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No. 922.

For the Week Ending September 2, 1893.

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PATENT OFFICE EXAMINERS WANTED.

Strange to say, there appears to be a greater demand for qualified persons to serve as Patent Office examiners than there are applicants. This probably is because the position demands considerable scientific knowledge, only to be acquired by thorough study, and ability to make intelligent use of such knowledge in the performance of official duties. Applicants for examinerships in the Patent Office must pass examination before the Civil Service Commission, Washington, D. C., who will furnish blanks and instructions. The subjects of the examination are: Physics, technics, mathematics and chemistry, and mechanical drawing. The salary of the position is $1,200 per annum.

THE AMERICAN ASSOCIATION AT MADISON, WIS.

BY H. C. HOVEY.

The recent meeting of the American Association for the Advancement of Science, in the charming capital of Wisconsin, serves to bring to the memory of the older members the familiar name of the late Dr. Increase A. Lapham, who doubtless did more than any other one man in this State to stimulate the scientific zeal of his fellow citizens. His original investigations in archeology won the honor of knighthood for him from the King of Denmark. And his promptness to recognize and encourage younger men of scientific aspirations, and give them a start in life, won what is better than any titular distinction—a place in the hearts of men. Dr. Lapham was eminent in botany, geology, and meteorology, and he was also the founder and first president of the Wisconsin Historical Library, one of the most valuable institutions of its kind in America. Indeed, he was identified so thoroughly with every scientific interest of the State as to make it peculiarly fitting that a tribute should be paid to his memory preliminary to mentioning the words and deeds of other men who, for several days have crowded the corridors of the State University and interchanged their facts and theories.

THE ORIGIN OF MOUNTAIN RANGES.

One of the most interesting and attractive persons in attendance this year, was the retiring president of the A.A.A.S., the veteran geologist, Professor Joseph Le Conte, of California. The subject of his annual address was "The Present Status of Science as to the Origin of Mountain Ranges." Mountains are focal points of geologic interest and theaters of intense igneous, aqueous, and eruptive agencies. Their strata vary in thickness from 10,000 to 50,000 feet at the crest (allowing for erosion), but slope away with diminishing thickness till they vanish in the valleys and plains. Their component materials are fragments of rock, coarse gravels, and sands, and their huge mass rises in folded structure above the general surface of the globe. Sometimes, as in the Uinta Mountains, there is but a single enormous fold; and again there is fold upon fold; and yet again there is occasionally great complexity, the strata being thrust under and over in a vast fanlike form. There are also sinclines and anticlines, which are often greatly appressed, as in the Appalachian range, where nineteen have been counted in a distance of sixty-five miles. Mountain strata are not equally affected by cleavage, some seeming to be very solid, while in the case of others the whole mountain appears to be cleavable from top to bottom. The earth wave sometimes breaks with surprising abruptness, and again it slopes away very gently.

Many theories have been offered in explanation of these phenomena. Bare facts are not science. Facts must be grouped and systematized. But as this work goes on, it is liable to grow daring and speculative, until it is necessary to demand a careful discrimination between what may be styled formal and causal theories. It is agreed that mountains were originated by a process of horizontal mashing and vertical uplifting of the earth's crust. But what caused this mashing and uplifting? A true formal theory must advance gradually. Mountains are born of sea-margin deposits. We find by observation that existing off-shore deposits are coarse at the top, shading down to fine, by the same law as that marked in the structure of mountains. But the enormous mountainous deposits would have been possible only where there was a corresponding subsidence of sea bottom. The earth sinks by loading and rises by unloading. Of this the Colorado plateau furnishes an illustration. It was originally 20,000 feet high, but 12,000 feet have been removed by erosion, which has caused the remaining 8,000 feet to rise above the general level. It may be regarded as now proved that the cosmic behavior of the earth is that of a rigid solid. A solid globe of glass, six feet in diameter, will change shape by the pressure of its own weight. The earth does the same. But as the earth is not homogeneous, its radial contraction will be unequal, and hence there will be ridges. The contraction theory assumes that the earth was once an incandescent ball, now cooling; and this cooling compels yielding along its lines of weakness. This is known abroad as the "American theory," and the author of this address was its originator. In conclusion, Prof. Le Conte said he was ready, if need be, to sacrifice "the child of his brain," but did not really think it necessary. He considered and refuted objections; and he finally returned to the contraction theory, not as demonstrated beyond a doubt, but as furnishing the best working hypothesis yet offered.

MAMMALIAN PALEONTOLOGY.

An elaborate an important address was given by Prof. H. F. Osborne, of New York, on recent progress in the study of ancient forms of mammalian life. A new era was opened twenty years ago by Kowalevski's memoirs on the hoofed mammals. At about the same time Leidy, Marsh, and Cope began to explore the ancient lake basins and found them rich in life. The first ten years of these twenty revolutionized our ideas of mammalian descent, and also brought data for the work of the next decade. Then came Marsh's law of brain evolution in relation to survival; Cope's proof of ungulate derivation from a simple ancestral foot resting on the sole, and with the conical ancestral molar tooth; and also Cope's demonstration of the tri-tubercular molar as the central type in all mammalia. We have learned that the fossil quadrupeds are now to be treated biologically, and not merely as petrified skeletons. The imagination must clothe them with flesh and behold them as living, moving, and feeding. New discoveries produce new conditions. There is nothing more obstructive than reverence for old ideas and systems after they have outlived their usefulness.

Paleontology is no longer a science apart, as it was formally regarded. It must keep abreast with geology, historical geography, paleobotany, osteology, and embryology. All structures should be studied with reference to their homologies. Every animal should be regarded as a whole and in its relations. How many toes an animal has is of less importance than how those toes are being displaced and reproduced. Our five fingers are a reptilian legacy; and the teeth of all animals cluster around a simple reptilian type.

General faunal succession of Mesozoic and Cenozoic time is marked by the sudden appearance and disappearance of certain series and the rise and fall of great groups. One of the most decided reforms in classification is in the use of the family division. It used to be the idea that families must be grouped as if in circles. But now they are regarded as in vertical lines, giving off branches. A horse, dog or lion is such from the moment he clearly appears to be such. In other words, we deal not with great separate lines of descent, but with stages of evolution in the same or parallel lines. The evolution of a family is simply an uninterrupted march in one direction. A certain trend leads to a final issue; but extinction or survival of the fittest exerts no influence en route. These changes en route lead us to believe either in predestination or in kineto-genesis. The trend of evolution is not the happy result of many trials: but it is heralded in structures of the same general form the world over, and in age after age by changes advancing irresistibly from inutility to utility. It is an absolutely definite and lawful progression. Fortuity is precluded.

Several papers will now be reported that had a bearing on the age of the globe and the length of time it has been inhabited; and the excited and animated discussion of these topics may be regarded as the most marked feature of this meeting of the A. A. A. S. The discussion was indeed originated at least a year ago, that is in its present form, and there is evidently a wide divergence of opinions, as well as considerable dispute as to facts.

GEOLOGICAL TIME.

In treating of geological time, as indicated by the sedimentary rocks of North America, Professor C. D. Walcott, of Washington, D. C., conceded, at the outset, that it is uncertain and is in conflict with the teachings of some other sciences. The physicist, for instance, requires us to bring terrestrial time within the extreme limit of twenty or thirty million years. The geologist replies that he cannot bring his facts within such narrow limits. Sir Charles Lyell, basing his estimate on modifications of certain species of marine life, assigned 240,000,000 years as the required length of geologic time. Darwin claimed 200,000,000 years; Crowell, about 72,000,000; Geikie, from 73,000,000 upward: Alexander Winchell, but 3,000,000; McGee, Upham, and other recent authorities claim from 100,000,000 up to 680,000,000 years. Notwithstanding this wide divergence, all agree in thinking the duration of the globe so great as to make man's occupancy of it seem but a span.

The attempt in Professor Walcott's paper was to throw light on the problem from ascertained facts as to the evolution of our continent, which was outlined in the Archean period and has not materially changed since. Its areas were more clearly outlined in Algonkian time, since which the changes have all been above the level of the deep seas. Sedimentation as the result of denudation has continued with little interruption. During the Upper Cambrian time the broad Mississippi area was worn down and the mass removed was carried into the ancient Cordilleran Sea. The processs then was rapid, as compared with similar work in

other periods. Chemical denu lation is by the taking up of material in solution. Murray, in describing the results of the Challenger expedition, says that 113 tons per square mile per year may thus be accounted for. Besides the lime, etc., precipitated from solution, there have been mechanical processes going on, as also the agency of organisms. Most of this has been in comparatively shallow water. There is no evidence of the continental marine deposits having been made in deep seas.

Without following the steps in detail, it may be said that the conclusion reached by Professor Walcott distributed geologic time as follows:

Cenozoic (including Pleistocene), about	2,900,000 years.
Mesozoic	7,240,000 "
Paleozoic	17,500,000 "
Algonkian	17,500,000 "
Total time of sedimentary rocks	45,500,000 "

In commenting on this table it should be said that the data for Archean time are doubtful. Also there are no sufficient data from the duration of animal life to fix geologic time back of about 10,000 years. The fact may be mentioned that while we have 55,000,000 square miles of land, there are 137,200,000 square miles of water.

The conditions on which denudation and deposition went on were given with minuteness and a formidable array of figures. As a specimen of Walcott's reasoning, it may be said that the rocks in the great interior basin of Nevada, Utah, etc., are 21,000 feet thick, and cover an area of 400,000 square miles. The limestones are 6,000 feet thick, and the sandstones and shales 15,000 feet. At the estimated rate of deposit in the ocean of the present day it required 1,200,000 years for the limestones of that area and 16,000,000 for the sandstones and shales, or 17,500,000 in all. With this as a unit, the tabular results were reached already given. In other words, as compared with the conclusions of other geologists, Walcott would measure geologic time, not by hundreds of millions of years, but simply by tens of millions.

THE EARLIEST MEN.

Profound interest was awakened by Dr. Daniel G. Brinton's address on "The Earliest Men." How did they come into existence? By special creation. Everything is special. The whole species is made up of special individuals; and their evolution is multiform. Scientific men are agreed that the human race did in some way arise from some inferior animal form—not necessarily monkeys. The transition may not have been gradual, but abrupt—evolution per saltum. We do not find the "missing link;" it is still missing; it may be forever missing. There are different opinions as to how many early men there were. There may have been several distinct centers, but science as well as orthodoxy points toward the conclusion that all men originated from one primal pair living in one definite place. When did these early men appear? A perplexing question. We used to be told that it was 6,000 years ago; but we now know that there were at that time thousands of men living in Europe, Asia, Africa, and America. It may be that we have misunderstood the Biblical record, or that it may have concerned a single branch of the race. It is certain, however, that man appeared late in the geological history of the globe. Human remains have been found in half a dozen places in the world under circumstances that seem to show that man lived in the Tertiary age: but the proof really seems meager. Did man appear during the great Ice Age? The testimony from ancient caverns whose mouths had been sealed by drift, and whose contents lay hidden under stalagmitic floors, as well as that gathered from stratified gravels and other sources, proves that man probably did inhabit the globe during or even before the Ice Age. The date of that age is not exactly fixed, but was probably about 50,000 years ago, altnough some men of science have assigned a less and others a greater period than this.

Where did the earliest men make their home? Manifestly there were certain conditions requisite. Man requires food and generally some kind of clothing. We may reason by exclusion. The first men did not inhabit an island, for they could never have got off. They did not live where it was very cold, because they would have perished. The greater portion of the northern hemisphere was under water at the time of their advent, hence that is ruled out. They could not have lived in Australia nor in Southern Africa on account of climatic conditions and for other reasons. In short, we find them limited by conditions to the area between the Himalayan Mountains and Spain. Practically the oldest remains yet found have been discovered in the most densely inhabited regions of Europe. The sacred record treats of a particular line of human beings. The fable of the lost Atlantis and the theory of Haeckel as to the submerged Lemurien are not tenable. Eurasia was certainly man's original birthplace.

What did the early men look like? Were they altogether rude? Did they creep on all fours or walk erect? The most expert anatomists have decided, after examining the ancient bones that have been exhumed, that there is no more difference between ourselves and those early men than there is between ourselves now. They were doubtless sturdier. They did not trouble themselves as much about dress as we do. They had reddish hair and probably a ruddy complexion, with blue or gray eyes. Their skulls were about as good as ours, except the famous one of Neanderthal, for which we have less respect than we used to have. In a word, they were men. They knew how to make a fire. Even the very oldest of all men knew that wonderful art. They also knew how to make tools from stone, wood and horn. They were conversant with a variety of instruments and tools. They had weapons with which they killed huge animals. They knew about boats. They had dwellings. They were socially inclined and lived in communities. They were brave and had wars. They endured hardships. They had good hearts and loved one another. We have positive proof that they took care of the aged and nursed the invalids among them. They had some kind of language and knew something of music. We cannot positively say that the very earliest men worshiped, but if they did so, their worship was spiritual. They had no idols. They had some sense of beauty. They decorated shells. They carved the horns of reindeer and tusks of mammoths. Those first men could travel rapidly. They encountered no very dangerous enemies. We can easily see how there came to be varieties among them, for more changes are now going on than ever before. All shades, from black to blond, are easily explained. We may safely conclude that the early men were essentially human and very much like ourselves, with hearts and brains, hopes and fears, woes and aspirations like our own.

THE EVIDENCE OF GLACIAL MAN IN AMERICA.

The A.A.A.S. inherited from the Rochester meeting a lively discussion between Professors G. F. Wright, W. J. McGee, and others, concerning the proofs of the high antiquity of the human race on this continent. For hour after hour the discussion proceeded, and other sections adjourned to hear the war of words. It is not easy to convey the exact idea of the situation to the mind of the reader unless he has kept up with the recent literature on the subject. It is well known that in various localities in France, England, and elsewhere in Europe, remains have been found that were regarded as decidedly glacial, although there is not perfect agreement even as to these evidences. However, it was perfectly natural for our own geologists and anthropologists to seek for similar finds in this land. Foremost among such explorers may be named Dr. C. C. Abbott, of Trenton, N. J. This gentleman lived right on the glacial gravels, which were being extensively excavated by railroad men and others, and kept a careful watch. His first finds awoke such skepticism as to lead to the suspicion that he manufactured them himself. Even Prof. Dawkins, of England, spurned them at first, until he was induced to look for himself, when his doubts were removed. Prof. G. F. Wright, who is a renowned glacialist, and Prof. F. W. Putnam, of Cambridge, Mass., whose fame as an anthropologist is established, accept Dr. Abbott's findings as genuine. In an able paper Prof. Wright protested against the prevailing tendency to over-skepticism concerning archeology, and contended that evidence ought to be satisfactory that would satisfy a jury sitting in a case of life and death. Accordingly he has been busy sifting the testimony as to the Trenton gravels, and gave his results in the aforesaid paper. He says that in examining about 5,000,000 cubic yards of gravel Dr. Abbott found twenty paleolithic implements in place in the undisturbed strata, and several hundred in the debris. His testimony is explicit and reliable. Other implements were found by Putnam, Shaler, Carr, Pumpelly and Whitney, as well as by Wright himself. The conclusion of these scientists is that the argillite implements were more ancient than those made of jasper, and that some of them were as old as the glacial drift. The upper stratum of soil is about a foot thick and contains many jasper relics, also those of argillite; but only the latter are found in the lower strata. Doubts have been expressed by some as to whether these are artificial or natural; but as the specimens were exhibited before the A.A.A.S., the members could judge of that for themselves. Dr. Holmes, an eminent archeologist, visited Trenton with negative results; but he worked under unfavorable conditions. Prof. Wright gave a careful *resume* of the entire matter, and compared with ascertained results the discoveries in Ohio and California, as well as abroad, and pronounced the evidence to be convincing as to glacial man in America.

Prof. Putnam, Prof. Chamberlain, Prof. McGee, and others, took a lively part on the discussion that ensued, giving the results of their own observations, and weighing the testimony given by their fellow scientists. The rules as laid down by McGee were certainly good, to the effect that when any object of unusual form and unknown origin is found in geological strata, the presumption is that it is natural rather than artificial. He also said that legal and scientific demonstration differ. In courts conclusions must be reached and must be final. Hence, with the utmost care, they may be in error. In science it is not necessary to hasten to a final conclusion. Science can wait. It is also desirable that evidence should be both unimpeachable in quality and abundant in quantity. The question of the antiquity of man is so highly important as to make sweeping conclusions undesirable. He regarded the Trenton testimony as interesting but tantalizing, because not absolutely conclusive. We do not have to hurry along to a conclusion. Let us patiently accumulate materials, not merely from one individual, as Dr. Abbott, nor from occasional visitors, but from all sources. Let us examine the paleolithic specimens more carefully to see if they are really in place, and if they are tools or "rejects." Then when all the evidence is in, we can probably arrive at results that will be satisfactory to the scientific world at large.

Taking into consideration the eminence of the men engaged in this friendly controversy, and the earnestness with which they defend their widely varying views, the expectation is that more may be expected from the same source in connection with the approaching Anthropological Congress at Chicago.

The Incubation Periods of the Infectious Diseases.

The Clinical Society of London has recently published the result of extensive observations regarding the period of incubation of some of the infectious diseases. A constant period of incubation is not to be expected. In most instances it will be seen from the following table that the difference in the maximum and minimum period is not very great. It seems remarkable, however, that a disease should show such extremes as typhoid fever:

	Normal.	Maximum.	Minimum.
Variola	12 days.	14 days.	9 days.
Varicella	14 "	19 "	13 "
Measles	10 "	14 "	4 "
Rubella	18 "	21 "	8 "
Scarlet fever	2 "	7 "	1 "
Influenza	3 "	5 "	1 "
Diphtheria	2 "	7 "	2 "
Typhoid fever	12 "	23 "	5 "
Mumps	19 "	25 "	12 "

It is a peculiar fact that the diseases in which the period of incubation is shortest are those in which the infection may persist the longest. The period of quaratine must be governed largely by the period of incubation, hence the subject is an important one for a variety of reasons. Dr. Dawson Williams, commenting upon these figures in the *Medical Magazine of London* for June, states that the period of quarantine should be at least a day longer than the maximum for each disease. This is a very uncertain rule, however, for the patient should be free from all signs of illness, and especially from fever. The necessity for disinfection of clothing is shown by cases reported in which persons wearing garments which had been exposed to infection have escaped, while others coming in contact with the same clothes have contracted the disease. This is probably explained by the great susceptibility of certain persons to particular diseases. The period of infection is very doubtful. It may be greatly prolonged by some complication. This is especially true of smallpox, diphtheria, typhoid fever, and scarlet fever. The period during which a disease may be infectious cannot be stated definitely. It varies with different cases, and must be determined according to the nature of the symptoms and the character of the case. Measles, chicken-pox, and mumps lose the direct power of infection very early, and the infective principle does not remain active for a long period in the room in which the patient has been ill. Measles, mumps, and chicken-pox may be infectious in the earliest stages before definite or characteristic symptoms appear. Smallpox, fortunately, is not actively contagious until the eruption has appeared. This statement, the committee affirms, has been proved by abundant observation.—*N. Y. Med. Jour.*

Comparison of Power between Carbonic Acid Gas and Compressed Air.

The results of calculations show that, for a given tank capacity and carbonic acid and air stored at the same pressure, the (liquefied) carbonic acid is capable of developing four to five times more power than compressed air. If a compound engine is employed, and the gas or air is heated so that the temperature at the beginning of expansion is 383·5° Fah., the carbonic acid engine requires 21·6 pounds of carbonic acid per hour per horse power, and the air engine 14·3 pounds of air. On this basis of 21·6 pounds of carbonic acid per hour per horse power, we can determine the price it would have to be sold at to be an economical power.

If the carbonic acid is exhausted into the atmosphere, the cost is much too great for ordinary power purposes. If the exhaust is condensed, the engine will have the same theoretical efficiency as an engine using any other vapor through the same range of temperature, and the working pressures will be very high, so that practical difficulties are met with. Experiments with carbonic acid gas engines, in which the exhaust is condensed, have verified the conclusions pointed out by theory.—*Prof. D. S. Jacobus.*