RECENT ADVANCES IN AMERICAN ARCHÆOLOGY

THE sessions of the first day of the annual general meeting of the American Philosophical Society, held in the Hall of the Society, Independence Square, Philadelphia, during April 23–25, were devoted to a symposium on "Recent Advances in American Archæology", and were followed by a lecture in the evening by Dr. Sylvanus G. Morley on the work of the Carnegie Institution in Central America and Mexico, to whom the Society's Franklin Medal has been awarded for his investigations in this field.

"The Problem of the Eskimo" was discussed in the opening paper by Dr. Aleš Hrdlička. The Eskimo are one of the largest, still most pure-blooded, and in many respects among the most important of American native groups, and deserve, therefore, all possible scientific attention. They are, moreover, in the flux of a rapid change towards civilization, and all this carries with it, which by itself offers a great interest to the scientific observer. The anthropological problem of the Eskimo is not simple. It comprises the questions of their racial identity; their place of origin and antiquity; their relation to the Indian; the modes of their immigration; the reasons of their peculiar spread; the limits of this spread; the cultural history of the people; their physical characteristics; their homogeneity or heterogeneity; their relation to the Asiatic peoples; their relation to the south-western Alaskan groups; the present status of and changes in the Eskimo; their admixture with Indians, with Whites, with Negro; their diseases; and their prospects, demographic and anthropological, for the future.

"The Aztecs: their Cultural and Historical Position in Middle American Archæology" was the subject of a paper by Dr. George C. Vaillant. For various reason the Aztecs occupy an important place in Middle American archæology. They had one of the highest cultures in the Americas at the time of the Conquest. They have been more carefully observed since the sixteenth century than any other tribe in North or South America. In addition, they had their own manuscript records, which are capable of historical interpretation. Thus, from the point of view of achieving the full picture of American Indian civilization, we have more information than for any other part of the Americas.

There seems to have been in the Middle American area first an era, indefinite as yet archæologically, whereby peoples took their first steps toward agriculture. Next follows a long period of sedentary village life based on agriculture. Then came the development of the theocratic State involving pyramid construction, establishment of a pantheon, the creation of some sort of a calendar system and some type of writing. These traits were developed by a number of tribes who were completely independent racially and linguistically, and there was a constant type differentiation in style and form in their handling of these generalized problems. Apparently, about the eleventh century these ritualistic civilizations began to collapse, partly from internal causes and partly from external pressure of a military and political nature. The effect of this change is manifested by the presence of Nahua-speaking people diffused over a wide area. As a corollary to this expansion in Middle America we have in South America the creation of the Inca Empire, the only true empire in the Americas, and in North America evidence of tribal movements strongly affecting the population of the south-western United States and the south-east as well.

Prof. Harold S. Colton presented a "Reconstruction of Anasazi History". This group of prehistoric Indians, who lived on the plateau areas in the South-west, can be divided into six or more separate tribes, each with an independent history. Although all these tribes have much in common, they can be distinguished one from another over a long period of years.

In reconstructing their history, tree-ring studies have furnished a time-scale, calibrated in terms of our own era. Besides this we must recognize the following factors: (1) the persistence of certain culture traits, and (2) the diffusion of others. We must recognize and study the properties of frontiers between the Anasazi tribes themselves and between the Anasazi tribes and the surrounding non-Anasazi neighbours. We must recognize crises in the history of each, dominance or climax as well as the influence of trade and trade routes. From these factors it is possible to reconstruct the history of each separate cultural unit.

Dr. Dorothy Cross described "The Effect of the Abbott Farm on Eastern Chronology". These excavations on the Abbott Farm, along the Delaware River bluff, south of Trenton, New Jersey, have disproved former theories of both a pre-glacial and a clearly defined 'argillite' culture. The artefacts obtained from excavations on the forty-five to seventy-five foot bluff had a vertical distribution similar to that noted on most New Jersey sites, namely, they fall into a normal frequency curve with the peak three to four inches below the 10-in. plough line. No definite levels were discernible, and cultural changes were meagre.

The excavations on the marshy lowlands at the foot of the bluff disclosed three former humus layers, the lowermost 9 ft. from the present surface, separated by virtually sterile layers of sand and gravel. The culture in each humus layer was similar and the human remains showed the same physical type. Pottery of the same texture, surface finish, tempering and decoration was found in all humus layers in the lowlands and at all cultural-bearing depths on the bluff. Although argillite and shale were the most used materials, they were not concentrated at any given depth. Blanks, which were formerly confused with 'palæoliths', were found at all depths and of all materials, including jasper.

Traits diagnostic of certain foci and aspects in regions adjacent to New Jersey are well integrated at the Abbott Farm, and lack the chronological implications they appear to have elsewhere. The Abbott Farm has produced more than a hundred thousand artefacts and potsherds, which, by substantially eradicating negative evidence, may partially account for the uniformity of culture.

Prof. Fay-Cooper Cole's paper, "Chronology in the Middle West", dealt first with the chaotic condition of Mid-Western archæology which existed until a few years ago. Eventually several institutions collaborated in a series of field and laboratory conferences to discuss methods of excavation and fundamental problems, and out of this came the Mid-Western taxonomic system which has brought about systematic treatment of the data.

At present two widespread patterns of culture, with many subdivisions, are recognized and their

chronological order determined. Hints of an early pre-pottery horizon occur, then follows an early Woodland, out of which several distinct divisions emerge. Such names as Red Ochre, Black Sand, Central Basin, Lake Michigan, Baumer and Lewis stand for well-established cultural complexes which can be traced over wide areas. Into this situation came influences from the south and south-east which, meeting with Central Basin, produce the Illinois Hopewellian with its spread into Indiana and Iowa. A similar meeting with Lake Michigan appears to produce the Hopewell of Wisconsin. The early stages of the Mississippi pattern are lacking, but the late, fully developed complex with large settlements, truncated pyramids, and a great variety of cultural objects spreads over much of the Middle West. Upper Mississippi extends its influence over northern Illinois, Wisconsin and Iowa, where it continues into historic times as the Winnebago and Ioway Sioux.

Shortly before the coming of the Whites, great cultural shifts take place and the northern Woodland groups, known to the early settlers, become established.

Prof. Willian S. Webb described "Early Horizons in the Southeast". Artefacts typologically similar to those from the Lindenmeir site have been found *in situ* at two sites in Kentucky and in Georgia. These suggest the possibility of a South-eastern Fulsom cultural horizon. While these sites are non-pottery, and all evidence points to considerable antiquity, the absence of stratigraphy leaves their chronological placement undetermined. Deep shell middens on the banks of large streams in Alabama and Kentucky show long occupancy, and a distinctive cultural complex. Sites are either entirely non-pottery or have a non-pottery component at their base. Stratigraphy demonstrates that in Alabama this complex antedates all pottery-making peoples. The material culture complex is dominated by the use of worked bone and antler, and shows the atlatl in use in a variety of forms. Polished stone atlatl weight and large flint projected point are common.

T. M. N. Lewis discussed "Late Horizons in the Southeast". Interpretation of the late archæological horizons in the South-east, he said, is obliged to take into consideration the historical facts concerning the identities, characteristics and distributions of the various Indian tribes at the time of White contact. Even more important than the internal developments of the tribal cultures is the unravelling of the acculturation processes which were operative. The earlier occupants did not always disappear from the region, but tended to be displaced and their cultures modified by contacts with later peoples. Desirable village sites were successively occupied by peoples of divergent cultures and the remains are frequently inextricably mixed notwithstanding the fact that desposits are occasionally deep and stratified.

Three of the widely recognized archæological manifestations of the eastern United States, the Woodland, Hopewellian and Mississippi complexes, are not only involved in the longer perspective of south-eastern prehistory but also represent the important factors in the late horizons. Other more restricted south-eastern elements are also included in the late manifestations of this cultural province.

The chronological sequences of the various cultural entities which have been established in the areas of the South-east, where intensive investigation has recently been carried on, can be reconciled in a general way. These sequences are not always the same throughout this large region, but the major influences are discernible in comparable chronological relationships and the interpretations can be co-ordinated.

The major impediment in applying the Midwestern Taxonomic System to the South-east lies not in the principles of the system but in the fact that the determinants for the broader categories, such as pattern, phase and aspect, were set up largely on the basis of northern data or upon limited data from the South-east.

The most positive ethnic identifications of the proto-historic and historic cultures of the South-east have been confined mostly to the tribal groups of the Muskoghean linguistic stock, but there are some more speculative recognitions of cultures of ethnic groups, such as the Yuchi, Cherokee and Shawnee, which give promise of eventual substantiation and acceptance.

Frank C. Hibben read a paper describing "Discoveries in Sandia Cave and Early Horizons in the Southwest". Sandia Cave lies on the east side of the Sandia Mts., some eighteen miles from the town of Albuquerque, New Mexico. Excavations in the Sandia Cave were carried on during 1936–39 and also included tests and explorations in several other cave sites in the Sandia-Manzano area.

The chief importance of the Sandia site lies in its stratigraphy, which involves an already well-established horizon of early man, the Folsom. The stratigraphic sequence of the cave involves, from the most recent to the earliest remains, a superimposed stratum of dust and bat accumulation containing in its topmost accumulation a 3–6 in. layer of solidified calcium carbonate; below the calcium carbonate crust a considerable layer of varying thickness consisting of charcoal fragments, flint chips, bones, angular rock fragments, and other cave debris with intermixed Folsom points, gravers, scrapers, and other implements, indicative of a Folsom horizon; below this Folsom cave occupation, a stratum of sterile yellow ochre; beneath the yellow ochre, another cave floor with associated debris of bones, charcoal, and implements of a shape and manufacture different from the superimposed Folsom varieties, these earlier and lower placed points being distinguished by a side shoulder and rougher chipping as compared with the Folsom, and called, from the cave site, 'Sandia points'; below the Sandia level another sterile layer to bedrock. This stratigraphy is supported by the included mammal remains, which indicate that the Sandia and Folsom levels are late Pleistocene in date, as all large forms are of extinct species, and that the stratum above the calcium carbonate is recent, since only the sloth is found in the lowermost portion of this level.

In another cave in the same region, Manzano Cave, additional stratified discoveries were made which added to the above sequence. Projectile points and bola weights were found in a stratum corresponding to the Early Recent of the Sandia Cave. These projectile points are similar to those of Gypsum Cave. On a basis of these discoveries, then, the following sequence of events concerning the history of the Palæo-Indian may be proposed:

Manzano: Gypsum Cave, camel and sloth association; Early Recent.
Wet period: end of Pleistocene.
Folsom: bison, horse, mammoth association: end Pleistocene or Early Recent.
Wet period: late Pleistocene.
Sandia: bison, horse, mammoth and mastodon association; late Pleistocene.

In a paper entitled "A Possible Cochise-Mogollon-Hohokam Sequence", Emil W. Haury pointed out that in recent years American archæologists have established several culture groups on hunting and food-gathering planes of subsistence which have been assigned to time levels ranging from about 10,000 to 20,000 or more years ago. Folsom, Sandia, Clear Creek, Gypsum Cave, Lake Mohave, and Cochise remains are a few of the manifestations. While the tendency in these studies has been to push the history of man back into antiquity, refined dating methods, and particularly the development of the tree-ring dating technique, have caused the chronologies of the 'higher', or agricultural people, as for example the Basketmaker-Pueblo, to be revised upward and shortened over previous estimates. An ever-widening gap between the early and the late groups has consequently resulted and doubts have been expressed as to the possibility of establishing any continuity between the two.

An exception to this situation may be found in the southern portion of the South-west, where the Cochise Culture existed. This culture, as reported by Sayles and Antevs, has three recognizable stages, the earliest of which is dated at more than 10,000 years ago, and the latest stage ending approximately 500 B.C., or just before the appearance of pottery and presumably agriculture.

Combining the evidence which has been gathered from open sites and from Ventana Cave, recently excavated by the Arizona State Museum, there are grounds for postulating that the agricultural and pottery-making Hohokam and the Mogollon Cultures have roots which dip into the Cochise complex. Expressed in other terms, the addition of pottery, agriculture, and possibly a few minor traits, to the lithic industry of the San Pedro Stage of the Cochise Culture, produced the earliest known ceramic horizons of the Hohokam and the Mogollon. The early phases of these two groups have much in common, especially ceramically, and it would appear that a common parentage may be claimed.

In a discussion of "Folsom and Yuma Problems", Edgar B. Howard said that satisfactory proof is still lacking to give more than a relative dating for the length of time man has been on the American Continent. Extreme estimates range from about 2000 B.C. to 70,000 years or more ago. The Folsom problem, then, is only part of the broader one dealing with answers to the questions: How long has man been in America? Where did he come from? How did he get there? Before any attempt can be made to answer these questions it is essential to have some understanding of what constitutes a Folsom point and a Yuma point, since reference to these types of spear points appears in every discussion of early man in America.

No matter from what angle the question is approached, one becomes aware of its complexity. It is made up of what appears to be a number of unrelated problems, which, in reality, are parts of the same broad puzzle, namely, man. Many secrets, so far as America is concerned, are locked up in Siberia. Until we know more of the glacial geology, anthropology, and archæology of this region, we cannot hope to answer, with any degree of satisfaction, questions such as that relating to migration routes, the culture stage reached by these early wanderers, and many others which are necessary as a foundation to a real understanding of American prehistory.

L. S. Cressman described 'Cave and Lake Bed Cultures of South Central Oregon in the Northern Great Basin". Cave deposits of camp debris separated by pumice have been excavated in south central Oregon. The pumice, which came from the eruptions of Mt. Mazama and formed Crater Lake in the Cascade Mountains, has been given an age of not less than 5,000 and not more than 10,000 years by Dr. Howel Williams. The cultural material above does not differ from that below the pumice except in quality. Caves east of the pumice area contain the same kind of material.

These eastern Oregon caves show the transition from the atlatl or spear thrower to the bow and arrow. Fine twined basketry, the most conspicuous type of article found in the caves, must have been brought in by migratory peoples, for it appears completely developed immediately following a period without basketry. In the eastern caves near the end of the occupation were found a few fragments of coiled basketry. Well beneath the pumice in one of the stratified caves were found chipped obsidian tools, bones of horse, camel and several other genera along with the camp fires used to cook the flesh of these animals.

The bed of an ancient lake has given us three horizons: (1) the oldest, when horse, camel and some elephant-like animal slaked their thirst at the dwindling water holes and were hunted by man; (2) a second, about the shore-line when the lake was beginning to refill about 4,000 years ago; and (3) the historic Modoc culture about the modern shore line, dating from about the beginning of the Christian era.

Analysis of the basketry shows relationship with the culture of the earliest period of Lovelock Cave and the Humboldt Caves of the same region; technological details suggest a relationship with the Basketmaker cultures of the South-west. L-shaped awls made from the scapula of large animals suggest the Oregon - early Lovelock - Basketmaker relationship. Given the lapse of time indicated by the pumice, the Oregon material is antecedent, and perhaps ancestrally related, to certain elements of the classical Basketmaker culture.

In a paper on the "Archæology of the Andean Field", Wendell Cl. Bennett said that Peruvian archæological chronology has long been based on the sequences established by the extensive work of Max Uhle. Only recently has the importance of the Chavin style and culture been demonstrated, although it has long been recognized by such leading Peruvian archæologists as Julio C. Tello and Rafael Larco Hoyle. An examination of the site of Chavin on the River Marañón in the north highlands of Peru reveals a distinctive architectural style, a stone carving style based on the feline concept, and a simple monochrome incised ceramic style. Discoveries on the coast of Peru show similar ceramics at early sites in Ancon and Supe valleys, and more ornate ceramics with incised and relief designs similar to those on Chavin stone carving at many other sites in such valleys as Casma, Nepena, Viru, Chicama, Lambayeque and Piura. These discoveries show that the coast Chavin period is associated with buildings made of rough stone and conical adobes, sometimes with plastered walls elaborately carved and painted. Flexed burials covered with red paint were found by Larco in Chicama valley associated with the Chavin ceramics plus objects of gold, bone, shell and stone all incised or carved with the typical designs.

A review of the above evidence indicates that

(1) Chavin is older than any period yet discovered on the north coast of Peru; (2) as a style Chavin has a wide distribution throughout Peru and bids fair to become a third pan-Peruvian period along with the Tiahuanaco and Inca periods; (3) the ramification of styles pertaining to Chavin together with its antiquity and distribution make it one of the basic factors in the revised chronology.

CAUSES OF INTERTIDAL ZONATION

ON June 18 and July 9, the Linnean Society of London, under the chairmanship of the president, Dr. E. S. Russell, discussed the causes of the intertidal zonation of plants and animals. The discussion was opened by Prof. T. A. Stephenson, who attempted to elucidate the reasons for both the vertical zonation and the horizontal distribution round the coast of the common intertidal organisms of South Africa, as observed by himself and his collaborators during the years 1931–40 (see NATURE, **143**, 503; 1939). In his introductory remarks Prof. Stephenson stressed the importance of field observation, as well as that of laboratory and field experiment, for the interpretation of intertidal phenomena, and pointed out also that since much of what is observed between tidemarks is evidently due to the operation of complexes of factors, it is doubtful whether much is to be gained by too great insistence on the part played by each individual factor in a complex. After a review of a number of the factors which may be expected to be concerned in intertidal processes (nature of substratum, desiccation, temperature, wave-action, feeding-habits, competition for food and space, salinity, submergence and emergence, oxygen, carbon dioxide and hydrogen ion concentration, nutritive salts, light and taxes) the conclusion was reached that there is scarcely any factor the effect of which between tidemarks can be imagined which is unable to produce *some* effect on zonation, although certain factors are undoubtedly more important than others; and that the effect of some factors is much more local than that of others. It was further concluded that the principal agent responsible for the *horizontal distribution* of organisms around South Africa is sea temperature; that for *zonation on open rock* the controllers of primary importance are degree of exposure to the desiccation-heat-light complex acting together with degree of exposure to wave action; that for *zonation in rock-pools* the leading factors appear to be variations in temperature and salinity; and that *light* is probably more generally effective in determining the segregation of shade-loving from surface species than in contributing to the actual zonation. In all cases there are subsidiary effects due to causes other than the major ones.

Dr. J. S. Colman next contributed an account of some interesting intertidal enigmas, contenting himself with describing certain distributions for which explanation is urgently needed but which, up to the present time, remain quite unexplained. This contribution brought out very clearly what was recognized by all speakers, that although papers such as those contributed to this discussion introduce "an element of reason into a distribution which could previously best be described as orderly but irrational" Dr. Colman), yet the rationalizations hitherto attempted are undoubtedly too simple and very far from being able to explain all the facts observed.

The third speaker, Dr. E. M. Delf, dealt with the significance of the exposure factor in relation to zonation, enumerating its components: this contribution was in line with those of earlier speakers, and added reinforcement by means of a different selection of details, bringing out once again the fact that intertidal phenomena depend on complexes of interacting factors.

The meeting was then thrown open for discussion, and Dr. G. P. Bidder contributed a number of interesting examples taken from among the sponges, some of which threw additional light on points raised by previous speakers, while others introduced further features of intertidal life which had not previously been dealt with. Prof. L. Newton followed with some comments referring to algæ, noting particularly that, at least in Britain, the nature of the substratum may become important locally as a factor determining the nature of the flora; and that in past discussions on algal zonation the effects of light had probably been overestimated. Prof. Stephenson, Dr. Colman and Dr. Delf replied briefly to these comments.

On the resumption of the discussion on July 9, Mr. A. D. Cotton, in the unavoidable absence of the author, read a paper by Dr. V. J. Chapman on the horizontal distribution and vertical zonation of marine algæ on rocky shores. Dr. Chapman limited his attention to the common Fucoids. He found himself in agreement with Prof. Stephenson's opening remarks as to the validity of field-work as well as of experiments in the search for the causes of zonation, and also agreed that, of the factors controlling horizontal distribution, temperature appears to be the leading one. Passing to the question of critical levels between tidemarks, Dr. Chapman compared the work of several authors and synthesized their observations for five different localities, concluding that the existence of certain critical levels may be a reality despite undoubted local variations. In an assessment of the various factors the operation of which will render one level more critical than another, the effects were reviewed of mechanical exposure, substratum, submergence and emergence, exposure to air, temperature, illumination, salinity, gaseous exchange and nutrient salts, desiccation and biota. These factors were classified as *causal*, *presence or absence* and *modifying* factors respectively. Lastly Dr. Chapman considered the relation of algal zones to tidal levels in the light of the foregoing review, and pointed out lines along which further progress might be made in the search for the causes of zonation. Mr. Cotton, in reading the paper, added comments of his own referring to matters of detail, but no further discussion took place.

Regarded purely as a verbal discussion, this symposium was disappointing, because, as the result of an unfortunate combination of circumstances, several of those interested were unable to attend the second session of the discussion, and some of them not even the first. At the same time there was a considerable measure of agreement between the views expressed, and the subject was seen to have been somewhat clarified during recent years in spite of universal recognition of its complex nature and of the need for extensive future investigation; and the papers contributed should, when printed in the Society's *Proceedings*, form a valuable reservoir of ideas for the further development of the subject.

T. A. STEPHENSON.