The Geographical Distribution of the Mammalia.

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The study of animal life, of the present, though more especially of the past forms, aside from the interest and information which may be gained from a zoological point of view, is a very important one. It is by this study that we are enabled to form theories as to when and where they originated, how they developed and finally were distributed in such a peculiar manner all over the earth's surface. This latter, the study of animal distribution, gives a good basis for the formation of theories as regards the original land surface of the earth and the various changes which it has undergone through the different geological periods.

To make a complete and exhaustive study of all of the different forms of animals

would be a well nigh impossible task, hence it is we confine ourselves to a study of the mammalia, as they are the highest, best developed and easiest to study and serve as a representative form of all of the members of the animal kingdom. We will also confine ourselves to their geographical distribution as seen in the present as well as the past conditions of the earth which have effected them in their method of distribution.

First, as to the present aids and barriers to distribution.

There are various natural barriers that tend to confine the different animals to certain localities. There are some mammals, notable examples of which are the whales, dolphins, rats and elephants which seem to be stopped but by few obstacles. The elephant, for instance, is able to go almost when and where it

will, forcing its way through dense jungles, crossing deserts, swimming rivers or climbing to the tops of mountains. The whale is only stopped by the presence of land or of too cold a climate and the dolphin is found in very nearly every sea. The rats and mice are adapted to almost any climate and may be found all over the earth. The bats also because of their power of flight may be found anywhere on the earth's surface.

The examples given are exceptions to the general rule. One of the principal barriers to migration is climate. The different mammals are best adapted to certain ranges of heat and cold and under natural conditions cannot live outside of these boundaries. There are animals peculiar to the polar regions, as the white bear; to the temperate regions, as the buffalo and to the tropical regions

as the elephant. Under artificial conditions they do not seem to be limited as we can see white bears and elephants in this country in almost any menagerie. The conditions that are connected with the different climates are perhaps more important, for with a certain climate we have a certain vegetation and as most mammals are dependent on vegetation for their subsistence they are confined to the regions where the best form of food for their maintenance is found. Connected with this is the amount of rainfall and the amount of moisture in general, for some mammals are best adapted to moist places and others to dry ones. A river, especially if it is a large one, will furnish an impassible barrier to most mammals and hence we often find peculiar forms on the opposite sides of the same river.

A valley may prove a barrier to an animal which is adapted to a mountainous region or a desert. Mountain ranges are impassible barriers to most mammals and we often find different species of mammals on the opposite sides of the same mountain. A desert also furnishes an example of a barrier to most mammals, perhaps with the exception of the camel. Oceans, seas and bays are also very important agencies in confining mammals to certain regions, for with the exception of the aerial and aquatic forms, no mammal has been known to swim beyond the distance of a very few miles. Some mammals are peculair to the mountains, as the goat. some to the prairies, as the buffalo; others to the forest as the monkeys. Hence it is we judge that the different mammals tend to live in the various places which are best adapted to their modes and habits of life.

There are also different agencies which aid in the dispersal of mammals. For instance, in the polar regions, one of its peculiar mammals as the polar bear may become stranded on an ice berg and from thence be carried to places farther south and be eventually left on some other land. Many bears are annually left in Iceland by this means. In many rivers, especially the Amazon, may be seen, floating along with the current, huge rafts made of trees, held together by the interlacing of vines, covered with vegetation and often huge trees. Animals may become stranded on these minature floating islands and be carried by the aid of wind and waves far out to sea and be left on the shores of some island there to populate that island with those of its kind

Second, as to the past aids and barriers to distribution.

A study of the apparent aids and barriers to distribution give us a great deal of information, but it is by a study of the fossil remains of the past ages that we are best enabled to trace out the origin and distribution of the different mammals up to the present time.

The first evidence we have of fossil remains of mammals is found in the Eocene deposits of the Tertiary period and from there on they may be traced through the various gradations up to their present form. All of these changes may be traced by fossils found in the northern hemisphere. It is here that we find even fossil remains that are at present found only in the southern hemisphere such as the elephant, rhinoceros and hippopotamus which are peculiar to Africa; the marsupials which now are found only in Australia, the lemurs of Madagascar and the

apes of Malaya. How are we to account for their presence in the northern hemisphere? They certainly lived here during some of the past ages. We also find that the fossils of the eastern and western halves of the northern hemisphere are identical. Taking these various facts into consideration, we cannot help but conclude that during the earlier part of the Tertiary the land masses of the earth were found in the northern hemisphere and that the eastern and western halves were more closely connected than they are at present.

In the southern hemisphere, it is thought that there were three land masses much as there is at present represented by Africa, Australia and South America. These land masses, it is thought, were at different times connected with the great land mass of the north in order to allow their being

inhabited by the animals from the north. Australia was probably connected during the Eocene period and this permitted its being stocked with the marsupials which were so numerous at that time, subsequently it was isolated and has remained so since. This explains why Australia has such a peculiar fauna. The other land masses were probably connected later and several times allowing the inflow of the different animals from the north.

This supposition is based on phenomena which have been witnessed even in recent years- that of the raising and submerging of land. But just how and when this was done is still not well understood and will not be till a more thorough study is made of the fossils of the southern hemisphere.

One thing is almost certain and that is that at one time

Europe and Africa were connected, and at the same time the northern and southern halves of Africa were separated by an arm of the sea. This is shown by a submerged bank in the Mediterranean and fossil sea shells found in the Sahara desert.

From a study of the animals of the eastern hemisphere it is found that of the northern and southern parts that they much resemble each other and the same is true of the western half. Hence we decide that the eastern and the western halves of the northern hemisphere are the two great branches of the tree of life from which all of the others originated.

It was probably during the last connection of Europe with Africa that the then prevalent type of mammals, the ungulates and primates, migrated into Africa.

But how are we to account

for the disappearance of these animals from the northern hemisphere?

It is from a study of the action of glaciers that we are enlightened on this subject. We find everywhere in the northern hemisphere north of 40° of latitude, evidence that at some past time the whole northern part was covered with glaciers. This is shown by the mountainous moraines which are found some of them thousands of feet high and hence we judge that at one time the whole temperate zone was covered with a vast ice sheet thousands of feet thick much as Greenland is at present. It must have been this cause then which changed the once almost tropical temperature of the temperate zone to the frigid one of the arctic and drove many of these animals farther south over the land connection which was then present between Europe and Africa into the now torrid region of the tropics.

Later the land connection was separated and the ice melted away but left a less congenial climate in the north. With this coming of the ice or glacial epoch was the appearance in the temperate regions of the animals from the north. When the ice melted away these animals were forced to go back north or else up the mountain sides and hence it is that at present we find on the mountain tops animals and plants peculiar to the arctic regions.

Following the glacial epoch we have a depression in the land surface of from one hundred to five thousand feet and consequently a period where inland seas and lakes are numerous. Then again at the end of this epoch or the champlain there followed a corresponding upheaval movement by which the land was brought by gradual changes to the condition in which it is in at present.

It is during this epoch that the mammalian age culminates; that we find the remains of the various giant mammals that were present at that time, such as the mastadon, mammoth, cave bear and saber toothed tiger.

It was at this time then that man gained the ascendency which he has held ever since. He is at present a universally distributed mammal.

This then is a brief history of the various conditions and changes which the earths surface has undergone through the different geological epochs beginning with the Eocene and on up to the present combined with the various natural aids and barriers serving as an explanation of the "Geographical Distribution of the Mammalia."

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