THE

OLD NEW WORLD

AN ACCOUNT OF THE EXPLORATIONS OF THE HEMENWAY SOUTH-WESTERN ARCHÆOLOGICAL EXPEDITION IN 1887-88, UNDER THE DIRECTION OF FRANK HAMILTON CUSHING

BY

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PREFACE.

This account of the Hemenway Southwestern Archæological Expedition in the Salado and Gila valleys in Arizona is the result of observations made by the writer during three months spent with the expedition in the early part of the year. It was originally printed in the *Boston Herald* of April 15, 1888, and is reproduced in this form in response to various requests. Within this compass it was, of course, impossible to give more than a synopsis of what has been accomplished. Various important features have here been simply mentioned which will demand treatment in detail for the satisfaction of earnest students. These requirements will be fully met in the forthcoming report by Mr. Cushing, who also intends to treat separately certain interesting aspects of his discoveries. Meanwhile the writer hopes that these indications of what has been done in little more than a year's research may contribute somewhat towards awakening a sense of the importance of the vast mines of treasure relating to the primitive conditions of mankind and the early cultures of the race—so essential to an understanding of what man is and guidance to a knowledge of what he may become — awaiting the attention of serious investigators in our Western World.

SYLVESTER BAXTER,

Secretary of the Hemenway Southwestern Archæological Expedition.

LEDGEWOOD TERRACE,
MALDEN, MASSACHUSETTS.
July 18, 1888.

EXAMPLES OF DECORATED POTTERY EXCAVATED AT LOS MUERTOS.

THE traveller enters the valley of the Rio Salado surrounded by wide reaches of sage-brush and greasewood, interspersed with thickets of mesquite. A dreary, unpromising spectacle! he thinks, and the bare, tawny ground beneath the bushes has all the unfertile aspect of the traditional desert, to eastern eyes. A moment more, and behold a transformation as sudden and as magical to the astonished vision as was ever worked by change of scene on theatre stage! The desert has vanished, and smooth fields expand with the floorlike evenness of a Kansas prairie as far as the eye can see toward the distant bases of the surrounding mountains. Under the calm blue of the Arizona midwinter sky the young grain spreads away in broad acres of tender green; sleek kine are browsing contentedly in rich alfalfa pastures, and long, straight lines of alamos and Lombardy poplars intersect the fields in pleasant perspectives. It is a picture of peace and plenty.

This magic has been wrought by the touch of the life-bringing water, which sparkles on all sides in the tree-bordered canals that tap the abundant river and spread their contents over the land in rapid streams. And still the change goes on. Wherever the water can kiss the land, there the soil stirs with new life and clothes itself with a beauty that appeals to all eyes because it is the garb of bounteousness. Daily the rich fields widen and the desert shrinks; at night the burning brush on the clearing dots the horizon with its flames like the lamp-lines of a city's environs. For every acre now yielding fat crops, a score will soon be under cultivation, and the river's capacity for irrigation is still beyond estimate.

Yet the valley was not always a desert. Centuries ago it was fair, with a fertility like unto that which is again overspreading it after a long fallowness. So the two chief towns of the region are not unfittingly named. Phœnix justifies its designation with the fact that all around it, out of the ashes of a long dead civilization, our mightier modern culture is arising and founding one of its fairest abiding places; while the beautiful fields amid which Tempe sits, carpeting the feet of ruddy and purplish mountain walls that rise in slopes of bare rock and craggy peaks, make a scene not unlike the typical landscape of ancient Hellas, whose fair and famous vale has a namesake here. Then, too, the fervor of the summer is very encouraging to a classic paucity of attire!

The investigations of the remains of the ancient civilization that peopled the valley plains, mountain gorges and mesa tops of this vast desert region of our national domain is the object of the Hemenway Southwestern Archæological Expedition, of which considerable has been heard of late. The expedition has been in the field but a little over a year, and the results already reached indicate how

deeply indebted the scientific world will be to the wise munificence of the Boston lady who instituted it. Mrs. Mary Hemenway, perceiving that the present unrivalled opportunities for the study of the aboriginal cultures of America would soon be lost forever through the destruction of their monuments and the absorption of their surviving representatives under the waves of our modern civilization advancing over regions that, until recently, have been deemed uninhabitable, and recognizing in the person of Mr. Frank Hamilton Cushing one rarely qualified for the pursuit of such investigations, quietly established this expedition late in the year 1886, and its operations in the field were begun in the second month of 1887. So rich did this region prove in its opportunities for systematic excavation that Mr. Cushing, alive to the scientific value of a collection that should be thoroughly representative of a typical locality, has confined himself, throughout the first year, chiefly within a radius of a few miles of this spot. Through the knowledge thus gained he will be able to work up more rapidly, and with a more complete understanding, the other regions comprised in his proposed undertaking.

II.

The Hemenway Southwestern Archæological Expedition is probably the most thoroughly equipped undertaking of the kind yet instituted, and as such it will probably mark a new era in ethnological science; for, as Mr. Cushing says, archæology is simply ethnology carried back into prehistoric times. This unprecedentedly thorough equipment of the Hemenway expedition is not by virtue of the outlay involved, for other archæological enterprises of a far more expensive character have been undertaken. It lies in its well considered and comprehensive scope in the

coördinate pursuit of several branches of research, each helping the others in its progress, and contributing to a result that promises to be the most complete working up of any region, and the race of man that has chiefly occupied that region, yet known to modern science. Therefore, it is not too much to expect that in this work, when well advanced toward its consummation, we shall have a new point of departure for the guidance of all future researches of ethnology—the study of mankind: the youngest, the least formulated, and yet the greatest of all the sciences, including them all, with the student of them all as its subject.

The branches of research involved in the scope of the Hemenway expedition are mainly four:

Ethnological—or the study of man as a race, including all features constituting the peculiar characteristics of that race, whether physical or psychical, and therefore broadly comprising all circumstances affecting the race.

Anthropological—or the study of the characteristics of man, considered as an individual, and naturally including in its line of research those elements which have caused those characteristics.

Historical—comprising a careful study of all that has been recorded, so far as may be ascertained, concerning the region to be investigated, its primitive occupants and other races with which they have come in contact; the study including not only documentary records, but that most important factor in the historical investigation of a primitive race, the guiding thread furnished by its oral traditions, which have repeatedly proven, under their correct interpretation by those competent to understand them, infallible witnesses to the past.

Archæological—or the study of the prehistoric remains of a race as instrumentalities for the understanding of what

that past has been. But these, it is assumed by the expedition, can only be properly understood when viewed in the light obtained by present knowledge; when regarded in that light a fragment of pottery may often tell a tale more plainly and eloquently than a written record.

Beside these four main lines of research there runs the study of the topography and physical geography of a region—the characteristics of soil and climate and its natural history—for these features of environment are potent in affecting, and even sometimes originating, the racial and national traits of a people. All of these lines of research will be found here and there running into each other, one requiring the practice of the methods of the other for the determining of questions that may arise; and, embracing them all, stands ethnology, the science of mankind, making its demands when need be upon all the vast store of human knowledge accumulated in the structure reared by modern science.

Other archæological enterprises have been, in the main, exploring or collecting undertakings; the Hemenway expedition is archæological in the truest sense, its object being not only the careful collection of material for the study of the past of the race whose remains compose that material, but the study and mental reconstruction of the past as necessary accompaniments of the collection and exploration of that material during the very progress of the work.

III.

The scientific corps of the Hemenway expedition is organized with reference to the most efficient prosecution of these several lines of inquiry. It is nearly seven years since the present writer had the privilege of meeting Mr. Cushing at Zuñi and making public, through the columns of the *Herald*, the first account of his remarkable inves-

tigations in that isolated pueblo of New Mexico. Mr. Cushing's discovery of the esoteric societies existing among that people, together with the remarkable fund of information secured by his intimate association with them, proved a revelation to the scientific world, throwing a flood of light on the nature of primitive man, and giving a new impetus to ethnological research. His course was the first example of how ethnological studies should really be pursued; it showed the necessity of conducting such investigations from the inside, and the absolute futility of external observation in all work of the kind. The object of Mr. Cushing's researches among the Zuñis, adventurous and attended by exceptional hardships as they were, has in some quarters been somewhat misapprehended as to its bearings. At the time of my visit, however, I fully understood that his purpose was not merely to study the Zuñis as a peculiar and mysterious people; his chief design was to study primitive man through the Zuñis, the thorough knowledge of a typical stock affording a firm basis for obtaining a knowledge of other stocks or races through the application of the principles thereby obtained. It happened that his choice of an example was exceptionally fortunate, for the Zuñis turned out to be representative of the most complete survival of the ancient sedentary culture of the southwest, and as such so regarded by a majority of the other existing Pueblo races. Their designation as the "Father of the Pueblos," which I employed when first writing of them, is therefore appropriate as a substantially literal version of their appellation by cognate peoples.

The fault of much of the best of the ethnological research previous to Mr. Cushing's has been that it has been conducted upon purely materialistic lines, and the assumptions thus made have necessarily led to false, or, at best,

inadequate, conclusions. Mr. Cushing, however, through a thorough acquisition of the language of the Zuñis, and identification with their modes of life and even thought, was enabled to look at their institutions from the standpoint of primitive man himself, which, in its conception of all appearances as realities, is precisely the reverse of our modern standpoint. Without this thorough knowledge thus gained by his Zuñi studies, his line of important archæological discoveries made during this first year of the Hemenway expedition would have been impossible. These discoveries have been the result of the application of the knowledge of the institutions of a living, but primitive, sedentary people, to the interpretation of the remains of an ancient race of a similar character.

The anthropological work of the expedition is in charge of Herman F. C. ten Kate, M.D. and Ph.D., a native of Holland, and the son of the distinguished artist of that name resident in the Hague. Dr. ten Kate is a graduate of the University of Leyden, and has a thorough medical training, which, of course, is of the greatest advantage in his line of research. Though a young man still in his twenties, he has attained eminence in his branch of science through his reports upon investigations conducted in the course of extensive journeyings in various quarters of the world, from Algeria to Lapland, from the East to the West Indies, and among numerous Indian tribes of the United States, Mexico and British America. In some of these travels he has been the companion of Prince Lucien Bonaparte, who is an earnest and munificent ethnological student. Dr. ten Kate has acquired a store of highly important material through a line of anthropometrical investigations pursued largely among primitive races, making a series of accurate measurements and other records, in the course of which various specially designed instruments

of delicate adjustment are used. These data, which include also close observation as to the color of eyes, hair and skin, quality of hair, form of face and features, etc., when collected in large quantity, form valuable material for the classification of different varieties of the human species, and the distribution of those varieties and their modifications through the intermingling process which has been going on for ages in nations and races. These researches, together with others, Dr. ten Kate will pursue amid the various Indian tribes now living in the territory covered by the scope of the expedition. The anthropological work enters the archæological field in the investigation of the important series of skeletons exhumed in the investigations, and the correlation of the results of this with those of the work just described.

In this work Dr. ten Kate has the cöoperation of Dr. J. L. Wortman, the comparative anatomist of the Army Medical Museum at Washington, who, in view of the great importance of these osteological remains of an ancient American race, has been specially detailed for the purpose by the curator of the museum, Surgeon J. S. Billings, U. S. A. Dr. Wortman, who, like Mr. Cushing and Dr. ten Kate, is also a young man, is one of the foremost of comparative anatomists and osteologists in the country; for several years he was the assistant of Prof. Edward Cope, the eminent palæontologist, and he has achieved a high reputation in his line of science by reason of both his original research and the nicety of his laboratory work.

The historical work is in charge of Mr. Adolph F. Bandelier, a gentleman who is preëminently fitted for the task. Mr. Bandelier is one of the foremost of American ethnologists, and the thoroughness of his work in the historical field has given him a high reputation in Europe, as well as in this country. He unites with his deep erudition a bril-

liant capacity for the maashalling of facts in that unity of aspect which makes the true historian. Probably no other man living is so thoroughly conversant with the materials of Spanish-American history; and his work now in hand on the documentary aboriginal history of Zuñi, and, following it, of the Southwest generally, can hardly fail, when completed, to place him in the ranks of great American historians. His work for the expedition, in conjunction with his preparation of a history of the Church in New Mexico, presented to the Pope by the archbishop of Santa Fé, on the occasion of the recent jubilee of His Holiness, gave him access to a vast amount of valuable material in the archives at Mexico, hitherto inaccessible, and the notes thus obtained, bound and arranged in several volumes with the careful exactness of the true historian's method, form a most interesting feature of his choice historical library at Santa Fé, where his home has been for several years. Mr. Bandelier was one of the first to recognize, after due examination, the great scientific importance of Mr. Cushing's work at Zuñi, and it is an interesting fact that the work of each — the one upon purely ethnological, and the other upon purely historical, lines — has, when they have entered upon the same field, tallied with and corroborated that of the other. Both history and archæology thus stand in similar relations to ethnological research; the latter goes back and clears up the mysteries of the former, and they in turn, help to make the present intelligible.

Another important member of the expedition is Mr. Charles A. Garlick, until recently of the United States Geological Survey. Mr. Garlick, who is a brother-in-law of Major J. W. Powell, the director of the United States Bureau of Ethnology, and of Prof. A. H. Thompson, who is in charge of the United States Geological Survey, besides having care of the practical affairs of the expedition,

is its topographical surveyor as well, and has made excellent maps of the ground covered by the work. In his engineering work he has had the assistance of Mr. Fred. Hodge, Mr. Cushing's private secretary, who has turned a good training as a draughtsman to account in the plotting of carefully made plans of the excavations. Mrs. Cushing and her sister, Miss Margaret W. Magill, are also members of the party, and in the classification and care of the specimens they have rendered important aid, while Miss Magill's artistic talent with pencil and brush has been of invaluable and constant service. The immediate supervision of the force of laborers, consisting entirely of well trained Mexicans, is intrusted to Mr. Ramon Castro, a fine type of young Mexican manhood, who, under the guidance of Mr. Cushing, has developed what might be called an instinct for the presence of archæological remains so keen that the faintest traces are usually sufficient to reveal to him the nature of what will be found beneath the surface.

IV.

Mr. Cushing's researches here constitute the second great step in what he has chosen for his life work. They have already enabled him to disentangle important leading threads from the skein which involves the mystery of the nature and origin of the sedentary peoples in the great American family of mankind. Here in the valley of the Salado he came across the vestiges of a group of ancient cities, akin in character to similar groups whose ruins are to be found by the score throughout all the once fertile valleys of this southwestern country. This group, amid which Camp Hemenway lies, has lain forsaken for untold centuries, its walls gradually uniting with the soil of which they were made until nothing was to be distinguished but a low

mound in the midst of each city, ill-defined heaps of earth at close intervals, various depressions in the surface here and there, irregular lines of old irrigating-canals, and the ground covered with pottery shards, remains of stone implements, etc., scattered far and wide among the mesquite forests and brush thickets.

As shovelful after shovelful of earth has been removed, revealing more fully the remains of the life which animated the spot with its doings and strivings, a life as engrossing and important to its actors then as ours is to us in the larger activities of to-day, and, perhaps, after all of just as much account in the economy of the world, Mr. Cushing has by degrees been enabled to reconstruct that life of the dim past, until many of its features already form coherent pictures before our mental vision.

Some of the printed accounts of his investigations have, doubtless, appeared tinged with sensationalism, but for that Mr. Cushing cannot be held responsible. Even in this corner of the world such operations cannot be conducted without attracting attention, especially when Phœnix, the chief city of Arizona, is but a few miles distant. There is a natural tendency to exaggeration among the witnesses of any operations that are out of the usual order of events, but Mr. Cushing has exercised due scientific caution in reaching his conclusions, and the sober facts are interesting enough without embellishment.

Without his Zuñi experiences, the clear light which Mr. Cushing has cast upon much of these primitive peoples would be impossible. The facts of the daily life and religious institutions of the Zuñis, their keramic and other industrial arts, and things plainly recorded in the structure of the Zuñi language and thus handed down through the centuries from remote antiquity as plainly to one who knows the linguistic ground as though they were graven in stone — all

these have been indispensable means to the attainment of his striking results. What he has found here has also, in turn, made plain to him the meaning of various facts observed by him in Zuñi, and which he hitherto could not understand.

V.

Could we behold this valley as it appeared when it was peopled by that ancient race, we should see a cluster of cities standing upon the level, or slightly and evenly sloping plain, separated by distances varying from a mile or two to five or six miles. The intervening spaces would be occupied by carefully cultivated fields, bearing crops of corn, beans and pumpkins. In the midst of the valley courses the rapid river, with its shores marked by tall trees, undergrowth and cane-thickets, just as to-day. From its banks broad irrigating-canals meander through the valley, adapting themselves to irregularities of the surface and not running in such straight lines as their modern successors. The branches of these thread the fields in like sinuosity, and dispense fertility far and wide.

When the fields are green with the young crops, the cities stand out in sharp contrast, like islands of tawny yellow amid the verdure, glowing in the sunshine under the azure, and with the mountains rearing their purple walls in the background. In the winter, however, they are like parts of the ground amid which they stand, and of which their walls are formed. In the midst of each city there rises a massive structure prominent above the rest, with walls thick and fortress-like, and six or seven stories in height. Around this there stand the dwellings of the people in enormous blocks, with flat roofs and rising in terraces three or four stories in height. One of these blocks may cover acres of ground. In each city we find another public building,

a great oval structure of one story; and again, outside of all the high massive walls enclosing each block, huts not unlike the great oval structure and covered with sloping thatch instead of flat earthen roofing. Between, around, and beside the blocks there run the canals, their course marked by trees. Whoever has seen the pueblo of Taos at the foot of the Rocky mountains in New Mexico, with its two blocks of terraced buildings and the stream running between them, may, if he but imagine the ovens and sheds standing about the hut described, gain something of an idea of the aspect of these dwellings; but one of these ancient structures would contain within itself many like those of Taos. Beside each block of dwellings there is a reservoir filled with water, and occasionally there are two, the canal either entering or running through. Near the reservoir is a heap of earth, and each building has close by a large circular pit. Far off, on the borders of the fields, stand hamlets of thatched huts, with sides of wattled cane, precisely like those clustered nearer the central buildings. Such is the general aspect of the scene, but in two or three of the cities, instead of one great central structure, there stand several smaller edifices of similar aspect in various parts of the town.

The population is of a race like that of the Pueblo Indians of to-day, but theirs is a stone-age civilization and more highly organized than that of its surviving remnants. The people are industrious, peaceable and contented, but they have their full share of the pain and suffering which must have been the lot of mankind in all ages. The men till the fields and engage in the chase; the women attend to the household duties, cook the food and grind the maize into fine meal in the stone handmills or metates, and they make and bake the pottery, decorating it with the designs which have been handed down from a still remote past,

and which are yet faithfully repeated by the Zuñis and to less extent by some of the other pueblos of to-day.

There is a deal of mechanical activity always going on among the men, for the fashioning of the various implements of stone and bone, for instance, the grinding or rubbing down of the stone axes to their symmetrical shapes and true lines necessitates an amount of patient, painstaking labor that would be the despair of one of our nineteenth-century workmen. But the work done with these clumsy tools is much more expeditious than would seem to be possible. With these tools we see them hewing trees and chopping and working the wood into the various materials used in their house-construction, shaping it into bows and arrows and making various utensils, or breaking it into fuel; we see them chipping stones into nicely formed arrowheads, spearheads and knives; we watch them making their highly prized articles of adornment from seashells and turquoises and other stones precious in their eyes. They have, in all probability, by the evidence furnished by petrographs and tradition, as well as analogy, driven in long lines, single file, strange "little bestes of burthen" which, perhaps, have carried water and these same precious stores of shell and stone material over long journeys; and then, as now, the dog is man's faithful companion. Men are coming and going, bearing heavy burdens on their backs — deer and antelopes from the chase, grain from the fields, or staggering beneath the weight of heavy stones from the river bed, or rough blocks of hard, porous lava, to be shaped into the indispensable metates, for generally these things are too heavy for their "little bestes." Occasionally a man comes in from a long journey to the distant gulf of California, or the shores of the Pacific in California, bringing the equivalent of several small fortunes in the shape of loads of the most coveted varieties

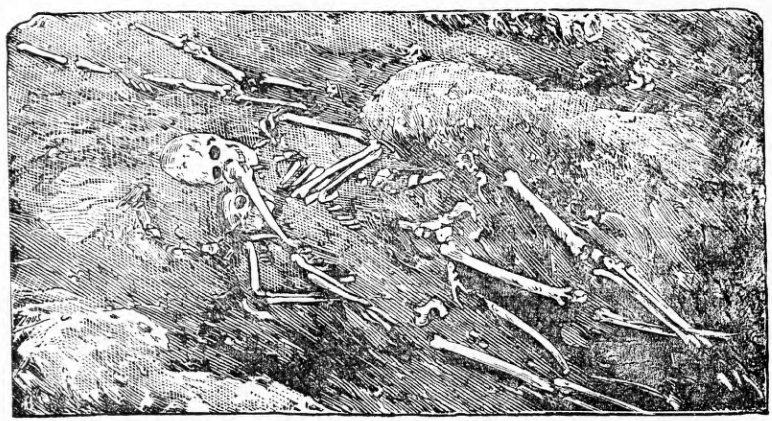
of shell, and which Mr. Cushing finds to be worked into bracelets, ear-rings, beads; small shells for use as strings of tinkling bells, and large ones for use in sacred ceremonials.

In their undertakings which concern the people as a whole, they are coöperative, and the individual, under such circumstances, subordinates himself completely to the community, which works as a unit, and thus constructs the extensive irrigating systems, the public edifices, etc., which even to us seem gigantic in their extent and conception, making us marvel that they could have been carried out with such crude implements. Without this unity of effort they would, indeed, have been impossible. One feature of their coöperative work is the public ovens belonging to each block of buildings, in the shape of the great pits above alluded to. Each block was occupied by a distinct clan, and in these ovens or baking-pits, enormous quantities of food are cooked, to be shared, perhaps, by the entire clan. The method of cooking is much like that of the New England clambake, which originated, it will be remembered, with the Indians of our coast: great fires are burned in the pits for several hours and then smothered in a shaft at the bottom; green branches are then thrown in to make a lining of considerable depth, on these are placed large amounts of green corn and other vegetables, together with meat. More branches are then piled on, and the whole finally covered with earth and packed hard. On this a great fire is built, around which at night a semi-sacred dance goes on. After twenty-four hours or so the pit is opened and everything is found to be deliciously cooked. So intense is the heat of the fires in these baking-pits, and so much are they used, that the clay with which they are lined has been melted throughout to a vitreous slag.

The great central edifices are the temples, the dwellings of the hierarchy of hereditary priests, containing the storerooms for the share of the grain and other crops which is theirs on the tithing principle, contributed by the entire community, as well as rooms for sacred and public purposes. In time of war the building incidentally becomes the citadel of the place, and with its massive walls it is well nigh impregnable. As the dwelling of the priestly rulers it might perhaps be called the palace or temple; at all events, it may correctly be termed the germ of the palace and castle that came into being when monarchial institutions had fully developed out of a similar stage of culture in other parts of the world.

With the people whose past we are beholding, religion is the main thing of life, and every act, every movement, however insignificant or however slight, has its religious aspect and significance. So thoroughly are they pervaded by their devotional attitude that it requires no exercise of authority on the part of their priesthood to secure submission; their obedience is that of children to their parents, filial and reverential, and the voluntary outcome of their mythico-social life. They have their esoteric societies for the guarding of what they deem secrets of nature, methods of treating disease and fighting sorcery. These societies have their lodge rooms probably in each block of buildings, and in the great oval building we have seen is their meeting-place for more formal and public exercises; this building is what is commonly called the estufa in speaking of the modern pueblo, but the term, which means "stove," is a misnomer; perhaps sun-temple, the name which Mr. Cushing applies, would be more correct, since it is the headquarters of the Priest of the Sun, the spiritual head of the people, and standing apart in his functions from the hierarchy, the "six Masters of the House."

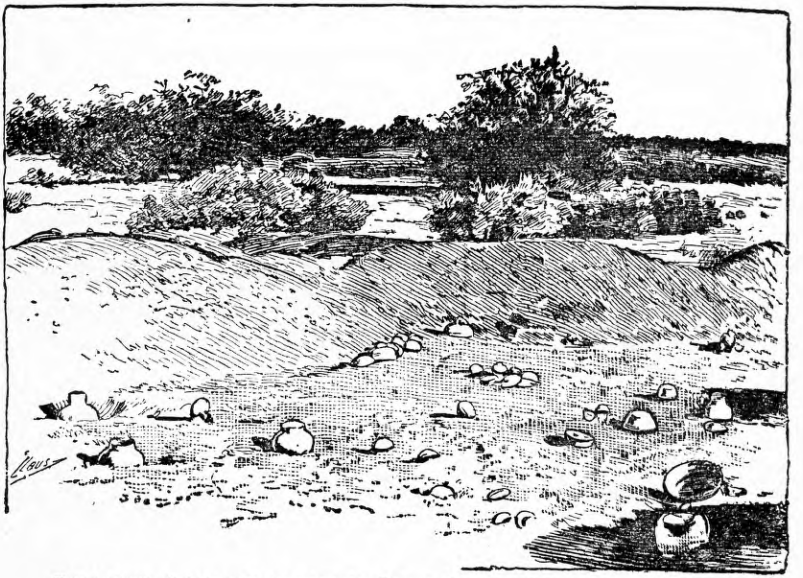
The burial customs of this people are of two kinds: the common people were cremated, and the priests and members of the hereditary priestly caste — the line of descent being always through the mother — and of the esoteric societies, were buried. For, according to their belief, in order to secure the complete liberation of the soul from the body immediately after death, it is necessary for the body to be burned, its destruction setting the soul free at once, while the priests have, by virtue of their spiritual powers,



A Double Burial: Male and Female.

this knowledge, and so their bodies do not need to be burned. This knowledge also belongs to members of their caste by right of heredity, and sometimes by initiation sanctioned by them. Such persons are, therefore, always buried in the temple or beneath the floors of their houses. The low, gray earth and ash-mounds which we have noticed near the reservoirs are the "pyral mounds," or places where the bodies of the dead are cremated. After the funeral pyre, loaded with precious sacrifices, offerings of members of his clan, has burned out, the few remaining

bones of the dead are gathered and placed in a jar of pottery and buried on the margin of the mound. Unless the burial-jar has been specially made or reserved for the purpose, it is neatly "killed" by drilling a hole in its bottom or otherwise partially breaking it, thereby allowing its soul to escape with that of the person whose remains it holds. The personal belongings of the dead are also



EXCAVATED CEMETERY AT BASE OF PYRAL MOUND, SHOWING POTTERY CONTAINING CREMATED REMAINS.

burned with him, that their spiritual counterparts may be set free to accompany him into the other world. In the case of the house-burials, however, the vessels containing food and drink buried with the deceased are not "killed" except in the case of young children who may be considered too inexperienced to know how to exert the power necessary to taking the vessel and its contents with them upon their journey.

VI.

All these facts have been acquired by Mr. Cushing through the knowledge gained in his Zuñi experience, enabling him to read the past in the light of what he there learned concerning the nature of primitive man. His principal excavations thus far have been carried on in two of the ruined cities of the valley about six miles apart, which he has respectively named Los Muertos and Las Acequias, or the City of the Dead and the City of the Canals, from local features, the former name coming from the large quantity of skeletons and cremated remains found there. Camp Hemenway is situated in the midst of Los Muertos, which covers an area of something over two square miles drawn out along the borders of a canal or artificial river, to a length of nearly six miles. According to the very conservative estimate made by Major Powell of what the population of an ancient ruin in the Cañon de Chelle, in the north of Arizona, must have been, judging by the number of dwellings, Los Muertos had at least 13,000 inhabitants, and it is not improbable that the number was greatly in excess of that figure. As has been stated, Los Muertos is one of the smallest of a group of seven cities, and, conceding an average of 13,000 inhabitants to each city, the population of the entire group would have been at least 90,000, and probably very much larger. There are various very strong reasons aside from these for holding that the population of these fertile, universally irrigated valleys, was a dense one. One of these is the carrying out of large constructive works, a labor which, with the crude implements of a stone age, would have required the coöperation of large forces of men. Most conspicuous of these are the extensive systems of irrigation, with the great canals running many miles into the interior. One of these canals in the Gila valley is fully thirty-eight miles in length at the least calculation,

and in other parts of Arizona there are ancient canals over seventy miles long. The construction of these canals to-day, with all our improved appliances even, would be a great undertaking, and their execution with simply stone implements for excavation and baskets or litters for carrying the earth would have been beyond the means of a small population. Moreover, a small population would have kept near the river and made but a short canal. One of these ancient canals has been partially utilized by the Mormons of Zenos, or Mesa City, one of the towns in this valley, in the construction of their own irrigating system, and they say that, at a single point where the old canal had been cut through a bed of hard, natural cement, it saved them an expense of between $10,000 and $20,000.

The irrigating systems furnish another strong argument in favor of a dense population, by reason of the great economy of water that was practised, and consequently the large area of land that was brought under cultivation. The ancient people were content with a fall of but one foot to the mile, whereas the fall thought necessary by the white inhabitants of to-day is twice as great — an extravagance which must be remedied in time with the growth of population and the increased demand for land. The primitive inhabitants, therefore, carried their irrigation to much higher levels than is feasible under the modern methods. But even thus it appears that the supply from the river did not wholly meet the needs of the ancient inhabitants, for they still further husbanded water by storing up the rainfall from the neighboring mountains as it flowed down from the ravines in the gullies, or *arroyos*, worn in the ground. They thus were enabled to irrigate additional tracts of land. Sufficient amounts of water were diverted from these *arroyos* at practical points and led into large tanks or storage basins, generally oval in form and made

with high banks of earth, lined at the bottom and sides with puddled clay, which was often rendered still further proof against leakage by filling the basin with brush and making a fire that baked the clay into terra-cotta.

Another feature of the great public works of this class was but recently discovered by Mr. Cushing. It is still more significant of vast population operating coöperatively. The unusual rainfall of the past winter has caused a luxuriant growth of small flowering plants upon the plains surrounding Los Muertos and other ancient cities of the southern Salado system. Mr. Cushing observed, however, that while this growth is always most luxuriant where ancient buildings have stood, it is absent along the inner borders of the banks of what were once extensive irrigating canals, whose lines could previously be traced no farther, so obliterated had they become in the course of time. Following out one of the canals of Los Muertos by this means, he found that it led off to the southwest some three miles farther than it had been explored, terminating in an enormous *represo*, or storage reservoir, irregular in outline, something like a mile in length and averaging nearly half a mile in width. Apparently, advantage had been taken of a natural depression for the creation of this reservoir. Considering that its banks were built of earth excavated by stone implements and transported in baskets, it is evident that an army of laborers must have been required for its construction. The reservoir was evidently designed to store the surplus water from the canals, and it is not improbable that one of its purposes was to enable the canals, without waste of water, to be run bank-full, for the sake of the navigation, which naturally would have existed under the need of transporting building and other heavy material from the river and crops from the fields to the towns, and with the facilities offered by water-ways

of such magnitude. It seems likely that the craft used in these canals were rafts of bundles of reeds, since enormous quantities of reeds from the river were used for roofing and other constructive purposes, and floating them down the canals would suggest their availability for transportation purposes. Thus, under such conditions of irrigation, in a timberless region, probably originated the balsa or raft of reeds, universal among the Peruvian aborigines and in the Gulf of California.

These ancient canals may often, or almost always, be traced by the large and small, black river pebbles or cobble stones that are found in profusion on their banks, when not covered, together with the worn-out digging implements of stone. The reason for the existence of these river stones in such places is to be found in one of the many peculiar beliefs held by primitive man in the taking of appearances for realities. Just as they are sometimes found to hold that the motion of the trees causes the wind, instead of the wind moving the trees, and that the butterflies bring the summer, rather than the summer the butterflies, so, as they see the apparent motion of pebbles in flowing water, they hold that the water is urged along by the pebbles. Therefore, they placed the pebbles along the banks of the canals, particularly in places where there was danger of breaking, under the belief that the stones, or "water-tamers" as Mr. Cushing calls them, would exert their influence in repelling the water as it leaped up against the banks, and urge it along in its proper course down the stream. At the entrance to their reservoirs and all around the great reservoir above described, little heaps of these river-stones are to be found, put there to show the water the way out of the canal into the places where it is wanted to go. The Zuñis of to-day hold this belief, and the existence of the "water-tamers" among the ves-

tiges of these people shows that the belief was handed down from very ancient times.

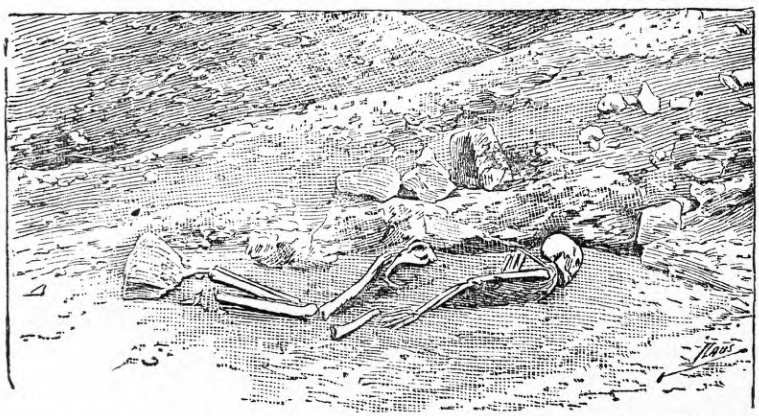
The study of the methods of irrigation and agriculture pursued by the primitive races of the Southwest is highly interesting and instructive. The subject has been followed closely by Mr. Cushing for several years, and the results of his investigations thereof will, when made public, have not only scientific, but also a genuine practical value in indicating improved methods for bringing large tracts under cultivation, and showing that, with all our boasted nineteenth century civilization, the modern man can profitably go to school to the occupant of the soil in an age when they used hoes of stone and planting sticks, instead of steel ploughs, seed-drills, cultivators and harvesters.

Of late years it has been a favorite theory among ethnologists to hold that there never was a large aboriginal population in America, and that the enormous number of ruins found here in the Southwest is to be accounted for by successive occupations of a small number of inhabitants. The ancient history of the Old World, however, shows that the population of fertile portions of desert regions was compact and dense; the valleys of the Euphrates and of the Nile — the former as desolate and waste to-day as our own Southwest — sustaining enormous populations in ancient times. Similar natural conditions exist here, and what was there to prevent dense populations in these valleys? Then, too, a successive occupation by migrations of small populations, building city after city, pueblo after pueblo, of those whose ruins exist to-day, would have necessitated a period of time so great, even giving but a few generations of habitancy to each place, as to confer upon many of these ruins an antiquity so vast as to be beyond the bounds of probability and the lasting qualities of the materials employed in constructing them.

It is certain, however, that some of these ruins do possess a very considerable antiquity, while on the other hand Mr. Bandelier's recent researches would seem to show that cities of the general character of Los Muertos — with the feature, that is, of the central temple or citadel — were in existence, and inhabited when the first Spaniards invaded the land. At least there were people dwelling about such places, though perhaps only as the Pima Indians dwell about these ruins to-day. On the other hand, then, the theory of successive occupations holds good, with the qualification of large populations. It is seen that the institutions of this people required a contemporaneous inhabitance of an entire group of their towns, but that inhabitance was subject to termination through a regard for a peculiar article of faith, which must have existed with them from a very remote period in their past, and which must have been a controlling motive in the migrations which dispersed them over such wide areas of the continent.

This was a belief in the necessity of maintaining their abiding place at the centre of the world. Should the stability of the natural conditions of the locality inhabited by such a people be undermined through the occurrence of disturbing phenomena, and should religious ceremonials and sacrifices be unavailing in persuading the gods to cause a cessation of such phenomena, then the place would be abandoned with all the belongings of the people, and however desirable the region might be for residence, however rich the soil, a taboo would be laid upon the towns and the fields, and no one of that race might longer dwell there or till the soil. A removal to a short distance, no farther away than a neighboring valley, for instance, would be enough to comply with the self-imposed edict, and there the people might live even for centuries, perhaps, about a stable earth-centre, rejoicing in the favor of the gods.

Earthquakes were one of the main causes of the instability of the "centre of the world," and it was evidently that which occasioned the abandonment of the group which has been the scene of the investigations of the Hemenway expedition for the past year. Mr. Cushing first came to this conclusion through finding the household utensils left in their regular places, unbroken and undisturbed, just as they would have been in the case of such a deliberate abandonment under taboo. That earthquakes were the cause was shown by the nature of the sacrifices which he also



SKELETON OF MAN CRUSHED BY WALL PROBABLY OVERTHROWN BY EARTHQUAKE.

found, the same sacrifice that the Zuñis make to-day to the gods of the lower regions, the divinities who produce and control the phenomena of earthquakes, whenever a great landslide or other allied disturbances occur in their country. The walls of many of the houses were also found to be overthrown and the roofs burned, as if from the fires on the hearths, and now and then the skeletons of persons were found who had been caught and crushed beneath the falls. That of one man thus excavated appeared to have been held to the ground alive and mangled, as if struggling to free himself.

When at San Francisco on a visit last autumn, Mr. Cushing, at a dinner given in his honor by members of the Academy of Sciences, gave some account of his work here. President Holden of the University of California, and Professor Davidson, in charge of the coast survey on the Pacific, were particularly interested in what he had to say concerning the earthquake idea, but were evidently disposed, and very properly, to receive his theory with scientific caution, the subject being a specialty with them both, they having recently returned from elaborate investigations of the great earthquake of Sonora at its centre of disturbance at Bavispe, that had occurred the preceding spring. Therefore, they asked Mr. Cushing if he had observed in which way the walls had fallen. "As if hinged at the bottom, and, opening outward, they had let the roof fall inside," he responded; whereupon they assured him that his theory was absolutely correct, for an earthquake was, generally speaking, the only cause which could make walls and roofs fall in that manner. This fact was a discovery which had been made by them during their observations at Bavispe, and it was not until after this dinner to Mr. Cushing that their report announcing it was published.

In this connection a singular occurrence deserves noting. On May 3, 1887, two gentlemen, resident in Arizona, were visiting Camp Hemenway, and were dining with Mr. Cushing. They listened with interest to what he told them about the ancient earthquakes, but they said that they could not accept his conclusions, since this was a region free from such disturbances. Ever since the first occupancy of the territory by the Spaniards even such a thing as an earthquake had not been known. They had scarcely finished the discussion when the flag on a staff over a neighboring tent, visible from the table, was observed to be fluttering violently, although not a breath of

air was stirring. Then a strange motion of the earth was felt beneath them, accompanied by a rumbling noise. "An earthquake, gentlemen," exclaimed Mr. Cushing, drawing his watch and timing the disturbance. The shock lasted something like two minutes; it was the great Sonora earthquake whose effect was felt far up into Arizona and New Mexico. "I believe you now!" exclaimed the guests, and one of them looked at Mr. Cushing with an expression that might have been interpreted to proceed from a suspicion that their host was a wizard, who had conjured up the earthquake expressly to prove himself right.

VII.

Speculation naturally arises as to the probable age of these remains. That is, of course, a difficult matter to determine, and, in the present stage of the investigations, little more can be looked for than an approximate minimum estimate. The culture itself represented by these remains is undoubtedly very old upon this continent. When the Spaniards first came into this country the most notable edifice in the Southwest among the ancient structures, Casa Grande, on the Gila, was even then a ruin, and it is, after nearly three centuries and a half, still standing. Mr. Cushing's researches have proven the Casa Grande to be a typical central temple and citadel of the ancient civilization, and all the others have long since crumbled into mounds which give only slight indication of their structural character. The condition of the articles taken from the ruins, particularly of the pottery and the skeletons of the inhabitants, is such as to betoken an age of between 1000 and 2000 years at least.

An indication of the possible age of these remains may be found in a consideration of the remarkable archæological discoveries reported from the Spanish province of Alme-

ria, made last summer, so shortly after these of Los Muertos as to be almost simultaneous. The account of those reads like a repetition of the story of these, for there, too, it was a stone-age culture whose remains have been brought to light; that people also practised both cremation and house-burial, and there, as here, the house-burials often included both husband and wife, or at least man and woman, side by side. As the conditions of soil and climate in southern Spain and our Southwest are remarkably alike, both regions being dry, hot and desert-like, and conducive to the long preservation of buried remains, it is quite possible for relics of the past to last as long here as there. And for European archæologists there is set an interesting task in estimating the possible period of a stone-age civilization on the borders of the Mediterranean, in a land subject to the influences of the iron-age Latin cultures and the bronze-age pre-Latin people. It is a striking fact, that at nearly the same time there should be discovered the remains of two cultures so closely resembling each other in their institutions, both in new Spain and in old.

There are evidences in the habitable valleys of the Southwest, of superimposed occupations of the same sites, as in the great centres of population in the old world, and for the same reason — the character of soil and other natural conditions being such as to invite population by successive peoples. And as race-history almost universally shows that more or less of the blood of preceding peoples passes into the veins of successive occupants of the same soil, this seems sufficient to account for traditions among the latter pointing to descent from a race whose culture often occupied a higher grade than their own.

Mr. Cushing's studies have led him to characterize this primitive sedentary culture, for convenience of designa-

tion, as Shiwian, or Toltecan,— not as Toltec, not as recognizing a distinctive Toltec race — but as distinguishing a culture, though not necessarily a race, as the parent of the Aztec, Maya, Peruvian and other civilizations of Mexico, Central and South America. Of this he is firmly convinced, for by comparing his own studies here with the explorations of others conducted in those regions, he traces by the sure and gradual lines of natural development the evolution of those civilizations from this root and stock, which formed an ample framework for the elaborations there supplied. The word Shiwian comes from Shiwi, the name by which the Zuñis call themselves. As the Zuñis furnish conclusive evidence, both in their language and institutions, as well as in the way in which they are regarded by neighboring Pueblo races — which have adopted not only their religious customs, but the very words designating those customs — that they, of all existing Pueblo nations, preserve in the greatest purity the heritage of the ancient sedentary culture of the new world, it is most fitting that they should give the generic name to the ethnic groundwork upon which the autochthonous American civilizations are based.

VIII.

It will be seen that the results of the Hemenway expedition are of importance, not so much through what has been found, as by what has been *found out* in the progress of the work. The collections, however, are remarkably rich and extensive; their great and paramount value rests upon the knowledge of their collector, and thereby the circumstances under which they were collected. Without this, they would be simply like the great majority of other collections — merely curiosities, or museum bric-a-brac. The collections of the Hemenway expedition, however, will rank among the few that may be said to have a soul;

that is, deriving their value more from their intelligently recorded history than from their objective interest, great though this may be. One of the other notable exceptions to the general run of archæological collections is that which Professor Putnam of the Peabody Museum at Cambridge is making with such admirable system and exactness among the ancient aboriginal earthworks in Ohio, and the results of Mr. Cushing's labors here cannot fail to throw much light upon the meaning of what has there been found.

All the facts concerning each and every article in the collection are ascertained and noted with as much detail as possible, that it may be enabled to tell its story; for, although that story may be veiled in mystery at the time of its discovery, there is no telling at what moment some other discovery may remove the veil if the history of that article is carefully preserved for reference. This has occurred again and again in the course of these explorations, and the records that have been preserved will prove invaluable aids for the guidance of investigations. And the fact that may prove the key to a vexed problem is not unlikely to be a seemingly unimportant detail. Therefore, all objects are carefully labelled and catalogued, and in the catalogue all the circumstances concerning their finding are noted. This record is also checked and amplified by the daily report of the director, written carefully by Mr. Cushing, giving the history of each day's work. So far as practicable, photographs are made of the excavations and the objects found; plans are also made of the buildings whose ruins are excavated, and these are shown collectively in maps of the localities.

The importance of having archæological work proceed under the direction of a man thoroughly conversant with the institutions and characteristics of the race, whose remains are under investigation, is shown by the knowledge

brought to the task by Mr. Cushing. One not familiar with Indian life and methods of thought would, in a field like this, be fumbling blindly in a labyrinth. The knowledge of the motives that would actuate primitive man under given circumstances tell him why certain objects are placed in certain positions and relations as plainly as if he

SKELETON OF MAIDEN SACRIFICED TO PREVENT EARTHQUAKES.

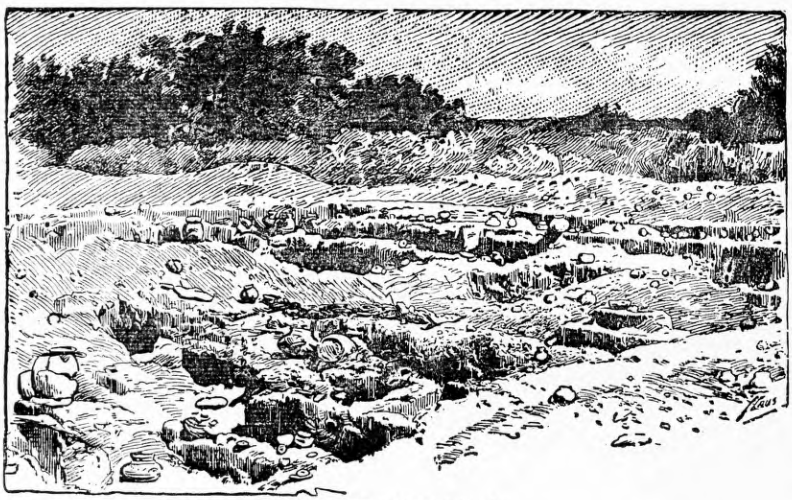
had seen them put there himself. For instance, he finds a skeleton buried with adornments that he recognizes as belonging to the paraphernalia of a certain priesthood that he knows among the Zuñis, and held sacred to that purpose, while on the facial bones of the skull is found the dry, colored dust of a pigment with which the members of that priesthood paint their faces during certain ceremonials

of the order. Mr. Cushing therefore learns, by this observation, that the same priesthood existed centuries ago among this people, and that the remains of one of its priests are before him. Again, by certain articles found about the skeleton of a female, he recognizes that here was an Indian Iphigenia — the articles are sacrifices to the gods of the lower regions, and the maiden was probably the best-loved child of a priest, slain to gain the favor of the deities and avert the earthquake dangers. So, also, from his knowledge of the Zuñi conceptions of the regions in space; of the tendency of that race, for the sake of protection as well as agriculture, to locate its towns and camps in certain relations to one another and generally in the midst of plains, then to distribute around about these homes their cave-sacrifices and shrines according to certain local conditions and to their ideas of the regions of the world, he is able to enter a valley-plain in the Southwest before unknown to him, and find there the cities of the ancient occupants — even though these be buried, with scarcely a trace on the surface. Having thus found these towns, he is then able, by looking at the mountains with Zuñi eyes — "dividing the horizon mythologically" — thus to choose, as would a priest of the old Shiwian cultures, the places of sacrifice; and when, according to this choice, he rides off to these appropriate places, he finds, readily and almost invariably, the round and square god-houses, the ritualistic petrographs, and even the cave-shrines placed there centuries ago, with their rich accumulations of textile, feather and wood paraphernalia in the shape of vessels, symbolic weapons, etc., preserved as thoroughly as if they had been kept in the cases of a museum.

The collections include pottery, stone implements, turquoise and other stones held in esteem in the ancient days, shells and shell ornaments, and human and animal remains.

So great is the age of the ruins that but slight remains of textile fabrics have been found — two or three precious scraps — and pieces of wood and other vegetable remains are also very scarce for the same reason. Those that have been found are in a charred condition, for the greater part, and it is this charring which has preserved them, enabling the burned roofs, for instance, to tell the tale of the earthquakes.

The pottery is found, for the greater part, in houses,



EXCAVATED HOUSE-RUINS.

buried beneath the floors as food and drink vessels for the dead with whose skeletons they were found, or in use as domestic utensils; or discovered buried at the bases of the pyral mounds, containing the cremated remains. It makes a rich collection; one of the finest in the world, when its typical character and the circumstances of its discovery are taken into account. In general characteristics it is the same as that of the ceramic art of the Southwest, both ancient and modern, and many of the designs are identical

with those made by the Zuñis of to-day, some types not varying in a single detail, illustrating the power of tradition in the conservation of design among a primitive people. One of the most important things is the discovery here of nearly all the types needed to complete the chain of development in the evolution of pottery-forms and designs out of basketry, traced with scientific exactness by Mr. Cushing in his paper on pueblo pottery, contributed to the fourth annual report of the Bureau of Ethnology, recently published.

The collection of stone axes and other tools is already unquestionably one of the finest in the world, both in variety of form and in nicety of finish, as well as in number of specimens. The articles of personal adornment show that the race possessed considerable artistic skill in that direction, as well as in pottery. Sea-shells were the favorite material for the manufacture of these, and much of the shellwork shows traces of having been used as a base for inlaying. Fortunately a very precious example, one of the gems of the collection, tells just how this inlaying was done. The article is a figure of a frog made by coating the back of a shell with an excellent kind of black cement, manufactured from the gum deposited upon the leaves and twigs of the hediondillo, or grease-wood, by a species of lac-insect. In this gum were embedded little mosaic fragments of various shades of turquoise and of red shells, and then rubbed down smooth. It makes a realistic figure, as well as a very beautiful article of primitive jewelry. Probably no public collection in the world has any example of this peculiar inlaid work, a few articles of which are held in priceless esteem by esoteric orders among the Zuñis and other pueblo tribes. A unique example of the art of this ancient people was found the other day while excavating the ruins of an interesting temple,

in the shape of the only specimen of their basket-work thus far encountered. It was protected by the charring of the contents, a kind of marmalade of pitahaya fruit, as it lay in the storeroom of the temple, but unfortunately it was badly broken by the shovel of a workman before it was observed. The fragments have a great scientific value, however, since they show that the decorative coloring was protected by a kind of lacquering, probably also made from the hediondillo gum, the first yet discovered among the prehistoric remains of this country.

The anthropological value of the large collection of human skeletons — nearly 200 having thus far been found— may be seen from the fact that the ancient pueblo skeletons have been extremely rare and correspondingly coveted heretofore, but three or four skulls having been found previous to the work of the Hemenway expedition. The collection of skeletons has particular worth, from the excavation and preservation of the remains having been personally superintended by two such eminent scientists as Drs. Wortman and ten Kate, so that every possible bone has been secured. This circumstance has, indeed, enabled those gentlemen to make a discovery of great importance, the nature of which, however, it would be unbecoming in me to indicate before its announcement in proper scientific form by its discoveries. The doctors also declare that the number of anomalies they have encountered make it the most interesting collection of skeletons they have ever examined.

IX.

As carrying out the work begun by Mr. Cushing in Zuñi and confirming the conclusions reached there, the following list, prepared from data furnished by his notes, will show the nature of some of the chief results attained

by the Hemenway expedition in but little more than a year:

1. The finding of extensive groups of petrographs, or rock-inscriptions, existing throughout central Arizona from Prescott to the Salado and Gila valleys identical even to detail with the Zuñi groups, and thus establishing that their purpose was, like that of the latter, ritualistic, and to be interpreted, when of Pueblo origin, mythologically, and not as records of events.

2. That the class of ruins typified by the Casa Grande remains is universal in the valleys of the Gila and Salado and neighboring watercourses, and equally so in lines extending southward far into Mexico. The chief characteristics of this type are demonstrated to be (1) the use by their constructors not only of stone and of hand-made adobe, or sun-dried brick, but also in the building of their main earthen walls by forming them within a framework of slight timber and wattled cane, thus characterizing their architecture as derived, like their pottery, from original basketry types—in this case, of hut structures; (2) the occurrence of enormous central citadel or temple buildings in the midst of (3) groups of dwellings distributed within walled enclosures, and (4) in their vicinity clusters of houses or huts of an inferior type, unenclosed, inhabited by an ultra-mural outcast, or laboring class; that (5) in shape these entire groups of structures or cities invariably conform to the lines of extension of the main irrigating canals, thus being of great length relative to their width; (6) that these ancient canal cities are universally located along the outside limits (that is, farthest from the river) of the irrigation tracts lying between the canals and the river; (7) that these cities invariably occur in groups, contemporaneously occupied, of six or seven, thus exactly corresponding to the mythico-sociologic division of the

"seven cities of Cibola" or ancient Zuñi, and the still preserved division into seven corresponding parts of the one modern Zuñi pueblo; (8) of the universal prevalence among their inhabitants of the significant dual system of burial of the higher social and sacerdotal classes by interment beneath the floors of the houses wherein they dwelt and their relatives continued to dwell, and in gentile cemeteries surrounding the bases of sacrificial mounds — designated by Mr. Cushing, in consequence of their use, as "pyral mounds"—of the ordinary classes, whether intra- or ultra-mural.

3. The occurrences, as in Zuñi, throughout all these pueblos, associated with their appropriate structures of (1, in temples), tribal; (2, in urban houses or quarters), of clan, or gentile; (3, in dwelling rooms and house sepulchres) of family; (3, in pyral sacrifices) of individual, amulets or fetiches, consisting of concretionary stones of high natural colors and peculiar shapes, and held sacred because derived from the "source of life" in the sea, lakes and rivers. In correspondence with this institution there occurs a decorative symbolism on pottery identical with that of Zuñi.

Conforming with the grouping of their cities, the ancient inhabitants practised an elaborate and thorough system of coöperative irrigation, superior, in some respects, to that of the present white inhabitants; in addition to which they practised an elaborate and even more ingenious system of rain irrigation.

5. That from the form of their canals and distribution of their canal-systems, as well as the evidences, direct and indirect, of the transportation of bundles of reeds and canes, they seem to have had a crude, yet effective, system of canal navigation.

6. That, from the evidences furnished by (1) the tra-

ditions of the Zuñis, (2) stray allusions in old Spanish narratives, (3) petrographic herder-rituals, these people had domesticated animals, notably the turkey, and probably also the rabbit and a variety of the auchenia or llama, as shown by (4) the petrographic inscriptions observed by Mr. Cushing in western New Mexico and central and southern Arizona, and the repeated finding of sacrifices for herd-increase or reproduction, of actual figurines strikingly resembling the last mentioned animals.

7. The practice of an entirely indigenous metallurgic art, evidencing a crude knowledge of the reduction of ores by smelting, working of the resulting metals by beating or repoussé treatment with stone implements, and fusing or brazing with terra-cotta and cane blowpipes, showing the beginning of the extremely interesting transition, within and from the stone age toward the metal age, in this, the working of the softer metals chiefly for ornamental purposes solely with stone-age appliances; the utilization of metal for implements being considered as marking the beginning of the metal age.

8. The establishment, by Dr. ten Kate, of the types of crania belonging to the remains of these people, as being of the peculiar brachycephalic pueblo, older Mexican and Peruvian type, and also the discovery, by Drs. Wortman and ten Kate, of new and strongly distinctive anatomical features that promise to be of extreme value in racial determination.

These, which are only the chief among numerous interesting discoveries and observations, all evidence, as above narrated, a continuous desert culture, the direction of whose growth and elaboration lay from north, southward, finding its most immediate course and its clearest and most perfect development and exemplification at its extreme limit, in Peru, especially among the Chimu and other Yunga re-

mains — its most primitive and representative living example in the little tribe of Zuñi, to-day, though to a greater or less extent still traceable as an absorbed element among nearly all the tribes of the Southwest.

Beside the strictly scientific fruits, and the fact that probably there is no really scientific achievement without a thoroughly practical aspect in the shape of benefits to human progress —although they may not directly appear— the Hemenway expedition has accomplished directly "practical" results which may be turned to great economic account in the very region where its researches are prosecuted. In investigating the remains of the primal desert culture of our continent — and Mr. Cushing holds that, from the necessities of environment, the origin of all great civilizations is to be sought in the desert — it is bringing to life the facts concerning a people who had learned all that the desert had to teach them, or at least all that it was needful for them to know. And the desert-craft of the aborigines is not to be despised. A single example may suffice. When Mr. Cushing's researches concerning their methods of irrigation are made public, it will be seen that, with their economy of water and their knowledge how to utilize and husband the rainfall for irrigation through simple and effective means of storage, in addition to the water brought in canals from the streams, the facts acquired by them through ages of experience can be adapted to our modern resources, to the great advantage of the multitudes who are now repopulating these valleys. And this knowledge will be of enormous benefit to the Southwest, vastly increasing its population, and enabling the cultivation of extensive tracts that are still regarded as hopelessly desert.

X.

All that promotes an understanding of man by men

strengthens the ties of sympathy that are destined to overcome, in the course of the ages, the mutual prejudices of individuals and the mutual hatreds of races. These ties will form the bonds of universal brotherhood, the attainment of which has been the aim of the masters of life, who have towered like mountain peaks above the levels of their kind, and, in the calm, clear air that lies beyond the turmoil of the clouded currents of passion and of strife for individual advantage, have seen that human happiness can have no lasting home where it is not plainly recognized that only that which is for the good of all men is for the good of any man. Dislike is dispelled by knowledge; and ethnology, the science of mankind, is, therefore, essentially the most philanthropical, as well as the greatest, of the sciences.

To understand any subject we must first go to its beginnings and work from the foundation upward. In tracing the history of the human race and the development of the human mind back through the long volumes of Nature's book, that, with their baffling pages of strange though plainly inscribed records precede our few chapters told in familiar speech called history, we must first go to primitive man and study the race in its childhood if we would understand the true meaning of that blossoming of humanity known as modern civilization. In making this work its task the Hemenway expedition is rendering an invaluable service, and the results already reached give promise of grander results to follow, as the strands now grasped in the light of discoveries made are brought together to form the line that shall lead far back among the vanished peoples of the very old "new world."

Written at Camp Hemenway, near Tempe, Arizona, April 4, 1888.