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FOSSILS AND THE COURSE OF HUMAN THOUGHT

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Publication in 1859 of the "Origin of Species" by Charles Darwin was a milestone which has hardly been equaled for its profound effect on subsequent human thought. The idea that animals were not suddenly created in the advanced state in which we find them but were slowly evolved from lower forms was a radical departure from traditional thinking. As a result, many of the beliefs about the universe which had been taken for granted were subjected to thoughtful scrutiny. Nearly all writings of modern times definitely show in their outlook the influence of the changed attitude resulting from the discovery and practical establishment of the doctrine of organic evolution. Further, it may be claimed legitimately that evolution is the central problem of the field of biology, since all organisms and therefore all parts of organisms point to a common origin.

Included among the lines of evidence which show that evolution has undoubtedly occurred are comparative anatomy, comparative embryology, comparative parasitology, domestication of plants and animals, physiology, classification, geographical distribution, and paleontology. Of these, none has been more important than the study of fossils.

In times gone by people have pondered the meaning of fossilized remains. Some thought that they represented merely the victims of some flood of historical times. It is true that well-preserved fossils often belie their actual place in antiquity. Others felt that fossils were placed by the Creator to mislead the weak in spirit, or that they were the work of the devil. When in 1726 there was unearthed the fossil of a giant salamander, Professor Scheuchzer of Zurich pronounced it "the damaged skeleton of a poor sinner drowned in the Deluge." A century later the great French zoologist, Cuvier, showed its true nature. Cuvier himself, however, did not fully appreciate the significance of fossils as related to evolution. He explained the succession in fossil beds as follows:

> "If there be one thing certain in Geology it is that the surface of our globe has been subject of a great and sudden catastrophe of which the date cannot go back beyond five or six thousand years; that this catastrophe has overwhelmed the countries previously inhabited by men and by those species of animals with which we are today familiar; that it caused the bed of the previous marine area to dry up and thus to form the land areas now inhabited; that it is since this catastrophe that such few beings as escaped have spread and propagated their kind on the newly uncovered lands; that these countries laid bare by the last catastrophe had been inhabited previously by terrestrial animals if not by man and that therefore an earlier catastrophe had engulfed them beneath its waves. Moreover, to judge by the different orders of animals of which remains have been revealed, there were several of these marine irruptions."

Cuvier's theory of Catastrophism, as it is now called, suggested that repopulation after each catastrophe came from remnants which wandered in from unexplored lands. In this way he avoided a decision on the matter of special creation after each disaster and also disposed of the matter of the appearance of new kinds of animals in each strata. Later writers maintained the necessity of special creation after each catastrophe; one author decided there must have been twenty-seven such events!

Even though the great antiquity of fossils is now recognized and their meaning has been well investigated, there is yet much perplexity concerning individual cases. Breaks in deposition, and rising and sinking with changing habitats for living organisms will cause breaks in the fossil record. Tilting, shrinking, bending, folding, breaking and faulting may occur in fossil bearing rocks; thus it is even possible to have older fossils above those of lesser age.

Then the process of fossilization is the happy fate of relatively few individuals, and that mostly in favorable localities. One reason why human fossils are so scant appears to be that primates thrive in more or less forested areas where sedimentary rocks are less likely to be formed, so that preservation is unlikely.

Of course, there have been those favored sites of coal beds, ancient resins known as amber, tar pools, and the frozen mud cliffs of Siberia. For obvious reasons preservation has been particularly good under conditions which prevailed in these places. An occasional fossil shows with great fidelity the parts of the original owner. An ancient duck-billed dinosaur, Trachodon, in the upper Cretaceous of some 100,000,000 years ago died in soft mud so that its body form, even to the character of the skin, is seen in satisfying detail.

If evolution is true, as we believe, then existing animals and plants are the present ends of long lines of slowly changing stocks, in most instances slowly diverging from central or common ancestry. If we consider only the species occurring in historical times we can see the evidence of their relative stability and therefore can readily imagine the vast extent of time required to produce the astonishing array of variety in plants and animals. Some million and a half species of animals and about a third of a million species of plants have been described and named, and this represents only a part of the number which exists. An examination of the Zoological Record will substantiate that in one group, the insects, thousands of undescribed species are found each year.

But we have more than the mere twigs of the evolutionary tree. Already before us are the relatively complete fossil histories of some animals -- for example that of the horse -- and it would seem safe to predict that in the centuries of discovery to follow, the record will be far more complete, showing graphically the course of evolution. Now we have enough clues to show us the probable origin of birds, of mammals, and of other forms.

When we examine skeletal material for details which will aid in understanding relationships between different kinds of organisms we recognize at once that in major stocks, even in distantly related kinds of animals, one can match parts bone for bone. Thus the bones in the wing of a bat can be matched with the same kind of bones in the hand of man. Again, these are found to have their counterparts in the front appendages of a whale. Parts which can be compared in such a manner are said to be homologous. It is evident that analagous structures such as wings of insects and birds, since they do not have the same fundamental origin and structure, obviously belong to animals which are unrelated. The value of the study of fossils is that we can piece together the intermediate steps in the relationships of parts and therefore understand the relationships of their possessors. This is well illustrated in the case of the horse and its ancestors.

The modern horse is a highly specialized animal; that is to say, various parts are highly modified to serve certain specific purposes. Thus the skull is specialized through elongation, the molars are arranged for efficient grinding, and the incisors are fitted for cropping grass. The whole construction of the head region, then, is particularly fitted for eating one type of food -- grass. Grassy plains have little cover for hiding from enemies,

and it appears that in the wild horse the chief adaptation for escaping hungry carnivores was the ability to run rapidly, and this capability was achieved by limbs and joints molded to that end. An examination of the fossil horse stock shows the gradual change from an earlier more generalized (and therefore more primitive) condition to the present highly modified form.

The horse has only one digit in each foot; it is said literally to stand on its middle finger, the hoof being a modified nail. Leg bones are elongated and rotational movement is not possible. The latter has been sacrificed to attain efficient back-and-forth motion for running. Splint bones on either side of the functional toes suggest former possession of additional functional digits at some time in the past. But speculation is not necessary here because the fossil record verifies the presence of additional digits in early horse ancestors.

The fossilized remains of Eohippus, forerunner of the horse, which lived some 60,000,000 years ago in western North America and elsewhere show that it was the size of a cat, that it had generalized teeth, and that there were four functional toes on each front foot and three such digits on the hind foot. The molars were short-crowned and without many ridges, which would indicate that these animals fed upon succulent vegetation rather than upon grass. The greater number of toes and the broader foot compared to size could well allow for existence near the margins of forests or swamps.

Examination of the fossil record reveals at least ten stages in horse evolution beginning with Eohippus. Since breaks in the sediments occur it appears likely that we will never have the complete record, but enough has been discovered to give us the unmistakable trend. By steps both feet lost toes, the hind foot always showing a greater reduction in this regard. Side toes successively became "dew claws" and then splints, the latter completely enclosed by skin. Without the fossilized remains we would be completely ignorant of all but the last step.

We have seen the trends in the horse line in which the changes were directional -- the increasing complexity of the grinding surfaces of the molars and premolars, the increase in body size and length of legs, and the reduction in the number of digits. What could have brought about this directional change?

The most reasonable hypothesis states that these changes were parallel to those of the changing environment. Former lush forests and swamps gave way to firm grassland plains in which coarse grasses became the dominant basic food source. Given these changes, it was a matter of remodel or be eliminated. It is thought possible that from time to time variants appeared and these served as the basic material for natural selection. Variations not based upon mere changes in the somatic tissues would have to be ruled out since only mutations arising from modification of germinal tissue could be passed on through successive generations, a point demonstrated by modern genetics. Those mutants better able to eat coarse grass and those whose legs fitted them for greater speed were candidates for survival in a highly competitive world.

Now we may turn to the world of animals without backbones for another examination of the fossil record to see if here, too, there are similar trends from the more generalized plan of construction to the specialized condition. Indeed we are not disappointed, for in cases where the material is sufficient the same principle holds. The trilobites can serve as examples.

These aquatic animals which would have appeared much like large pill "bugs" were dominant forms of life at the beginning of the Cambrian, more than one-half billion years ago. At first they were generalized, then radiated into various types with differing habits. The more specialized groups developed long projections which very well may have been their undoing as the environment changed. One can well imagine that these parts increasingly hindered locomotion. In any event the more specialized forms disappeared first, followed by the entire trilobite line by the Permian period. Before we judge the trilobites too harshly for their failure to survive, we may note that as a group they were successful organisms for a period of more than 200,000,000 years, an interval two hundred times that of the existence of man as far as may now be determined. We know a great deal about trilobites: their diversity of species,

some of their habits, success and failure as judged by survival, and yet no one has ever seen a living individual. Here the entire story comes to us from fossilized remains.

Turning to the record left by insects we again find a group which has persisted for a very long period -- in fact some three or four hundred million years. They were already common in Carboniferous times. Shales of Kansas have yielded dragonflies with a wing spread equaling that of large birds, not to forget cockroaches nearly six inches long. One wonders about the mosquitoes of that time, if there were any! Baltic amber, ancient fossilized resin, has yielded ants perfectly preserved to the last little hair. Since various castes were preserved it may be inferred that some species of those ubiquitous insects had already gone social. Some species were primitive; others have remained unchanged to this day, a compliment to the stability of the gene. Not only ants but the fossils of many other groups of insects were preserved and many remain to be found.

Returning to our central theme of evolution, one of the most convincing types of evidence is that of the comparative study of wing veins of insects. Here we have a vast array of recent material in addition to the paleontological findings. On the basis of such comparative work Comstock and Needham of Cornell University, at the turn of the century brought forth a discovery which another great entomologist has termed the greatest single advance in the field of entomology. They arrived at a hypothetical primitive type of venation to which all wing veins can be related. However modified a given species may be, one can deduce how each vein in its wings is derived from a comparable vein of the primitive plan. This work has made possible a common and simple nomenclature of veins. Of special interest is the fact that fossils were used to substantiate the findings. In general the ancient insects had more primitive venation than those living today.

Thus far our discussion has dealt with animals other than man. Some people who are willing to accept at face value the fossil record of animals are much less willing to look squarely into the countenances of our own remote relatives of the past. Of course we <u>are</u> set apart, and we differ from other animals chiefly by virtue of brain development which has made it possible for us to literally change the face of the earth. Whether or not we want to call ourselves animals is just a matter of definition. A biologist, who learns comparative anatomy, comparative physiology, and other aspects of the field, has the animal relationship of man forced upon him by the sheer weight of evidence. Without question, the body is animal-like. How we got that way has been partly revealed by fossil remains.

Earliest discoveries of Neanderthal remains came nearly a century ago and at that time there was general disagreement as to the meaning of the finds. Some thought they represented the victims of disease. One German scientist believed that a Neanderthal skull was that of a Russian soldier killed in the Napoleonic wars! It would be of interest to review the history of the discoveries of early human remains, but only a few of the findings can be mentioned. For recent details discussed in an authoritative but entertaining manner the reader would do well to consult William Howells' <u>Mankind So Far</u>.

Neanderthal man lived somewhere between 50,000 and 100,000 years ago, was widely distributed over Europe and had a definite culture which fortunately included special burial. He differed sufficiently from ourselves to be considered a separate species. The brow ridges were beetling, the skull was carried far forward, and the posture was stooped in the extreme. There are numerous remains from many parts of Europe so that now we have a rather good picture of this formidable appearing type of person.

Pekin man, the first traces of whom were unearthed near Pekin, China, in 1927, lived during mid-Pleistocene times, and was so different from modern man that he is considered to belong to a special genus, <u>Sinanthropus</u>, but the remains are very definitely human and not at all ape-like. The brain capacity was much less than ours, the brow ridges were massive, the long bones were heavy since the marrow cavities were much smaller in proportion, and the teeth were distinctive. Parts of about forty individuals had been discovered by the beginning of World War II.

Java Ape Man, discovered by Dubois many years ago, probably dates back to the early Pleistocene of some half million years ago, and is more human than ape but is still more primitive than Pekin Man. Parts of several individuals have been recovered in recent years so that Dubois' early interpretations have been substantiated except for minor details.

These together with a good many other finds have given us the basis for believing that man like other animals has been subject to the evolutionary process. Actually this need cause no one any particular worry since it should appear just as suitable to have been created in this manner as by a sudden synthesis.

Having now made a brief survey of bits of the field of paleontology, or biological geology, we can see the great contributions which have been made to our knowledge of the past, and more important, how animals are related and what their trends of development have been. This information has formed some of the more convincing kinds of evidences for evolution. In turn it may be stated that no idea ever presented in modern times has had more influence on our way of thinking than has the doctrine of organic evolution. Therefore, a knowledge of fossils has actually been a strong factor in charting the course of human thought.

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ANNUAL ASSESSMENT WORK

Suspension of annual assessment work on mining claims is covered by the law as follows:

PUBLIC LAW 47 - 78th CONGRESS
Chapter 91 - 1st Session
(H. R. 2370)

AN ACT

Providing for the suspension of annual assessment work on mining claims held by location in the United States, including the Territory of Alaska.

BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED, That the provision of section 2324 of the Revised Statutes of the United States, which requires on each mining claim located, and until a patent has been issued therefor, not less than $100 worth of labor to be performed or improvements aggregating such amount to be made each year, be, and the same is hereby, suspended as to all mining claims in the United States, including the Territory of Alaska, until the hour of 12 o'clock meridian on the 1st day of July after the cessation of hostilities in the present war as determined by proclamation of the President or concurrent resolution of the Congress: PROVIDED, That every claimant of any such mining claim, in order to obtain the benefits of this Act, shall file, or cause to be filed, in the office where the location notice or certificate is recorded, on or before 12 o'clock meridian of July 1 for each year that this Act remains in effect, a notice of his desire to hold said mining claim under this Act.

Approved May 3, 1943.

As there has been no proclamation by the President or concurrent resolution of Congress that "cessation of hostilities" has taken place, then suspension of annual work is in effect at least until July 1, 1946.

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VALUE OF GOLD

Why do people, when they have the opportunity, eagerly acquire gold? It is that age-old search for the safest investment for savings; the wish to exchange a government promise-to-pay for a precious metal that has always been a safe hedge against depreciated currencies; the universal feeling that no matter what governments may attempt in the way of discouraging circulation of gold for money, or what may be done with the gold standard, they cannot destroy the intrinsic value of gold. Since time immemorial it has stood the test. The feeling of trust in the value of gold is ingrained in human consciousness.

According to an article in the Commercial and Financial Chronicle, New York, issue of February 21, 1946, some prices paid for gold in foreign lands are as follows: Brazil is selling a limited amount of gold to the public at the official rate of 25.25 cruzeiros per gramme (about $47 per ounce). In Bombay the legal price has been equivalent to $60 - $75 per ounce. Occasionally the India Reserve Bank has attempted to restrict sales, and at such times the open market quotation has gone as high as $80 an ounce. The French louis d'or has a face value of 20 gold francs (about $6.50 at par). It commands a price of $12 to $14 on the open market, and sometimes a much higher price for coins.

As the article points out, it is an inescapable fact that the world price for gold is now double the official price. Although, for the most part, the gold producer may not take advantage of this unsatisfied demand for gold, it is important to note that there are exceptions such as those in Latin America (note the legal price in Brazil). The legal ceiling price is maintained through government fiat and control of foreign exchange, but like all other such artificial controls, there comes a time when natural laws become overpowering. Unless there is a correction in the inflationary trend, open devaluation will be unavoidable in this country as elsewhere.

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ASSOCIATION OF AMERICAN STATE GEOLOGISTS

The annual meeting of the Association of State Geologists was held February 21 - 23 at Urbana, Illinois, at the invitation of the Illinois Geological Survey, Dr. M.M.Leighton, Director. Technical sessions were held in the large building, occupied jointly by the State Geological Survey and Natural History Survey, on the campus of the University of Illinois. Several papers were read descriptive of the comprehensive work of the Illinois survey both in the field and laboratories. These papers showed clearly the great importance to the State of the survey which Dr. Leighton has built up. At one of the meetings, Dr. W.E.Wrather, director of the U.S. Geological Survey, discussed the plans and activities of the Federal Survey, and Mr. E.W.Pehrson, Chief of the Economics and Statistics Division of the U.S. Bureau of Mines, spoke of plans of the Bureau.

Meredith E. Johnson, State Geologist of New Jersey, and Edward L. Troxell, State Geologist of Connecticut, were elected president and secretary-treasurer respectively.

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CURRENT MINING NEWS

The Golden Dredging Company, Prairie City, Oregon, has been organized to work the Elliot placers on Pine Creek in the Upper Burnt River area, Baker County. The company is a partnership composed of Geo. England, Harry Morse, Thomas Harrie, Frank Kendall, and Jenkins Pryce, all of Prairie City. The ground to be worked occupies the old channel of Pine Creek. A washing plant will be fed by a 1½-yard Northwest dragline.

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C. W. Gardner, Baker, has leased the mill tailings at the Ibex mine on McCullys Creek, Baker County, and has set up a small cyanide leaching plant.

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Messrs. Holt and Bower, Boise, Idaho, are installing equipment on the Meeker and Wyant placer claims on upper Pine Creek, Baker County, Oregon. It is expected that the property will be in production this spring.

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