

cal savannas, of the steppes, of the deserts, of the landes, of the marshes, of the turf pits, of the littoral regions, of the forests, of the water courses, or of stagnant water and the sea, each of these floras constituting a great type of agglomeration, in the interior of which the mutual services are evidently numerous, but in which the principal cause of the approximation is the cosmic factor.

On the contrary, the grouping in vast areas of certain plants of which the pollen is transported by the wind (Graminaceæ, Coniferæ, Cupuliferæ, etc.) is a condition indispensable for the facility of their reproduction. There are comparable biological necessities that compel climbing plants to employ the support of contiguous trees in order to raise themselves to the light or which, in the interior of tropical forests, force numerous ferns and orchids to fix themselves to the summit of trees instead of obtaining their food and support in a dangerous soil. We may easily get an idea of symbiosis by imagining that a plant thus supported by another concedes to it in the way of payment, as it were, some one or another of the elements which it lacks. This is what occurs, for example, in the celebrated case of mycorrhizas, an intimate association of the mycelian filaments of certain fungi with the roots of certain plants, the tree profiting by the nitrogen which is furnished to it by its host. Among the services rendered to plants by the animals which demand food from them or which seek their secretions there are some that are well known. Thus we know that the cross fertilization of many plants is possible only through the intermedium of insects and birds, and that animals disseminate likewise the seeds once formed, etc. The chapter on the relations of ants and plants will always be one of the most diverting ones of the natural sciences. It seems that in them instinct has exhausted in advance all the most subtle actions that intelligence can imagine. The harvest ants, for example, collect and store small grass seeds, etc., in their nest, and arrest their germination by eating the young plant that is in process of emerging, and afterward place them in the sun to dry, then store them up anew, and feed upon the soft and saccharine parts, and carry the seed coats outside. Other ants of the American genus *Pogonomyrmex* weed all the ground that surrounds their nest, in leveling the surface, and tolerate thereon but a single plant, a grass, which thrives all around the nest. The *Attar* of South America devote themselves to the culture of fungi. For this purpose they prepare a material composed of comminuted fragments of leaves gathered from the trees in the vicinity, and of various other materials. It is upon this substratum that develops a fungus, always the same, the *Rozites gongylophora*. It must be stated, moreover, that the means of defense employed against ants are no less curious, or, we may say, no less ingenious, than the ones above mentioned. One of the strangest is a mode of alliance contracted by the plant with a species of ant against another species. Certain acacias are provided with hollow stipular spines, in the interior of which ants, "in garrison," find food and lodging. The cecropias of tropical America offer the *Azteca*, which protect their leaves against the *Attar*, more perfect lodgings still. These are cavities that exist in the hollow interior of the trunk and which are connected with the exterior by an aperture situated above each leaf insertion. In this housing the ants rear plant lice and make their exit now and then in order to seek secretions furnished by the plant support and which they use as food.

We ought now to give a rapid sketch of what Dr. Laloy calls social life in the animal kingdom, to show the various faunas, their origin and modifications, to describe the animal societies so wonderfully organized among insects, to speak of the cities formed by birds, of the family, of the herd, and of the clan in mammals, and also of animals of different species, to penetrate anew into the tropical formicaries, to see what hosts are admitted to them as friends, parasites, or slaves, etc. But our space is unfortunately limited.

However, we think that we have said enough to show the deep and enthralling interest that has enticed Dr. Laloy's talents. Although we have, so to speak, made but a cursory examination of his book, we have seen how replete it is with singular facts and ingenious views. We have been able to persuade ourselves especially at every instant (and a more detailed study page by page would only make it more deeply felt) of the great importance of the life factor upon the form invested by the life phenomenon. It is not only between living species and raw material that there is a perpetual motion of action and reaction, which is shown by modifications and adaptations; but the same law is true for the relations of species with each other. All the forms of beings with which we are acquainted are the resultants of the conflict of living matter with these two great orders of modifying causes.—Translated from the French of Jean Lafitte, in *La Nature*, for the SCIENTIFIC AMERICAN SUPPLEMENT.

Alum Plaster (Marble Cement).—Calcined plaster is treated with cold saturated alum solution, then recalcined, 1-12 the weight of the plaster of alum mixed with the plaster and the casts made. They set slowly, but finally become as hard and translucent as marble. (2) Pieces of calcined gypsum as large as a fist are steeped three hours in alum water (12 parts by weight of alum to 100 parts of water) at a temperature of 35 deg. to 40 deg. C. (95 deg. to 104 deg. F.), again calcined, mixed with 1-16 the weight of powdered alum, and wetted with water containing 1-16 part of sal ammoniac to each part of plaster, to form the casting paste. Casts made from this mixture possess consid-

erable hardness, a bright luster, and it is admirably adapted for the production of fine statuettes or delicate patterns.

A VAST NEGLECTED FIELD FOR ARCHÆOLOGICAL RESEARCH.

By HARLAN I. SMITH.

THE territory roughly included in the area known as "The Great Plains," "The Plateau Region," and "The Barren Lands," which forms such a vast portion of the North American continent, in my opinion, offers an extensive field for co-operative archæological research, since its prehistoric ethnology is practically unknown.

Its historic ethnology has recently received attention at the hands of energetic, trained anthropologists. Its prehistoric ethnology, or archæology, however, has been neglected, possibly because modern ethnological problems in that area have held the attention of visiting anthropologists, or perhaps for the reason that, on all that vast area, comparatively little literature or other material was available. Few archæological sites are known, and literature on the whole subject is scant, even clues to sites being of rare occurrence in papers on other subjects. Archæological specimens from the region in question, both in museums and in private hands, are not numerous; and those that do exist show a narrow range of forms, and, with few exceptions, have little or no individuality. All these facts have no doubt contributed to the causes of this deplorable neglect. A further reason was probably the supposition that the region was uninhabited until comparatively recent times; that it was an area where only a few finds could be expected as a reward for the persevering toil of the investigator; and that such finds would be of only a few types, of crude technique, and of a low order of art.

Some archæological work, however, has been done in this area, notably in Wyoming, but by anthropologists chiefly interested in problems relating to the ethnology of the present peoples.

The scarcity of archæological specimens from this vast area, and the dearth of literature on the whole subject, may be due to the fact that until recently no one fitted to collect or to write has visited the region, it having been occupied by white people only lately, and not even visited by them until comparatively recent times. It must also be remembered that the lumbermen, cattlemen, miners, and railroad men, who have made up a large percentage of the white people who have been in the territory, belong to a shifting population, not given to the examination, much less to the preservation, of archæological objects; while until very recently the number of farmers and settlers has been small. These stable people, having homes, possess means of caring for such specimens as appear to them interesting. Had they been in the region for a longer time, or even in greater numbers, we might have had more data upon which to work.

On the other hand, the scarcity of archæological material may be due to the comparatively recent occupation of the area by Indians, or to a sparse population, if not to both of these causes. It is quite possible that the plains were not thickly populated before the introduction of the horse, the acquisition of which, no doubt, gave a great impetus to migration throughout the entire plains area.

The area, more particularly but roughly defined, includes the western half of the Dakotas, all of Nebraska, the western third of Kansas, Oklahoma, a wide strip north and south through Texas, all of Colorado except a small portion in the southern part of the State, Utah with the exception of a small area in the southeastern part, Nevada, Wyoming, Idaho, Montana, and the vast adjacent portion of the British possessions. It includes, among great natural divisions, the upper valley of the Missouri, that of the Platte, the Upper Arkansas, the Great Basin, the Upper Columbia Valley, the Yukon Valley except near the mouth, the Mackenzie Basin, and the area draining into Hudson Bay. Linguistically the area embraces all of the territory inhabited by the peoples of the Kiowan and Kitunahan stocks, and the greater part of the areas inhabited by those of the Siouan, Shoshonean, Caddoan, Athapascan, and Algonquian stocks. The Siouan, Shoshonean, and Athapascan areas correspond to that part of the region regarding which we are in perhaps the greatest need of archæological data.

This whole area separates, or is in part bounded by, the Pueblo and cliff-dwelling culture-area, that of the Mississippi Valley, that of California, and those of the North Pacific coast and the plateaus of Washington and southern British Columbia as now outlined. An exploration of it would probably exactly define the limits of these culture-areas and the presence or absence of an intermediate culture area or areas.

It must be remembered that pottery of certain well-known kinds is one of the great characteristics or marks of individuality of the Pueblo area and of the prehistoric culture of the Mississippi Valley and forest area to the northeast, while, on the other hand, no ancient pottery is known from the California area or the Northwest coast. Both of these latter regions are so well known, that the absence of pottery, or at least its great scarcity, is determined; but its presence in the wide northern area of the interior of British America is possible. It is true that pottery has been found in Alaska which closely resembles that from the adjacent portion of Siberia. The art of making it may have come from Siberia; so that it does not necessarily lead us to expect to find pottery

in the Upper Yukon, the Mackenzie Basin, or, in general, in the Canadian Northwest.

In 1904 I called the attention of the Anthropological Club of Harvard University to the need of archæological investigation in the area lying between the plateau region of southern British Columbia and the cliff-dwelling and Pueblo region of the Southwest, pointing out at the same time the absence of pottery in the former area, its great development in the latter, and the interest which we have in defining the line separating the region where pottery was made from that where it was not made.

The need of archæological work in this vast territory is felt by students of historic ethnology. As has already been mentioned, they have started well in working up the area, and they would certainly be interested in the prehistoric relations of their problems. The length of time the various parts of the area have been inhabited, the history of every culture that has developed there, the modification of such cultures as may have been brought into the territory, their causes, and the migrations into and round about over the area—all these may be mentioned among the problems to be solved.

It is true that in this region we may hardly expect to find archæological material comparable to that found in the Southwest, Mexico, and Peru, especially the kind that would appeal to architects, artists, travelers, and students of modern history. But, however entertaining it might be to contribute to these interests, it must be borne in mind that archæological work is not done solely to meet the needs of those interested in these subjects; it is the professional duty of the archæologist to reconstruct prehistoric ethnology even in fields that are held to be barren or largely so, and negative results are helpful in arriving at a knowledge of the prehistoric ethnology of the whole of our continent.

Judging from what we know, however, we may expect to solve a number of problems by working over this area. It would seem advisable to conduct this archæological work in co-operation with students who are investigating living tribes; for a study of the modern Indian of a certain spot throws light on the archæology of the region, and an understanding of the antiquities of a given place is helpful in the study of its natives. Furthermore, by this system, the continuity of historical problems is met by a continuity of method.

In selecting successive fields of operation, it would seem best to continue explorations in an adjacent area, sufficiently distant from those already examined to present new conditions and give promise that new facts may be discovered, possibly a new culture-area. At the same time a new field of operations should be so near, that no unknown culture-area may intervene. Thus the limits of culture-areas may be determined and new areas be discovered. This method of continuing from past fields of exploration makes valuable the experience gained there in each successive field, while the discoveries in every region may always lead to a better understanding of the areas previously explored. If the results obtained in an area are not yet printed, the light thrown upon them by latter work is at once available for the original publication.

In accord with this plan, it would seem best that those explorers who are familiar with the Pueblo and cliff-dwelling region should examine the adjacent part of this vast area, especially in Kansas, where remains of pueblos are known to exist, and in the basins which drain into the Colorado and the Rio Grande. To define the limits of Pueblo culture would certainly be of interest to them, while at the same time their exploration in the adjacent country would add to the data needed by their co-workers.

In like manner the anthropologists of California are no doubt nearly as familiar with the prehistoric ethnology of Nevada as are those interested in the Pueblo region. Probably they will be more interested in it; and from their active investigation of the cultures of the prehistoric inhabitants of their State, who depended so much upon that natural product the acorn, we are led to look to them for the examination of the region between California and the great Cañon of Colorado. It would seem best that those who have explored in the Lower Columbia Valley and the plateau region of Washington and southern British Columbia should push their investigations eastward throughout the area drained by the Columbia and the Snake, thus attempting to define the eastern limits of the Plateau culture, to bound it, and to further our knowledge of it. Again, the explorers of the Mississippi Valley are perhaps best fitted to investigate the western limits of the culture found there. Some of these individuals are already interested in the prehistoric migrations of the Mandan, who are thought to have taken a north-westerly course from the Mississippi to the Missouri. The Historical Society of North Dakota has begun an investigation of the antiquities of its own State. Therefore archæological investigations in North Dakota may probably be largely left to that society. The Historical Society of Nebraska has expressed a desire to advance archæological research in its State, and possibly it may be able to explore even more than that part of the field.

From another standpoint, the ethnologists interested in the historic Indians might take up prehistoric ethnological work—students of the Siouan groups in the Siouan area, those of the Shoshonean group in the Shoshonean area, and students of the Athapascan group in the Athapascan area. By following this line of investigation, the work of just these men would clarify the problems of the whole situation.—Reprinted from Boas Anniversary Volume, 1906.