many works which are undoubtedly of a defensive character, as Fort Ancient, and the circular enclosure in Iowa shown in Plate II., "Fifth Annual Report of the Bureau of Ethnology." In fact, this was consistent with the Indian mode

of warfare. Long tells us, in the account of his expedition, that sometimes they would hastily dig a trench, throwing the dirt on the danger side, and thus form a defensive barrier.

Whether the hill-forts are to be attributed to the authors of the circles and squares is doubtful: in fact, the indications appear to lead to the opposite conclusion. Certainly there is no reason for supposing that Fort Ancient, Fortified Hill, and other works of this character in the Miami valleys, were built by this people. The writer is inclined to the belief that they are the work of the Shawnees, but cannot undertake at this time to give his reasons for this opinion.

As the so called "altars" form a link in this historic chain, we may as well remark here that the names "sacrificial mounds" and "altars," implying human sacrifice, have been brought into use without even the shadow of evidence therefor. As Morgan has truly observed, "there is no propriety in the use of either of these terms, or in the conclusions they would force us to adopt. . . . These clay beds were not adapted to the barbarous work." Possibly they may have been places where prisoners were burned, which was the chief sacrifice offered by Indians. The basin-shaped clay beds of the Kanawha and East Tennessee mounds seem to have grown out of them, and their uses were probably similar.

CYRUS THOMAS.

[To be continued.]

## THE ROYAL SOCIETY OF CANADA.

THE eighth annual meeting of the Royal Society of Canada is just over; and, from the interest manifest in the four sections into which that society is divided, no better proof of the growth, usefulness, and success of such an organization can be desired.

Of forty-three papers which were presented, either read *in extenso*, in abstract, or by title, no less than twenty of them treated on scientific topics, while the remainder were devoted to historical, political, and literary subjects.

Sections III. and IV. of the Royal Society are specially devoted to the sciences: the former embracing the mathematical, physical, and chemical sciences; the latter, the geological and biological sciences. A list of the papers read in these sections was published in *Science* of June 6.

The character of the papers read in the section of the geological and biological sciences were all of a high order, and interesting discussions took place. Dr. G. M. Dawson, assistant director of the Geological Survey, was president, and for his inaugural delivered an address upon the "Mesozoic and Tertiary History of the Rocky Mountain Region of Canada," in which the geological history of the Cordillera is traced from the triassic period to the close of the tertiary, and special reference is made to the process of development of the surface features of the region, together with the changes in elevation of the land at different periods. Another paper by Dr. Dawson, which can be regarded as a supplement to the foregoing, gave a very succinct sketch of the glacial history of the Rocky Mountain region of Canada, bringing the subject-matter to date. These two papers were followed by another from the pen of Principal Sir William Dawson, on "Fossil Plants from the Similkameen River and other Places in the Southern Interior of British Columbia." The following is an abstract of this paper: —

The deposits affording these plants have been described by Dr. G. H. Dawson in the "Report of Progress of the Geological Survey of Canada for 1877–78" (pp. 130B, 166B). They are of lacustrine origin, and underlie basalt and other volcanic materials. The beds holding well-preserved remains of plants are chiefly those composed of fine laminated clayey or silty material, which in some cases has been hardened by silicious matter which appears to have been derived from springs contemporaneous, or nearly so, with the date of formation of the beds. These deposits have been approximately assigned to the period of the miocene tertiary. They contain a number of species of fossil insects which have been described by Scudder (report above cited, p. 175B), and fossil plants, of which a provisional list was given in the same report (pp. 186B–187B). The present paper relates to additional collections of plants from the Tulameen or North Fork of the Similkameen, Tranquille River, etc., and which, while they extend our knowledge of the flora, tend strongly to confirm the miocene age of the formation, and to connect it with similar deposits farther north in Alaska.

The object of the paper, "Stratigraphical Notes on the Citadel Hill, Quebec" (in French), by L'Abbé Laflamme, was to determine the structure of the beds constituting the cliff at the citadel near the Dufferin Terrace, Quebec, where the "land-slide" occurred in September, 1889, and thereby to ascertain the cause of the disaster. Professor Laflamme pointed to imminent danger even at present, and the probable sliding-away of several feet of strata, which sooner or later must take place. A very interesting and animated discussion followed.

The paper on "Illustrations of the Fauna of the St. John Group, No. V.," by G. F. Matthew, M.A., was a continuation of the paper of last year which described the fossils of the "Basal Series" (beneath the St. John group), and the new ones of Band C of Division 1 of the St. John group. The following points were discussed in this paper: (*a*) a description of the structure of the St. John basin, (*b*) a description of the new series in Division 1 of the St. John group and of newly recovered parts of others, (*c*) a description of the tracks and organisms of Division 2, and (*d*) a description of the fossils of Division 3. Peculiar tracks have been detected, which appear to be those of radiate animals. A good many tracks have been observed in the sandstones and shales of Division 2, which are like those of the Eophyton sandstone in Sweden; but it is thought that this resemblance is due to a similarity of conditions under which the above sandstones and those of Division 2 were deposited, as the *Paradoxides* fauna undoubtedly intervenes.

Mr. E. Gilpin, commissioner of mines for Nova Scotia, in his paper on "The Evidence of a Nova Scotia Carboniferous Conglomerate," referred to the nature, source, and extent of the modern drift of Nova Scotia, and to the shingle beaches formed from it He described the carboniferous conglomerates of Cape Breton as consisting usually of detritus derived from local sources, and in Nova Scotia proper cited the conglomerates of the south side of the Cobequids, and of New Glasgow, as good examples of conglomerates formed from subjacent strata. The auriferous conglomerates of Gays River, Colchester County, were described, and the occurrence in it of bowlders referrible to pre-carboniferous measures lying to the north was noticed. The inference suggested was that the modern drift-transporting agency, carrying to the Atlantic shore bowlders referrible to the Cobequids, was paralleled, at the opening of the carboniferous period, by a similar agency furnishing bowlders found in lower carboniferous conglomerates at Gays River.

The paper on "Southern Invertebrates of the Shores of Acadia," by W. F. Ganong, was submitted to the Royal Society, and read by Professor L. W. Bailey of New Brunswick University. It opened with a sketch of the progress of knowledge of the distribution of marine invertebrate animals on the east coast of North America, from the time of the establishment of Milne-Edwards's "Pennsylvanian Region" in 1838, down to its division into the Syrteusian, Acadian, Virginian, and Carolinian faunæ, as accepted by students to-day. Attention was then called to the well-known occurrence of southern or Virginian forms in the Gulf of St. Lawrence, at Sable Island, and at other points on the coasts of Acadia and Maine; and a table was given showing the twenty-five undoubtedly southern species of mollusca. At least three *Echinodermata* occupy these localities, mingled with the more northern forms. This anomalous condition cannot date far back, since post-pliocene deposits show no trace of it. Indeed, there is evidence to show that changes are still going on; and facts drawn from Indian shell-heaps, from dead beach and dead dredged shells, and from old books, all show that these southern forms had for-