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THE LESSONS OF THE ZOO

By Dr. Wm. E. Ritter,
Director, Scripps Institution for Biological Research.

How differently people regard such things as "zoos", natural history museums, and marine aquaria today from what they ever before regarded any thing of the kind.

For centuries a few persons of rank and wealth have gratified some sort of interest of theirs in wild animals and plants, by gathering around them, dead or alive, a few striking "specimens". The Royal Deer Park and the Royal Cabinet, for instance, have cut a considerable figure in the history of many countries. And such collections have occasionally been put to good use in the promotion of learning. Dr. Wm. Harvey, discoverer of the circulation of the blood, made important investigations on the generation of animals by having been permitted to use for this purpose some of the Court deer that were among the "Subjects" of his royal patient and patron, Charles I of England. And quite a good many similar instances could be mentioned.

But that anybody, at least anybody worth considering, except a few highly specialized students or highly curious and self-indulgent nobility, could be interested in, and could profit by, such collections seems to have entered nobody's head until within the last fifty or a hundred years.

Then came a time when it was recognized that lots of just ordinary people are interested, or may easily become interested in wild animals and strange plants.

Probably the traveling animal "show" - the thrilling menagerie of the childhood of many of us now reasonably old - did more than any other one thing, in America at least, to help on this recognition.

P. T. Barnum may be justly enough entitled to fame for discovering that he could fill his pockets with money by hoaxing the American public. But he is certainly entitled to credit for having stimulated and gratified the insatiable curiosity of hundreds of thousands of boys and girls by giving them a chance, for a small admission fee, to see and hear and smell many strange beasts from many parts of the earth. And how discerning of human psychology, and so how profitably this great showman "played up" the wild and savage traits of the beasts he exhibited!

Still later it appeared that there is genuine recreational value in public parks stocked even very meagerly with beasts, birds and reptiles; with trees and annual plants. Laboring men and women with tired bodies; business and professional men with fagged and numbed minds; and society people with jaded and disgusted souls can renew themselves more or less by occasional visits to such places.

And finally it dawned upon the minds of a few thoughtful, public-spirited persons that carefully selected, and well exhibited collections of natural history

objects have great educative value for both old and young.

So finally has come into being the modern zoological park, botanic garden, museum of natural history, and so on.

See now where the growing perception of the role of these as agencies for promoting community welfare is leading. Beyond a shadow of doubt, these with other kindred agencies, are leading civilized mankind into clearer light, relative to its own nature and to its place in this wonderful universe, than ever before in all its history it has been able to attain. A better knowledge of Nature, a better comprehension of man's utter dependence upon Nature, a better attitude of mind toward Nature - these are what such agencies are leading toward.

By all means let every community make its "zoo", its botanic garden, its museum of natural history, its public aquarium just as good as it possibly can be made. Then let it see that these are all linked up in the closest way with the public school, the public library, and all other agencies of sound education.

But then let it not fail to see that such agencies are after all only paths and doorways to the real heart of Nature.

By no hook or crook can real Nature be brought into the city.

No man or woman or child can live a normal, healthy life in either body or soul permanently isolated from the body and soul of Nature.

Of all the dangers that beset the modern civilized world none are greater because none are more subtle than that of the growth of the cities at the expense of the country and the consequent over-urbanization and under-ruralization of the people.

It is as eye-openers to these vital truths that the educative agencies of which we have been speaking are supremely important. And when they shall have done their perfect work, one of the things that will stand revealed will be that city boosting in entire disregard for the welfare of the country is no better as city boosting than is gambling. The time was and not very long ago, when the lottery business was considered a legitimate means of raising money for all sorts of purposes. But public morality, based finally on public welfare, has grown beyond this in the most advanced nations. Similarly will public morality in the foremost nations have to put its ban after a while on indiscriminate city boosting.

READING REFERENCES- Ritter, William E. The higher usefulness of science, and other essays. Boston, R. G. Badger, 1918.

A German professor has discovered that birds are blind to the color blue because they have yellow granules in the retina of their eyes which filter out the blue light rays.

Because a large number of mulberry trees in Piedmont, Lombardy, and Venetia provinces of Italy were cut down during the war, the production of silk cocoons by that country has declined about half.

Mexican bean beetles in Colorado have begun to live higher. Four years ago they were not found higher than 5,000 feet above sea level, but now they have reached 8,231 feet.

SUN HAVING SEVERE CHILL; PERHAPS AFFECTING WEATHER?

The sun has been suffering from a chill and the past winter has been one of the most unusual and the present spring one of the latest of record, according to Dr. C. G. Abbot, home secretary of the National Academy of Sciences. A paper read by him on the falling off in the sun's heat as measured at astrophysical stations of the Smithsonian Institution in Arizona and Chile was one of the sensations of the recent meeting of the National Academy. The central heating plant of the solar system is apparently working from three to four per cent. less actively than 15 months ago, the figures showed.

Dr. Abbot did not draw any conclusions between the sun's failure to perform and the overperformance on the part of the weather, but contented himself with entitling his paper, "The Solar Prelude to an Unusual Winter", and stating that it would seem to do no harm to call attention to both phenomena in the hope of fruitful investigation. He did not hesitate, however, to describe the drop in the sun's heat as "extraordinary", and to say that nothing so outstanding in the way of a change in the heat of the sun had been observed since measurements were begun in 1905.

The drop followed a number of years during which the sun's heat had been running above the normal and began in November, 1921, continuing steadily until the lowest figures were reached towards the close of the year 1922. Results for recent months have not been figured out as yet as the calculations take a long time.

Dr. Abbot gave no explanation of the sun's cooling off nor any prediction as to how long it might continue. He said the result was certainly due to causes outside of the earth's atmosphere as all effects from such causes were allowed for. It must be due to conditions in the sun or its immediate surroundings, he stated.

As to the possible effect on the weather, Dr. Abbot said nothing so simple as general coolness should be expected, for the earth is too complicated with deserts, oceans, and clouds for that. He quoted from reports of the Weather Bureau which showed that 1921, the year before the decline in the sun's heat began, was the warmest of record for the last 50 years, taking the country as a whole. Last year showed a slight decline but was still above normal as was the early part of the past winter. But in December, three months after the sun had cooled to near the lowest point, unusual contrasts occurred. The southeastern states were warmest and northwestern ones coldest for 30 years. In January unusual storminess prevailed and the storm tracks followed strange courses. These conditions continued into February and the temperature began to average below normal, especially in northern and northeastern sections. New England has experienced one of the heaviest snowfalls for the entire winter ever known. March was generally below the normal temperature in the same region and the latter part of the month and the first days of April brought the most severe cold wave ever known so late in the season ^{in the country} east of the Mississippi Valley.

Although not referred to by Dr. Abbot, the winter has been unusually stormy at sea and ice bergs are so prevalent in the North Atlantic that the usual southerly steamer tracks for the ice season have been shifted further southwards. Reports from the Great Lakes at the end of March stated that the ice conditions of the upper lakes were approximately those of mid-winter and that in the judgment of experienced navigators the St. Mary's river and the Soo locks would not be passable before May, or weeks later than normal.

Dr. Abbot and his associates will continue to keep the sun under observation until July, 1925, at least. Two stations are making daily determinations of how much heat the sun radiates. One of these is 5,800 feet above sea level on the top of Mount Harqua, Hala, Arizona, and the other is at an altitude of nearly 9,500 feet on the top of Mount Montezuma, Chile. It is an absolute desert where less than an inch of rain has fallen in 20 years. At these isolated stations, above the dirt and dust of ordinary places, scientists of the Smithsonian Institution are able to observe the sun nearly every day because of the infrequency of clouds.

READING REFERENCES- Abbot, Charles G. The Sun. New York and London. D. Appleton and Company, 1911. Bosler, Jean. Modern theories of the sun. In Smithsonian Institution, annual report, 1914. Washington, 1915.

NEW COMPASS FOR SHIPS PERFECTED

A development of the new "earth induction compass" similar to that designed for airships but intended for vessels at sea has been practically completed by Dr. L. J. Briggs and Dr. Paul R. Heyl of the U. S. Bureau of Standards and is ready and waiting for a sea trial on some vessel of the Navy. It is larger than the one used in planes, actuated by an alternating current motor instead of wind cups, and is more heavily built; but the principle is the same.

Two direct currents are generated by revolving two pairs of brushes at a velocity of about 1,400 revolutions per minute in the magnetic field of the earth. The instrument is so adjusted that when set for a compass bearing the currents flowing from each pair of brushes are equal and produce no effect on a galvanometer. If the instrument turns even slightly one current becomes stronger and the dial needle is deflected.

The advantage of the instrument for war vessels is that while the generator may be put in a fighting top and the greatest possible distance from any effect of the magnetism of the metal of the ship, the control dial may be on the navigating bridge. In contrast to the gyroscopic compass, now in use on many vessels of the navy, the new compass is inexpensive and within the reach even of the smaller merchant craft.

NO THYROID GLANDS, FEW BRAINS

The importance of the thyroid gland and the adjoining parathyroid glands of the neck to the development of the nervous system was illustrated at the recent meeting of the American Philosophical Society by Dr. Frederick S. Hammett of the Wistar Institute of Anatomy and Biology. Young rats which were deprived of these glands, the absence of which in human beings causes idiocy, showed a notable lack of development of the brain and spinal cord.

In the case of female rats the growth of the brain attained to only 3.4 per cent. of normal, while male rats managed to acquire 34 per cent. of a normal brain. There was a similar but not so great a reduction in the weight of the spinal cord, and the growth of the body was also adversely affected. Excision of the parathyroid gland alone led to a similar result but the results were not so extreme.

VAST MOUNTAINS FORM ON OCEAN FLOOR

The floor of the ocean in many places changes its elevation many thousands of feet in a comparatively short time, producing great sea-quakes and creating vast submarine mountains or valleys, Prof. William H. Hobbs, director of the geological laboratory of the University of Michigan, told the American Philosophical Society at its recent meeting.

These mysterious earth movements show themselves as perils to navigation, called vigias, that are reported by some navigators and sought for in vain by others, Prof. Hobbs said. St. Esprit reef in the West Indies has sunk as deeply as 2,000 fathoms although in 1876 a ship saw rocks at practically the same place, he pointed out. Off the coast of Australia there is also a zone of unrest in which a mountain is forming.

Prof. Hobbs predicted that these great movements of the floor of the sea will be revealed when extensive surveys are made with the Navy's new sonic depth finder, invented by Dr. H. C. Hayes.

While the number and magnitude of violent crustal changes are much greater in the oceans than on the land, the mountains of the sea give us a clue to how the topography of our earth was created, he said.

Though it is not necessary for the geologist to assume sudden world cataclysms in the evolution of the earth to account for the contour of the present crust, Dr. Hobbs urged the abandonment of the extremely opposite idea that the earth took its geological form through the action of gradual physical forces without great shifts of crust. The geological ideas on the amount of time necessary to form the earth are also being revised due to the studies of mountain building now in progress.

"The climate of the earth is quite abnormal at the present time since it is passing out of one of its exceptional brief periods of glaciation," he said, in stating that during the greater part of the geological history the climatic zones such as now on the earth did not exist. Lack of different climates would greatly influence the period required for wearing away mountains and valleys and thus affect the geologist's estimate of time.

MARATHON DANCERS LIFT TON, 1,600 FEET IN DAY

A girl marathon dancer who sticks to it for a 24 hour day performs an amount of physical work about equal to that of lifting a ton to twice the height of the Woolworth building or three times the altitude of the Washington Monument in the same period time. It is equivalent to lifting herself to a height of 3,000 feet or more greater than that of the highest mountain on earth.

These startling results are obtained from the figures given in a study of "Energy Transformations During Horizontal Walking" by Dr. Francis G. Benedict and Hans Murschhauser of the Nutrition Laboratory of the Carnegie Institution of Washington. A fast walker, taking 152 steps a minute, which is about the same as that of the modern dance, raised his body about seven meters, or 23 feet a minute.

Assuming the same for a lightweight dancer weighing 100 pounds and keeping at it for 24 hours, it may easily be figured that the lifting amounts to 1,380 feet an hour, or 33,120 feet in a day. This is more than 3,000 feet higher than.

Mt. Everest, the highest mountain in the world.

If the dancer weighed 100 pounds, the energy expended in this lift would total 3,312,000 foot pounds or that equivalent to lifting one ton 1,656 feet, almost exactly three times the height of the Washington Monument. For heavier dancers, the work expended would be proportionately more.

WANT ARTIFICIAL EARTHQUAKES CAUSED BY EXPLOSIONS

Use of the surplus explosives of the government, left over from wartime, as aids in the study of earthquakes was suggested by Prof. R. A. Daly of Harvard University to the American Geophysical Union at their recent meeting in Washington. The idea is to cause miniature earthquakes, the details of which would be known. From a study of them more would be learned about the big earthquakes.

Prof. Daly suggested that the explosives be set off in abandoned and worked out mines and the rate of the vibrations through the different layers of the earth's crust studied. It is known that earthquake waves travel at differing rates in the different strata but accurate measurements of these rates and differences are difficult in the case of natural earthquakes since it is seldom known accurately just when one occurs at the place of its origin, nor how deep is its beginning.

The artificial earthquakes suggested by Prof. Daly would not be heavy enough to cause any damage and would be measured and detected only by delicate seismographs.

VOLCANO ON STRIKE; SCIENTISTS IN ERUPTION

A volcano which won't play is holding up an important proposed research by the Carnegie Institution of Washington on the constitution of volcanic gases. The money is ready, the scientists have assembled their apparatus and are waiting to be told the volcano is performing, but the volcano, apparently unaware that it is holding up the progress of science, is still on a vacation.

The volcano is one of the big ones of the Hawaiian Islands and the tidings of its misbehaviors were related to the assembled scientists of the American Geophysical Union who met recently in Washington. It is a volcano especially noted for its usual eruptions of hot gases, the composition of which is not well known as the gases are generally red hot when they escape and it is a little beyond the hardihood of the most intrepid scientist to catch the incandescent vapors in bottles for analysis.

But science has a long distance weapon of research for just such cases, the spectroscope, the same instrument by which the composition of the incandescent gases of the sun and the most distant stars is determined. So it was arranged that a group of expert spectroscopists from the Mt. Wilson Observatory in California should take a jaunt out to Hawaii with their scientific artillery, set it up at a convenient distance from the volcano some dark night and proceed to determine the constituents of the volcano's breath at long range. Analysis of volcanic gases is important as a clue to what causes volcanoes, and when that becomes known it may be possible to predict future eruptions with great saving to life and property. Hence the interest of the scientists in the investigation.

To all of which the sleeping volcano is deaf, and dumb. No alarm clock will arouse it, nor pleadings move it. While the scientists wait impatiently, fuming meanwhile in imitation of the volcano's own frequent activity, it slumbers on with the large indifference of Nature in general to the performances of man, her latest toy and would-be cut-up of the universe. When it gets ready, the volcano will erupt; meanwhile not even scientists can move it.

READING REFERENCES- Johnston-Lavis, Henry James. The mechanism of volcanic action. In Smithsonian Institution annual report, 1909. Washington, 1910. Jagger, Thomas Augustus. Special bulletin of Hawaiian volcano observatory. Honolulu, Hawaiian Gazette Company, Ltd., 1913.

Dr. Edwin E. Slosson

CHATS ON SCIENCE

HOW OLD IS DISEASE?

There is a curious belief still lingering in the popular mind that diseases came in with civilization; that primitive men and animals lived in a state of perpetual health and died a natural death -- though it is hard to see what is meant by "natural" in this sense. Even Mrs. Charlotte Perkins Gilman, who is very much of a modernist, falls into this folk fallacy for in her poem on "the little Eohippus" she makes the cave-man prophesy:

"We are going to wear great piles of stuff
Outside our proper skins!
We are going to have diseases!
And accomplishments!! and sins!!"

"It was a clinching argument to the Neolithic mind" but really it was not so. The Neolithic man was all too familiar with diseases and doubtless had also his accomplishments and sins. He suffered from rheumatism and "cave gout" and toothache, for caverns are damp and chilly lodgings. He shared the diseases as he did the lodgings of the cave bear and saber-toothed cats. The earliest human bones, if indeed they can be called human - those of the ape-man who lived in Javy some half million years ago, bear the marks of a painful malady. The skull of the Dawn Man of Piltdown, England, a hundred thousand years old, is deformed by disease.

The men of the Stone Age must have suffered frightfully from headache for they allowed the tribal doctor to cut holes in their skulls with flint knives to let out the demon that was causing the pain. And if the patient was not cured or killed by this treatment he sometimes tried it again when he had another headache. Dr. Roy L. Moodie of the University of Chicago, in his new book, "The Antiquity of Disease", says: "A few ancient skulls reveal five cruel operations, which had all healed. The patient has survived them all." But he suggests that since this custom of trepanning was practiced most commonly in Peru the patient may have had the relief of a local anesthetic in the form of a few leaves of cocoa, the plant that gives us cocaine.

But eons before the human era the dumb animals had to endure all manner of diseases. The dinosaurs of the Mesozoic Era had "misery in the bones" - and

such bones as they were! You have seen them in the museum. It must have been worse than a giraffe's sore throat. "Pott's disease" was doing its wicked work millions of years before Dr. Pott was born, though this sounds like an anachronism. This is shown by the discovery of backbones of saurians that had been stiffened by tuberculosis. Tumors are to be seen on reptile skeletons buried in the rock chalk of Kansas, and broken bones showing signs of bacterial infection have been found as far back as the Permian of Texas.

Geologists have to depend mostly upon bones for their knowledge of ancient diseases since the softer parts do not leave fossil remains but the stems of crinoids in the coal fields are found bored into by worms and it is apparent that the mollusks, crustaceans and plants of earlier ages were afflicted with parasites and other pests.

The earliest and simplest forms of plant and animal life, the bacteria and protozoa, seem envious of later arrivals and wage perpetual war on them to this day. The larger animals prey upon the smaller, but so do the smaller upon the larger, and the most dangerous of beasts of prey are the littlest. When man appeared on the planet he found the microbe lying in wait for him. Sooner or later, we all fall victims to the lower forms of life, and, after death if not before, become the food of our invisible enemies. Even Tut-Ankh-Amen, embalmed and entombed for the perpetual preservation of his personality, will ultimately be gathered into the recurrent cycles of common life.

READING REFERENCES - Councilman, William Thomas. Disease and its causes. New York. Henry Holt and Company, 1913.

HOMESEEKERS ADVISED TO ROOST HIGH BY WEATHER EXPERT

Prospective buyers of real estate, especially homesites, were advised to consult the weather man as well as the real estate man before deciding on a home by Prof. C. F. Brooks of Clark University, who spoke to members of the American Meteorological Society at their recent meetings in Washington. Seek the heights rather than the lowlands if you want to be comfortable and save coal bills, he advised.

Asked by the authorities in Worcester, Mass., to give them some meteorological advice on city zoning, Dr. Brooks made a series of experiments in that city the past winter to find out just what sections were the most desirable from the point of view of climate, and his results indicated that the higher up the hills you go the warmer the winter climate.

The best locations for a home, he said, were the south and southeast slopes of hills at a distance at least one-third of the way up. Other slopes were exposed to the cold winds of winter and as for the valleys they were the coldest of all.

Cold air settles in the valleys because it is heavier than warm air and so on cold winter nights the valley floor may be 10 to 20 degrees colder than the hillsides. Prof. Brooks related that one night last winter when the temperature on the hillside was 11 above zero, the same thermometer when exposed in the bottom of the valley showed 14 below zero. A southeast slope is most desirable for the one gets the morning sunshine, which coming at the time when heat is most desired makes a material saving in coal bills, he stated.

In the discussion following his remarks, Prof. W. J. Humphreys remarked that the Swiss peasant had beaten the professor to it, as he preferably built his home on a knoll in the valley, above the coldest air and yet not on the hillside. "Yes," replied Prof. Brooks, "and the American settler in Alaska keeps on building his home in the valleys where it gets down to 55 below every winter while on the slopes it is undoubtedly not nearly so cold."

So the young couples who are looking about in this nesting season are advised to nest high, not to swallow everything the real estate man says, and above all to consult the weather experts if they want to save coal and temper.

IMMUNITY TO DISEASE CAN BE MADE HEREDITARY

That artificially induced resistance to infection may be transmitted to later generations is the conclusion reached by Prof. M. F. Guyer, of the University of Wisconsin, after years of experimentation on animals at the University. Prof. Guyer told the American Philosophical Society meeting recently about his latest investigations on the question of the inheritance of acquired characteristics. By inoculating successive generations of rabbits with the germs of typhoid fever he was able to develop in their blood an anti-body which is transmitted from mother to offspring and renders them more immune to the disease. Rabbits of the fourth or fifth generation so treated may be made capable of overcoming an injection of thirty or forty times as many typhoid bacilli as the original rabbits could stand. Whether such acquired immunity is also transmissible through the paternal side has not yet been determined but as Prof. Guyer says:

"It is of interest to learn that young may not only acquire immunity reactions from their mothers but may retain them sufficiently to transmit them in a measurable degree, without further immunization, to their own offspring. Even if this is nothing more than maternal transmission it may be of practical importance since a large percentage of a population might, in time, through such transmission come to exhibit some degree of immunity to a widely prevalent disease.

"If the results of our future experiments bear out our present data it becomes evident that when succeeding generations of rabbits are immunized to typhoid bacilli some modification is made in the immunity mechanism whereby individuals of later generations are capable of developing higher resistance against these germs than were the individuals of the first generation treated."

If Prof. Guyer's results are confirmed by further experimentation, they will throw a new light on the mechanism of heredity and the mode of evolution. They may explain how certain races have acquired immunity to diseases fatal to others; for instance, why measles, which is with us a mild infantile malady, has almost wiped out the adult population of some Pacific islands when the disease was introduced there. Prof. Guyer has proved in previous experiments that an eye defect, artificially induced in a rabbit, may be passed down to the ninth generation and probably becomes permanently hereditary. His researches are generally regarded as having dealt a death-blow to the theory formerly held, that acquired characteristics are never inherited.

READING REFERENCES- Karsner, Howard Thomas and Ecker, Enrique E. The principles of immunology. Philadelphia and London. J. B. Lippincott Company, 1921. Ehrlich, Paul. Studies in immunity. New York. J. Wiley and Sons, 1910.

CAVE MAN TEETH MAY SHOW MAN ORIGINATED IN EUROPE

Man may have evolved completely from apes in Western Europe, according to conclusions as to the relationship of the teeth from the famous Piltdown jaw with those of ancient apes and early and modern men recently announced by Dr. Ales Hrdlicka, curator of anthropology of the U. S. National Museum. Thus a Europe instead of an Asiatic origin of the human race is indicated.

The fossilized jaw has been a subject of dispute among scientists since its discovery near Piltdown, England, in 1912. Some scientists have maintained that it belonged to a very early human being. So primitive and simian-like is it, however, that others have declared it to be that of a chimpanzee. Recently Dr. Hrdlicka made a trip to Europe especially to examine the original fossil. He made careful measurements of the length and breadth of the crowns of the teeth of this ancient relic.

From a comparison of these measurements with the corresponding molars of a large number of European, American, Egyptian, Chinese, Lapp, Eskimo, Indian, Polynesian, Melanesian, Australian, negro, and other modern peoples, he declared today that the only conclusion that appears justified is that the Piltdown teeth, primitive as they are in some respects, are already human or close to human.

Comparison with the measurements of the teeth of a large number of cave men teeth, he said, shows closer connection with the earlier than with the modern types of human beings.

Generally speaking, he explained, the more recent the teeth, more particularly the first molars, the shorter they are. The length of the crown of the tooth from front to back appears to diminish with the progress of time, while the breadth remains about equal. The Piltdown teeth in breadth are ordinary human, but they are longer than those of either present day or early man.

After determining the human relationship of this "Dawn Man" as ^{it} has been called, Dr. Hrdlicka secured from the National Museum collection a large number of teeth of ten American and twelve European species of apes, including chimpanzees, orang outangs, gibbons, and others.

He found that the Piltdown man did not connect with any of the living forms of anthropoid apes. In Bohnert Alb, one of an extinct line of large Western European apes known as *Dryopithecus rhenanus*, however, he found a striking similarity both in shape and size, although difference in detail, with the teeth of this early Piltdown man.

"The close relation of the Piltdown molars to some of the Miocene or early Pliocene human-like teeth of this fossil ape, while not conclusive alone," Dr. Hrdlicka declared, "raises legitimately the query as to whether man may not have evolved altogether in western Europe."

the teeth of

The differences in the sizes of male and female were taken into consideration in the investigation. It was often necessary, Dr. Hrdlicka said, to use a magnifying glass and take a number of measurements of each tooth to insure the greatest accuracy in the results.

Dr. Hrdlicka recently declared that the Piltdown jaw was much older than the skull found near it and to which it had been supposed to belong. He placed the Piltdown jaw as much older than the Heidelberg jaw or any other European cave man.
