THE ORIGIN OF PRIMITIVE AMERICAN AGRICULTURE AND ITS RELATION TO THE EARLY AGRICULTURE OF ARIZONA

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THE MIGRATION FROM THE NORTH.

The origin of primitive man upon the American continent is still a matter of conjecture among anthropologists, however out of five most probable theories, we may easily select two that are most feasible and the least disputed.

The first, and most probable, is that the native American is of Asiatic origin, having travelled over ice in the winter, or by water in the open season by means of small craft, negotiating the mean distance of nearly fifty miles of Bering Straits in which two favorably distributed islands are located.

Second, that migration took place by an arctic land bridge, connecting Europe and America, of which sufficient evidence is left to prove the one time existence of such a connection during the Pleistocene Age. This evidence consists of fossils of flora and fauna of a tropical nature, taken from lands of the once existing bridge, and the present shallowness of the ocean. But due to the lack of substantiated evidence of man upon this continent at that early time, we can readily see the possibility of the same route at a later date by sea, stepping from Scandanavia or the British Isles, via the Shetland and Faroe Islands, Iceland, Southern Greenland and North America.

IMPUTED OBJECTIONS AGAINST THE NORTHERN ROUTE

Whether the native American is of Asiatic or European origin is not significant to me in this writing, except that it is my desire to prove that the agricultural knowledge of this

continent previous to the advent of the Spaniard was indigenous to the Americas (as controverted by the theories of some authors) and that its origin evolved from Mexico and Central America, and reached this continent by no other means.

In order to prove this, I first wish to refute some of the serious objections so often ascribed against the possibilities of a northern approach. That--"The Steppes of Siberia would cut off migration as well as the vast snow clad mountain ranges running east and west."

It may be said on the contrary, that mountain ranges only serve as a temporary check upon the migration of a people, that when the impending danger is greater and more pressing from the opposite side than the crossing of such an obstacle, man will take the least of two evils and find for himself new and unmolested hunting grounds beyond the impediments. The early history of Asia substantiates this fact, that the primitive dolichocephalic Mongolian was crowded northward toward Bering Straits (of which remnants still exist in the Koryaks) by the more aggressive Southern tribes, and on the West by the Tartar hordes from the Cent al Asian and Southern Siberian steppes.

Another serious objection against a migration from the North, is the missing link in the chain of evidence of prehistoric man in the region north of the St. Lawrence on the Atlantic and British Columbia on the Pacific, or as more broadly stated by Dr. Ballon in regard to the Bering Gate--"If that theory were correct, how explain the fact that in pre-Columbian days there was no civilization worthy of the name north of Mexico, whereas in the later country, in Central America, and in Peru there were peoples with highly developed arts, industries,

and even literature? -------To suppose that the prehistoric ancestors of these people came all the way from northern Africa and Southern Asia by the way of Bering Straits, and thence made their way Southward to Central and South America without leaving behind them anywhere north of Mexico the slightest trace of civilization seems on the face of it an absurdity."

Whether this migration to the South was rapid or not, is not known. It is claimed that the progress in the migration of a primitive people is slow, but the fact that no extensive evidence, other than the Kitchen Middens has yet been discovered of a timely northern abode should not distrub us, for undoubtedly they constructed habitations of a portable character, as maritime people or hunting nomads would in the summer, and more or less of a temporary nature in the winter. Even the earliest Kitchen Middens, who would have existed at a subsequent time, left no ruins of their timely dwellings. Moreover the climatic conditions in the North are very adverse to the preservation of such evidence and the scarcity of the populace would be a factor entering into the lack of surviving evidence of an ancient people in the frigid zones. If these people were of the paleolithic age, they would not leave evidence of pottery which belongs to the neolithic age nor would their crude implements be so readily distinguishable, being hard to distinguish because of their crude type and scarcity of numbers. Even at present, the Eskimo makes only the crudest type of pottery.

On the other hand let me state , that recent evidence has been found of shell deposits of Kitchen Middens existing on the Aleutian Islands, and that now deposits are known to exist from Japan to South American on the Pacific and in Denmark,

Scandanavia and along our Atlantic seaboard to South America. It would not be any more than natural that these primitive nomadic people of the stone age should migrate toward a temperate and unmolested zone, for the various northern conditions are not favorable, meteorologically or biologically, to the development of a cultural people who would leave behind them momentous ruins. This can easily be observed from legends, history, and ruins by turning to the cradle of civilization. All of the higher types of the more primitive culture of Asia, the Indian, Assyrian, Chaldean, Babylonian, Median, Persian, Judean and later Greek and Roman in Europe, have originated in the southern part of the north temperate zone where climatic conditions and plant life (with plant life we associate agriculture), favored, not obstructed, the advancement of a people, producing the so-called "cultural zone." Thus explaining by the lack of these favorable environments why the northern part of North America was for thousands of years peopled by only nomadic tribes. Before we could find the development of a culture "North of Mexico," it would be only, after these people first migrated to Southern Mexico and Central America, cultivating and developing there, the indigenous plants which were suitable for agriculture. All of the great Empires of the eastern hemisphere reached the zenith of their power when at the most extensive stage of agriculture. So in regard to the physical and biological relations, it has been pointed out, that--"The progress of mankind beyond the savage state has been retarded and even arrested by the prevailing excess of heat and moisture."

Agriculture as a sedentary occupation under the favorable conditions of the cultural zone has developed man by tending to deprive him from his nomadic nature, thus developing a communal system resulting in the exchange of ideas, commerce, and reserve resources which gave rise to a culture, a social development and military organization, out of which grew the establishments of vast empires and the great ruins that are left to perpetuate their ancient existence. This answers why "no civilization worthy of the name North of Mexico" existed in pre-Columbian days.

FAVORABLE AGRICULTURAL ENVIRONMENTS EXISTED IN MEXICO AND CENTRAL AMERICA.

Since we have taken the Northern route, the most readily accepted and least disputed, it can be plainly seen that the people travelling thru the arctic reaching this continent, were hunters of the sea and wild animals of the icy regions, and while working south along the coast or coasts, they brought with them no advanced arts, industries, or vestige of outside influence of agriculture during their attributed long sojourn as primitive people. But they continued their maritime habits, living upon fish, invertebrates, (molluscs and crustaceans), leaving behind them their antique refuse heaps by which they became known as the "Kitchen Middens." For it is well known that a primitive people are conservative, thus having a tendency to adhere to their old customs. Finaly, they broke away from the salt water, following the fresh, where they developed weapons capable of vanquishing the land animals and by their wanderings, radiated over the continent in a southerly direction into Mexico as a nomadic people from which place certain tribes acquired the art of agriculture from plants of recognized value and became a

sedentary populace, such as the Maya of Central America, the Cave, Cliff and Pueblo people of the plateau region of the Southwest, the Mound Builders of the Mississippi Valley, and the later Aztec culture of Mexico and Inca of the Western Coast of South America. So we too, in America had developed as in Asia, a culture of a similar primitive form in which the progress of the homo sapiens had advanced beyond the savage stage.

Unlike Asia in the Eastern hemisphere, we find the seat of culture of the Americas' in the torrid zone, but this is justified by physiographical conditions as A. H. Keane in Stanford's Compendium of Geography of Central and South America, says in regard to the Agricultural resources in Mexico--"Thanks to the vertical arrangement of its climatic zones, the general fertility of its soil and a fairly abundant rainfall on all the escarpments of the plateaux, Mexico possesses an extremely diversified native flora, and is also capable of growing all of the economic plants of the world in juxtaposition-------. Such also is the equable character of the climate, that in many districts field operations are carried on all the year around, and the traveller is bewildered at the spectacle of corn just sprouting from the ground, yellowing from the sickle and being trodden out by mules on the threshing floor." Thus due to the physiographical and meteorological conditions we find Mexico favorable to the development of a human and biological culture. Biologically, "Elevation has a greater effect upon floral development, than its greater or less proximity to the equator."

In Central America we find a central mountain system modifying the climatic conditions, such as permitted the fostering of the Eden of this continent on the Anahuac table lands. On these table lands we find a very moderate maximum seasonal

variation of about ten degrees between the hottest and coldest days of the season. Here we find varying vegetation from the tropical at the coast, to the tree limit 12,500 feet above sea level. There it is now claimed the Toltecs from Tola dwelled, representing the earliest known seat of civilization, (not of the Nahua, who are now thot to be later invaders from the north), but of the indigenous Mayan element who were the famous builders of the pyramids of which Keane says---traces of language still persist in isolated branches of the Huastec and Tamaulipas on the Pacific and Vera Cruz on the Atlantic. The Toltecs believed as the Chechimecs and others that their ancestors came from the North. Evidence tends to show that the early Mayan culture had been overrun by the Nahuas coming from the North of the Rio Grande del Norte and thus the Mayans were separated by one of the Nahuas most progressive and representative tribes, the Aztecs, who inhabit//ed the centrally located table lands at the advent of the Spaniards.

A PRIMITIVE CONVERGING MIGRATION
A LATER DISSEMINATION

We have observed how man in his migratory advance, moved down thru the North American continent, converging into Mexico and Central America where he found favorable conditions, establishing there, the cradle of primitive American civilization. There the building of Empires had been accomplished, which we should not look to lightly upon from its antique view point, because this same state of advancement took thousands of years to develop in Asia, after having been passed on from one conqueror to another. The number of dissimilar languages also bears witness to the antiquity of the American aborigines as well as the widely disseminated agricultural plants and genetic variations.

While in Europe it is calculated that the cultivation of plants dated back 10,000 years, a conservative estimate in this country may be placed at 2000 years. The fact that the center of Indian population is situated to the South tends, again to show its antiquity. Mexico has 38 percent, or over 5,000,000 pure Indians and 43 percent or over 9,000,000 mixed, while to the north, the United States had only 265,683 in 1910.

To Mexico, and Central America with its antiquity, its diversified flora as great as any country can boast, and with the highest culture on this continent, I think we can look without hesitancy, for the origin, the indigenous development and the successive waves of migration that were centrifugally thrown out. They travelling northward along the Gulf of Mexico to and up the Rio Grande, or up the Sierra Tara Humare continental divide in West Central Mexico and its accompanying plateau region, again striking the Rio Grande at the southern border of New Mexico, spreading into the plateau of the Southwest and reaching into the Mississippi Valley as witnessed in the Cave, Cliff, Pueblo and Mound Building people of the earlier days. They left behind them traces on the Rio Grande and such Cliff Dwellings in Mexico as the Tarahumaries' of the Sierra Madre which were inferior to the dwellings of the Southwest. With these migrations from the habitat of those domesticated tropical plants, the seeds and knowledge of primitive agriculture were brought north to the United States. Thus it may be said, that the development of corn in Mexico and its distribution was a fundamental principle, in fact, the staff of life in the development of the American aborigines and sedentary populating of the continent to such a marked degree as could have not otherwise occurred.

THE TRANS-PACIFIC THEORY

Authors have always tried to show evidence of pre-historic foreign influence, for instance Scott Elliot in "Prehistoric man and his Story," puts forth the following hypothesis -- "The Kurasivo Drift and Benin Currents lead from Japan to California and in the Northern Summer to Central America or even to Peru. Chinese junks have actually been stranded on the shores of California." Continuing he says, there is a definite legend of a great fleet of boats from the North landing near Tumbez, Peru. "Let us, therefore, suppose that the earliest mounds in Japan were raised at, say, 1200 B.C., and that the Japanese with Bronze swords invaded and destroyed this Neolothic civilization, somewhere about 1100 to 1000 B. C. Then fugitives from Japan, despairing of any resistance to these Mongol barbarians, set sail, we will suppose in a fleet of boats, and landed, according to legend, near Tumbez in Peru. These people would, on our hypothesis bring with them a knowledge of domestic animals; they would know how to work copper and have some sort of a misty idea as to the manufacture and use of bronze and of gold and silver, but would not be practical workers in bronze (like the Incas). If they brought rice or other grain with them, they must have lost their first harvest, or ate up all of their seed corn* during the voyage. They did not apparently bring animals with them. Such an hypothesis explains the similarities of the civilization of Old Mexico and Peru to those of the Old World"------. "We have already pointed out how irrigation, terraces and the use of manure in agriculture are found both in the Old and New Worlds. From the 'lynchets' of England, by Spain, Tripoli, Egypt,

*Grain is often spoken of as corn by English authors.

Mesopotamia, India, Burmah, China, Japan and Mexico and Peru, there is nearly a continuous chain of this particular system of agriculture. This method of growing crops hardly exists anywhere else except along this particular route and in such islands as Madagascar, Java, Sumatra, etc, which are in direct continuity with it."

The author, however, does not give this as the origin of the aborigines, but as a superculture landing upon our unknown shores. I give this simply as an illustration that Elliot as well as others have endeavored to connect the culture of the Western hemisphere to that of the Eastern.. However it is known that--"Resemblences exist between the instinct of man in all climes" so with plants--Bailey in "The Evolution of our Native Fruits," says--"for similar conditions develop similar plants," thus the evolutionary formula which has been so ably shown by Darwin, "That all things are the outcome of their environment." So we find under similar environments that primitive man and plants have produced objects exactly similar, without any association from an outside source; that the origin of architectural art, the knowledge of the art and science of agriculture etc., which have been attributed by many to Egyptian, Asiatic, and other origins, are most likely the outgrowth of a natural indigenous development and it seems that we have no more right to suppose that agriculture shows a vestige of outside influence, than we would have to believe, the native Peruvian origin of agriculture as coming from the divine son of the sun.

The visits of the Asiatics to supposed continents in the Pacific (instead of Asiatic Seas), have been found to be exaggerations of over-zealous translators.

Again, the wrecks of ages which have been blown across the Pacific by authors, were crude, weak and unfitted crafts, with food and water for such a trip at their best.

PRIMITIVE AGRICULTURAL EVIDENCE IN ARIZONA

EVIDENCE OF A SOUTHERN ORIGIN

Evidence of a semi-agricultural people who lived long before the height of the Aztec culture of Mexico, but perhaps contemporary with the Mayan culture of Central America has been found in cave burials in northeastern Arizona. Even these, the earliest people of Arizona (that we have evidence of), had a knowledge of corn and its value, relying upon it and to some extent upon beans and squash for a vegetable diet. Supplemented by pinons (which grew profusely thruout the inhabited region), acorns, grass seeds, native fruits and some game as evidence by bone implements, awls, needles, and burial robes consisting of yucca cords twined with turkey feathers, rabbit skin robes and rabbit sticks (like a boomerang in shape). All of which have been found in the subsequent Cliff Dwellings and among the present Hopis, with the exception of the turkey robe, although they still have the domesticated turkey in contrast to the other tribes outside of the pueblos. These early cave dwellers used the atlatl, a spear thrower, of which George H. Pepper, (1902) says--"They had, however, a form of weapon unknown in the Southwest, either in ancient or modern times, save in this restricted area,--the throwing stick, whose nearest neighbor is found in Chihuahua, Mexico, in the form of the 'atlatl' an implement of war concerning which wonderful tales were told by the earlier chroniclers of New Spain." Since that time other extensive excavations have taken place. In the summer of 1916 Drs.

Kidder and Guernsey excavated a burial cave of Cave Dwellers ten miles north of Marsh Pass near Kayenta (which the writer had the pleasure of seeing), in which was unearthed numerous human mummies, a dog, baskets (of a type characteristic only of the Cave Dwellers), corn, grass, seeds, ornaments and the atlatl, (which was also used by the Maya and Nahua), but still no trace of the bow.

Thus evidence is always pointing to the south, from whence they received thru commerce with a more highly cultured people, or most likely bringing with them, in their migration northward, those skills and agricultural resources as will later be shown by the origin of the domesticated plants in Mexico and Central America.

THE AGRICULTURAL CLIFF DWELLERS

The chief industry of the Cave Dwellers outside of agriculture and hunting was basket making (by the women), distinguishing them from their more advanced agricultural successors, the brachycephalic Cliff Dwellers who dwelled in the same caves establishing their residences over the unknown burials of these dolichocephalic Cave Dwellers. Erecting their Cliff Dwellings of stone, of crude construction at first and later out of rubble masonry and clay, and in isolated instances of small adobe bricks with a liberal amount of grass worked in, as observed by us in Nitsi Canyon.

The Cliff Dwellers are easily distinguished from the Cave Dwellers by the above characteristics. The Cliff Dwellers relied more and more upon their fields for a staple food, as the wild animals diminished with the ever increasing population and the depredations of the other tribes upon the once numerous wild herds.

herds. It has been calculated that nearly 7000 acres as the ar required for a single Redman living on wild animals, but that, domesticated animals under favorable conditions may double thei numbers every year. Since in North America the only domesticat animals in the primitive days were the turkey and dog, so upon agricultural development was placed the main reliance for their subsistence and increase in numbers. Herodotus states that crop returns of 200 fold under favorable conditions were raised in Mesopotamia and the plains were covered with populated cities, whereas 30-40 fold at present would be considered a favorable yield in the United States, while 25 fold would be reckoned a fair yield on Indian corn grown under their present crude methods. So with their neolithic implements of stone, horn, wood and bone, we could not expect a greater remuneration, even if more intensively cared for.

From the origin and descendants of these Cliff Dwellers we can in a meager way find out something of their agricultural development. Evidence of their implements, pictographs, pottery, basketry, designs, jot, tend to substantiate a southern origin and there is sufficient evidence to believe that the present Hopis of Arizona are descendants of the ancient Cliff Dwellers. From legend, from similarity of physiogony, (the brachycephalic skull), similar and same pottery designs, similarly constructed ceremonial chambers, (kiva or estufas), similar building materials, rooms and entrances (doors), weapons, rabbit sticks, moaling bins, basketry and designs, method and manner of burials, and absence of stairways seem to be sufficient evidence to recognize the Hopi of Arizona as a descendant of the pre-historic Cliff Dwellers. Thus thru the Hopi legends we may secure a limited

knowledge of the pre-historic migrations of their ancestors, (the Cliff Dwellers) and intimations leading to their agricultural conditions.

According to Mrs. J. W. Wetherill, an authority on the Navajo Indians, it was the practice of the Navajos to take captive the women of their enemies (Hopis, etc. for infusion of new blood) and it is the custom of both the Hopi and Navajo that the clan is passed from mother to child. So we find Hopi legends prevalent in numerous clans of the Navajos. Here we find legends of different clans, of Hopis having inhabited such Cliff Ruins as Mesa Verde, White House in Canyon de Chelly and such famous ancient Pueblos as Pueblo Bonita by the Tsaynotgeenies.

From the same source we also find out that the Cliff Dwellers and Pueblos in Southern Colorado, Northwestern New Mexico and Northern Arizona had moved backward and forward in four or five successive migrations, according to the drouths, causing them to abandon their dwellings often in good state of preservation, leaving implements and valuable evidence of their customs intact. Showing that they depended mainly upon agricultural resources for maintainance and the attending rainfall.

These varying periods of drouth and rainfall that caused the depopulating of the Pueblos, comes natural periodical cycles, according to many scientists, forming definite varying waves of decades and centuries which cause a corresponding advance and retreat, to and from the North where moisture was more plentiful.

The Navajo legend of creation shows, as translated by Mrs. Wetherill, that the Cliff Dwellers were in a high state of civilization and raising crops when the Navajo wandered into that country and that there are still traditions prevailing in the

Navajo-Hopi clans from the "In ae sassi" or "ancestors who fought the drouth."

These early people were located in what is now our present semi-arid plateau regions of rocky mesas and drifting sands of elevated deserts of the Southwest. Ranging in elevation from 4000-6000 feet, with deeply eroded narrow box canyons, winding tortuously with precipitous walls, which harbor numerous caves of large dimensions in which these early people dwelt. In the floor of these canyons were narrow strips of arable land protected from winds and absorbing all the warmth that nature affords in her colored stone walls of sedimentary formation. The retentive sandy-loam of the canyon bottoms, enabled the production of earlier crops than could otherwise have been raised on the unprotected mesas. There we find the domiciliary cliff dweller working in nearby fields--carrying on his art of horticulture, for as yet it had not become a science--intensively caring for the welfare of each individual plant with constant diligence as promoted by the natives' intrepid existence. To them we owe our sincerest gratitude in recognition of their faithful patience and endurance, while Longfellow says that--

"Patience is a plant
That grows not in all gardens," and

and "That it is powerful," while Lowell, thru Columbus, voices himself--

"Endurance is the crowning quality, and
And patience all the passions of great hearts."

Having digressed temporarily for the sake of eulogy, in Longfellow's "Psalm of Life" we may ourselves, if need be, take heed.

"Let us then be up and doing,
With a heart for any fate;
Still achieving, still pursuing,
Learn to labor and to wait,"

as we may say, the forefathers of our native people of this State did, so we may say as A. H. Keane, "Many of the ancient Pueblos, especially those of the Northern area may be designated as horticulturists rather than agriculturists, so intensive was their method of cultivation." Bailey's Encyclopedia on Horticulture says--"Horticulture is derived from hortus (Latin), a garden, (originally an enclosure, cultra, to care for or cultivate a garden. By custom, however, garden and gardening denote more restricted areas and operations than are implied in the term Horticulture."

Here those early natives, reared in view of their dwellings, the staff of their life under watchful care and assiduous waiting, least it be destroyed by some marauding enemy and even nursed it by hand borne water in ollas in case of drouth to offset the wrath that the Rain Gods had inflicted upon them. Truly we may say, that their method was horticultural as is stated in the Standard Dictionary--"The cultivation of the garden or mode of cultivation employed in the garden."

HITSI CANYON

EXCAVATIONS IN GOURD CAVE.

In the northern part of the State, there has been found the most densely populated area of the Cliff Dwellers, in such canyons as Sagie with its branches and Canyon De Chelly as tributaries of the San Juan flowing to the north. Sagie Canyon is separted by a high mesa, thirty miles wide, from Hitsi, which

sinuously twines its course in a north westerly direction thru high mesas to the west of Navajo Mountain as a tributary to the Colorado River Canyon. ~~Whit~~ Such outlying districts as Verde Valley, Roosevelt, the Mogollons, San Francisco and White Mountains exist, in various parts of the State.

The canyon "Tohon oh hoshie Boko" in Navajo meaning "Bubbling water canyon," (named from a spring located on the south side, midway up the valley), is a spur of Nitsi Canyon. In this district the Cliff Dwellers had been established at an early date and here had enjoyed considerable culture. Perhaps in this isolated and well fortified branch, existed one of the last rendevouz of the people of that age, as observed from our excavations of their late culture.

Physiographically it was a secluded place. At the time of the entrance of our excavation party, July 22, 1916, it was owned by a Navajo, "Pinnietson", (Pin head) of considerable wealth and influence, who had purchased this and surrounding valleys in Nitsi from the Piautes. The Piautes in conjunction with the Navajos, used to make raids across the Grand Canyon upon the Mormons in Utah, stealing their cattle and running them into this valley, where by a rail fence across the entrance of the canyon, they made an immense natural pasture a mile long and one quarter mile to a half mile wide, with surrounding walls of red sand stone from several hundred to over five hundred feet high. There were two entrances one by a pass guarded by the Inscription house and the other opening into the main Nitsi Canyon abounding with ruins. The several caves excavated in this canyon, the Gourd Cave, so named by us due to the fact that numerous bitter gourds grew at its entrance proved most valuable from its archaeological standpoint, because of its combination

of both the antique and more recent culture of the cliff dwelle The later and new habitation was superimposed upon the older. This cave also proved valuable in regard to its agricultural evidence, likely the most valuable ever found before in this state.

It was a cave of the ground-level, located on the North side of the canyon with a southern exposure. There was no existing spring in the immediate vicinity, except across the valley nearly a quarter of a mile away. A seepage in the back of the cave had caused the decay and softening of a store room of ollas against the wall, which crumbled when exposed by excavation. There we found evidence of two dwellings. The wa of the upper dwelling still traceable, reaching a height of four to five feet on top of a mound ten to twelve feet above the floor level of the valley. Located inside and to the rear of this cave, whose opening was about 300 feet wide, extending to a depth of over a hundred feet, was a mound, a part of which the Navajos had used as a sheep corral for decades previous to our excavation. The front of this mound consisted of a refuse heap of tons of debris and from which was recovered some twenty cotton bolls, considered as a rare article because no mention of such in other excavations has come to the writer's attention Intermingled with the debris were dozens of sandals, manufactured from yucca, human and bear hair of the most modern type of their workmanship and a large number of cotton cloth goo-strings, several skulls with no attached bones and discarded refuse, squash shells, (of the edible, long neck gourd), etc, showing that the cotton bolls were of a contemporary time and were by no accident introduced by other than Cliff Dwellers.

This heap seemed to be almost entirely the refuse waste from the upper and most recent dwelling from which beautifully worked and decorated pottery of almost a glazed stage was taken, showing a high culture of their ceramic art. The Canyon's natural advantages of shelter, productive soil and a favorable water supply for agriculture, flooding of the high sand stone mesas in the summer, or from melting snows in spring, furnished a sub-moisture to the loamy soil in this canyon where today most productive crops could be raised.

The upper dwelling exposed on the surface of the mound had been devastated by fire. Some of the supporting poles of the roof had been consumed by flames, causing the roof to fall in, thereby extinguishing the fire which was consuming the bean vines that hung on the ceiling with pods intact. By careful scrutinization of the debris from this room, several quarts of beans in good state of preservation were obtained, representing twelve different varieties, or crosses, likely originated from the black, red and white color types. From the lower dwelling with parts of its floor six feet below the clay floor of the upper dwelling was excavated pottery of a more primitive type, but still showing signs of an extensive agricultural industry. Here a mummy was exhumed in the southwest corner of the dwelling, in an artificially constructed cist in the wall, placed in a cotton burial robe and according to their custom, bowls were placed at the head. These bowls contained corn, skeins of cotton, also bundles in the uncombed state with the seeds adhering.

CORN

ITS SUPPOSED ORIGIN

The development and selection of all plants from the wild state was due to some marked use or character which attracted t attention of primitive man. First, observing it in the wild state, then around the dwellings where the seeds were probably distributed by accident, they conceived the idea of artificial planting and afterwards cultivation and selection. Often the foresightness of some great leader from observation of its utility, or supposed divinitation of ~~its utility~~ the plant, led to an order for its cultivation such as recorded in the early days of China and others handed down by legend from Mexico.

Corn was the staff of life of the aborigine of this continent, like it is to the present Hopis, who have fifty-two varieties of corn food according to Dr. Hough of the National Museum.

Keane, speaking of corn says--"This cereal being most exhausting to the soil, it might be supposed that its fecundity must be greatly reduced after 1200 years of cultivation, for the Aztecs have a tradition that it was introduced with cotton by the Toltecs in the seventh century. But there is no sign of exhaustion on the plateaux where the volcanic hills are thickly strewn with potashes and other rich chemical substances. These fertilizers are continually washed down to the bottom lands by the gentle summer rains, and thus the ground is perpetually renewed by a sort of automatic process."

Corn, (Zea Mays, Linnaeus), or Maize, the Spanish name which Columbus adopted for this cereal, was derived from Mahis in Hayti. The first voyagers to visit the new world were

surprised to see this new plant and its extensive cultivation. Columbus in reports to the Queen, writes of corn fields eighteen miles long. By other early explorers large fields were noted in the States of Florida, Illinois, New York and into Canada. In New York alone it took the British soldiers days to destroy the Indian corn fields. Notwithstanding, it has had many erroneous names and origins applied to it in nearly every language, since its introduction into the old world in 1500 A. D., when maize was sent to Seville for cultivation. As De Candolle says in his Origin of Cultivated Plants--"We conclude that maize is not a native of the old world. It became diffused rapidly in it after the discovery of America, and this very rapidly completes the proof that, had it existed anywhere in Asia or Africa it would have played an important part in agriculture for thousands of years," and he also states that the finding of the ear of corn in a sarcophagus at Thebes is believed to be the trick of an Arab impostor.

Maize has never been found in the wild state, but is supposed to have been derived from Teosinte (Euchloena mexicana) of southern Mexico and a near relative Euchloena luxuriens of Guatemala, both are native fodder grasses of which the later more nearly resembles the cultivated corn and will readily cross with it. Montgomery suggests a possible cross with a gramma grass of Mexico (Tripsacum dactyloides) bearing a corn like tassel with seed, and the teosinte which has a resemblance of a branched ear. Bancroft says that there is a tradition that Nahualt, chief of the Nahuas, taught the cultivation of maize. Again, Montgomery says--"There is good evidence that corn was developed by

evolution from teosinte or a near relative, and that this origin probably occured in Central America. From Mexico, it probably spread to South American and North America." Hershberger says-- "Linguistic evidence shows that maize was introduced into the United States from tribes of Mexico and from the Carib of the West Indies, but the time of this corn only be conjured." The corn grown by the present agricultural Indians of the Southwestern plateau (Hopi, Navajo and Zuni) is the same as that found in the old Cave, Cliff and Pueblo ruins. It varies little from the primitive corn except that modern corn is larger. It was raised as far north as the fiftieth parallel north latitude to the southern extremity of Chile, thereby testifying that it has taken several thousand years for such a wide dissemination.

Corn was undoubtedly introduced into the plateau region when rainfall was more abundant. This is shown by the planting sticks which show evidence of only a shallow planting of six to eight inches, while at the present time a planting depth up to twice that distance is practiced amongst the natives with their acclimated drouth resisting varieties. G. H. Collins of the U. S. Department of Agriculture says that "adaptability of the drouth resistant corn of the Southwest was due to its ability to force the growing shoot of seedlings thru to the surface of soil when planted at a depth of a foot or more." Also from experiments that, "Hopi maize shows the mesocotyl may freely develop up to lengths of thirty-six centimeters." Whereas under the same conditions our common corn produced only a mesocotyl ten centimeters long by experiment. Thus, he concludes, this semi-arid corn produces, first, a greatly elongated mesocotyl that permits deep plantings and second,

the development of a single large radicle that rapidly descends to the moist subsoil and supplies water during the artificial seedling stage. The numerous seeds, almost a dozen or more planted in a single hole made by a planting stick, helped to exert concentrated pressure in forcing the plumose thru the earth and enabled deeper planting. Owing to the large number of plants in a hill it was necessary to plant the hills at a considerable distance apart, depending upon the type of soil and available moisture. A flooded sandy mulch over the surface protected the lower strata from evaporation enabling sufficient moisture to insure germination and the development of the plant to a maturity sufficient to withstand the ensuing floods.

This Indian corn thru inherited ages has developed a low spreading plant, covering the hot sand and preventing evaporation of the immediate soil. The numerous plants in a hill lessen the foliage transpiration, protect the pollen from the hot windy blasts thus insuring the filling out of the ear.

CORN STORAGE

The development and advancement of a people depends largely upon their ability of cooperation, enabling them to perform acquired and conceived altruistic motives and accomplishments. Amongst these early people we find no drones and a social system with every individual working for one definite end, the preservation of human existence. With the failing supply of stored meat in the form of wild game, they had turned to agriculture in the early days as a life buoy and along with it they developed a storage system, upon which their existence so vitally depended, a system against rodent , fire, drouth, devastating enemies with the object of preserving the fruits of their hard earned toil and to stand off the pangs of hunger.

These granaries were caches in which they stored their grains and valuables in secluded places, first those for immediate use and secondly for reserve.

Those for immediate use were constructed in accessible recesses, nooks, cubby holes and corners, and under low hanging rock ceilings of the caves, often in the rear of their dwelling. An intermediary step was those caches constructed near the fields where temporary storage took place after harvesting.

Those for reserve were often concealed in unoccupied caves, in cists, or reservoirs excavated in shale in the bottom of the cave with a wattlework roof covering, supported by cross bars with an opening covered by a flat stone and then by sand to deceive suspecting enemies. Other reserve caches were vault-like structures erected in niches in high and secluded places built of stone and clay of the identical color of the surrounding cliffs, serv ng as a camouflage, making them imperceptible at only a short distance when the small door was closed by a stone or by a laid up wall. Each family of the present day Pueblo Indian has a reserve store-room with a sufficient reserve supply to hold out against a season, or even seasons, of drouth. Across the northern Arizona boundary in the San Juan drainage, often cylindrical storage vaults are found and in the cliff dwellings to the south in Mexico large cement ollas with heavy walls of eight inches in thickness and dimensions as large as twelve by twelve feet, accomplishing the same purpose as the present Indian storage baskets used by many tribes.

The method of storing corn was on the cob, except when it was prepared for use and is then found shelled in the pot holes alongside of the mealing bins. Here it was stored in underground

ollas covered with stone lids at the floor level and accessible for grinding within a hands' reach of the mealing bin. An exception to the storage on cobs may be that of selected seed for planting, which was shelled and stored in seed jars for security. It seems they had a system of drying their corn on the cob by inserting a stick into the anil end of a cob instead of inserting it on a nail as is done in present days. Again the stick with attached cob might be inserted thru braided corn husks and the second cob attached for equilibrium. It is said that they also used the same method as used by present pueblos with long ropes of braided husks and the butts of ears strung together on yucca leaves. This seems most probably from the braids found in the ruins and is a system still used by practically all Indians.

The corn found by us in the Cliff Dwellings varied in color from white, yellow, blue, and red to almost a black, often showing effects of cross pollination. Two distinct types were traceable, Zea Maya indurata ~~=~~ the flint corn and Zea maya amylacea, or the dent corn. Effects of cross-pollination was again shown in this as well as in the color, where both flint and dent were found on one ear.

Most of the corn found had been husked and preserved in "pot holes," (sunken ollas near mealing bin with stone slab covering). Such corn varied as greatly as that on the cob described below:--

Jar #2099, flint, ears 4-6 inches

1 ear, dark red	12 rows	Gourd Cave
1 ear, #966,	10 rows	Sagie Canyon
1 ear, cross,	16 rows	Sagie Canyon
1 ear, cross, yellow &red		Sagie Canyon

Jar # 3881, ears short, scrubby, 3-4 inches

1 ear, faded blue,	12 rows	Paiute Cave, Navajo Mountain
1 ear, reddish to black,	8 rows	" " " "
1 ear, dirty yellow,	6 rows	" " " "
1 ear, #970, dirty yellow,	14 rows	Chilchin Taboko

1 ear # 968, ½flint × ½dent, 14 rows — Sagie canyon
1 small ear, a clear flint with markings like cracked glass on grain

NATIVE COTTON

Cotton is the most important fibre for the manufacture of fabrics and the definite period of its antique cultivation is no more known in the western hemisphere than the eastern. The name cotton as coming to us thru Europe was perhaps taken from the phonetic resemblence of an Arab word for this article in North Africa.

India is said to be the oldest cotton producing country in the Old World, where it is claimed to have been growing and manufactured 1000 B. C., and probably at an early a date amongst Egyptians, however much of the so-called cotton under microscopic examination has turned out to be linen. In America no other fine fiber similar to cotton was used. When tongs and sinews of animals became scarce, "Invention, the mother of necessity," made use, in perhaps a crude way at first, the course native fibers of yucca, agave, (pineapple plants in Mexico) and related plants which made strong string and cords. This first art of spinning developed into the manufacture of textiles. It seems that no authentic knowledge of the use of cotton amongst the cave dwellers has been brought to light, but their successors, the Cliff Dwellers have highly developed the art of spinning and weaving until they were able to make large pieces of textile, such as the burial robe on the mummy found by our expedition in Nitsi Canyon. Undoubtedly the introduction of cotton into Northeastern Arizona occurred at a later time than corn.

The Spaniards coming to America found cotton cultivated in the West Indies. Its cultivation was also evident in the

tropical and semi-tropical zones of the new continents. Coronados expedition into New Mexico speaks of the Indians (Zuni) raising cotton. Winship states that those who lived near the Rio Grande raised cotton, but the others did not, and also that there was much corn raised in that neighborhood.

Cotton, although raised in the West Indies, did not spread across the continent from the east, notwithstanding the present favorable growth of cotton in that Southern region of the United States. In this region the upland cotton is raised rather than the sea island which is confined to the coast and the islands. The cotton blankets seen by De Soto's troops on the lower Mississippi were said to have been brought from the West, possibly from the far-off Pueblo country of New Mexico and Arizona. Although the latter section seems less favorable to its cultivation, especially the Hopi, from time immemorial cloth, cord, thread, and seed are commonly found in ancient deposits in caves, cliff dwellings, and ruined pueblos thruout that region.

The classification of cotton in general has led to voluminous discussion and contradictions, as well as the part that the indigenous species of the new world has played in the development of new variation. It is however known that some types of supposed wild species still exist in Northern South America and Mexico, but it is said that no species of Gossypium is native to the United States. Recently Prof. J. J. Thornber of the University of Arizona discovered a new and distinct species of cotton, Thurberia thespesoides, which is now being eradicated to control a native boll weevil. There may yet be found a native Gossypium. It is said by old Indians on the Navajo Reservation that a cotton grew wild there until

recent times, which has evidently been eradicated by the extensive overstocking by grazing goats, sheep and cattle. But whether this was a wild species or one that escaped from the cultivation of the aborigines will doubtless never be known.

Dr. Kidder and Guernsey say--"Whether cotton was grown in Northern Arizona or whether it was obtained in trade from the South has not yet been definitely decided," but they are inclined to think that it could be grown and probably was from evidence of waste. The finding of cotton bolls and seeds in Gourd Cave and cotton which was plucked from the bolls with seed adhereing is sufficient evidence to establish the fact that cotton was grown this far north by the Cliff Dwellers. Its growth is assured for Moencopi, a Hopi village near Tuba city, just sixty miles south of the Cliff Dwelling center. Haustene Lucas, an old Navajo medicine man eighty years old, as interpreted by Mrs. Wetherill, says that in his younger days he say cotton grown below the springs near Moencopi from which it was irrigated. He also describes a trip to the Zuni country in the early days where he saw cotton grown on the Rio Grande and in Pueblos north of San Mateo Mountains. He picked up a ball of Upland cotton and said that kind was raised there and in Moencopi, but in the earlier days they grew cotton like that--(pointing to that excavated by us from the Cliff Dwellings). It seems from this information, although the Indian's report can by no means be said to be authentic, that there may have been introduced a higher developed type of cotton by the Spaniards.

Cotton has been grown as far north as 43° N. Latitude and 33° S. latitude within an isothermal line of 60° Fahrenheit,

whereas Mesa Verde Ruin, to the North, in Colorado, is only 37° 23' North and the Arizona district lies between 36°-37° extending as far south as 34° 30! This proves the possibility of its growth under favorable conditions such as those existing in the protected even the elevated canyons, so favorable to an early cropping.

The cotton bolls found by our expedition in Gourd Cave, show a variation in the number of carpels (locks), showing that they evidently had not been carefully selected and that the breed was not true to type--49.75 percent showed four carpels 49.75 percent three carpels and .5 percent with two carpels.

The staple was of a medium fine, kinky fiber, which would lend itself favorably to the manufacture of a good textile under our present methods. The average diameter of the fiber as examined under the microscope showed approximately the same diameter as our present Arizona-grown short and long staple.

The length of the staple was obtained by the measuring of numerous individual fibers and taking the averages because the decadent stage of the fiber prohibited the usual method of judging the staple. Catalogue number 1092, from [illegible] was found to have a maximum length of one and one-eight and an average of three quarters inch. Catalogue number 1033, a maximum length of one and three-eighths inches and an average length of nearly one inch with coarser fibers than No. 1092.

According to the recorded lengths this primitive cotton would be placed in the short staple class which averages one inch. The maximum length of one and three-eighths inch, shows that by a person understanding the science of plant breeding, or by selection alone under favorable conditions, they could have

developed a type which would have reached the long staple c of one and one quarter to one and one half inches.

The botanical description of the boll, alone, makes it l classify, especially with its variations which seem to make classification doubtful -

Boll--globose to roundish ovate.

Carpels--two to four in number, from two to three on.

Fiber--buff color with some discoloration from age, wit fiber adhering slightly to basal end of seed.

Seed--eight mm long, four to five mm. broad.

Color of Seed--dark brown with numerous irregular confl longitudional ridges converging at apical and basal end of see

Shape of Seed--tending to narrow oblique obovate. Compa with other varieties; the seed is one half of the size of the Arizona short staple, smaller than Egyptian long staple, and about the same size as the Sea Island long staple cotton. seed.

Carpels--of the Cliff Dwellers, two to four; Sea Island more than three; Egyptian, three and occasionally four; Upland, four to five.

Boll shape--Cliff Dweller's cotton, globose to roundish ovate; Upland, globular; Egyptian, longer and more pointed, (small than Upland); Sea Island, ovoid acute.

Color of fiber--Cliff Dweller's buff, upland white, Sea Island white, Egyptian slight yellow or Buff.

Seed of Cliff Dwellers--basal end covered with brownish cast fuzz, fiber also slightly adhering, hence it would be adaptable to a roller gin; Egyptian, fuzz on both ends with brownish, greenish cast. Upland, coated all over with adhering whitish fuzz, Sea Island, seed completely separate from fiber.

Seed surface--Cliff Dweller's, dark brown with numerous irregular confluent longitudional ridges converging at apical and basal end. Sea Island, seed black and smooth, Egyptian, dark brown to black, smooth; Upland, dark brown to black with adhering fuss.

The Upland cotton is a Gossypium hirsutium. It is the cotton grown in the true short staple cotton belt of the United States.

N.P The Sea Island and Egyptian cotton (long staple) are of the Gossypium barbadense type.

THE BEAN

Like most ancient plants the antiquity of the bean is obscure, but its origin is attributed to the South like the other primitive cultivated plants. Its presence is known to be indigenous to this country as well as the old world. Wild forms at present exist, in Arizona and in Mexico, those in Mexico being closely related to many of our edible varieties. Beans to a limited extent have been found in the early Cave Dwellings and in abundance in the Cliff Ruins. In Court Cave alone we excavated twelve distinct color types, varying from black to white. The type of bean found in the Cliff Dwellings by us has been the Phaseolus vulgaris, Linnaeus, or kidney bean of the colored, spotted, and white variety. The well known Mexican frijole is of this species and shows a close resemblance to some of the excavated varieties except for the shade of the pink color. In fact there is a marked resemblance of many of the beans used at present in the Southwest, Mexico and as far south as Venezuela to those of the pre-historic days. While looking over a selection of over five hundred bottled varieties in the Plant Breeding Department of the University of Arizona, gathered from all parts of the world, one could almost invariably pick out those similar varieties which would prove to be from the Southwest, Mexico to South America. In Bulletin No. 68, University of Arizona Experiment Station, by C. F. Freeman, a type 70, called the Mottled Red Indian Bean is described as follows: "This variety was found as pure field cultures among both Pima and Papago Indians. It was however, not a common sort. The type is mostly red with white mottles. These mottles occur as irregular patches of pure white extending interruptedly around and at a little distance from the hilium. The red (dull purple

lake, 170-1-4) also occurs very often as circular spots in the white. The seeds of this variety are large, flattened and only slightly elongated. Average data: Length 11.3 mm., width 7.5mm., thickness 4.9 mm, weight,.34 grams." The original of this variety described is practically identical with a type of bean excavated from Court Cave, except that on some beans there is a slight tendency to have more white. Undoubtedly these beans are of the same stock. This again may be significant for the Papagos, (a branch of the Pimas), and the Pimas are by many that to be related to those ancient Pueblo and Cliff people.

Other varieties showing resemblances were labeled as follows: Cow peas of the Pima Indians, Colorado Pinto, Caracios Negros No. 1, considered poor man food from Venezuela, J. S. Rose, Caracas, 1915, and Bussey, No. 142-167-170-179 and 230, beans from Francis Eschaussier, Rascon S. L. P., Mexico. A small black, more or less flattened rhomboidal bean has a very like resemblance in one listed in the collection as Bussey, No. 232, from Francis Eschaussier, Rascon, S. L. P., Mexico.

No P Another resemblance was found in one marked Bussey #92, Red, C. B. Conung, Kirkland, Arizona, grown by him forty years, drouth resistant and heavy producer. A record of the Plant Breeding Department label numbers was not available and time prohibited the working out of the origin and history of each individual variety. From available evidence we may take it, that practically all of our native varieties of beans have originated in Sonora and Southward.

The wide dissemination can readily be understood by the natives' migrations and commercial relationships. The Hopi is still known to be a great trader. Evidences of this trade

relationship is shown in numerous instances. The fact that the beloved cotton textile from Arizona and New Mexico was seen on the lower Mississippi by early explorers, copper from the Superior region found amongst the Mound Builders as far south as the Gulf of Mexico, and that our plateau Indians had shells from the ocean as ornaments, prove their commercial relationship. Also Dr. Bessey obtained some beans from Indians in Nebraska which were supposed by them to possess a great charm, and sent them to Professor Thornber, which proved to be no other than our native pink bean.

So we can see the wide spread possibilities of natural cross-pollination of different varieties, from various sections of the country during natures untiring ages. These varieties would not likely breed true to character, unless because of some peculiar color, shape or quality they had been selected. This however seems to have been true of some attractive varieties still under cultivation of the Phaseolus vulgaris specie.

These varieties in the museum and gathered by us do not resemble the Phaseolus acutifolius to which the tepary belongs.

CULTIVATION

In America we find plants domesticated first, unlike Asia, where animals were most likely domesticated before plants and it is said, as early as 3000 B. C. in Elam. This may have been partly due to the greater abundance of wild game, the source of which supplied them with sufficient meat and skins, for it is known that the buffalo covered almost the entire continent at one time, but it is most likely due to the disappearance of such domesticable animals as the horse and camel from this continent in the early geologic ages. The only animal that could be habituated to the burden was the llama in South America, even it is not very adaptable because of its obstinate temperament.

Not until after the importation of beasts of burden by the Spanish did the Indians have any way of tilling their soil, other than by crude wooden, stone, bone and horn implements that were manually wielded.

They planted their crops in sandy and loamy soil which had sufficient aeration, allowing the ready absorption and percolation of rainfall and flood waters, thus eliminating in a large measure the laborious necessity of cultivation. The only evidence of approaching cultivation such as known by us is mostly from the later pueblos by stone picks and mauls which may have been used to mash clods, and their stone slabs resembling hoes with a somewhat sharpened edge, thigh bones and seldom horn to which wooden handles could be attached with thongs. With such crude implements little actual work could be accomplished.

The removal of obnoxious weeds in the near proximity of the plants where they could not be pulled by hand without

disturbing the young plants, was accomplished by means of a weeding knife varying in length and with a thin edge for cutting. Planting sticks were used as a means of puncturing the ground to depths of several inches to a foot or more according to the crop planted and the available moisture, into which were dropped seeds, and the hole was closed by means of the foot. The wooden planting sticks were from two to four feet long, sometimes resembling canes and were made desirable for penetrating the earth by sharpening or flattening the ends of the stick. Often they selected a branch with a stilt like projection by which pressure could be applied from the foot.

IRRIGATION---METHODS

The prehistoric native by conquering the adverse environmental stresses of the Southwest, developed a cultural superiority over surrounding nomadic tribes, who were governed more by impulse rather than by a resolute determination. Irrigation developed cooperation. In cooperation there is unity, and "in unity there is strength."

The stages of early irrigation amongst the natives of this state may well be classed as follows:

The first, and most primitive was the natural type, where flood waters from drainage of ravines or by pouring over precipices of the canyon walls during the rainy season and season of melting snow, flooded the lower levels depositing silt and sand which acted as a mulch, protecting the lower stratas from evaporation. Often advantage was taken of naturally sub-irrigated patches of ground, around springs and along streams.

The second was by the artificial method of carrying water in ollas to intensively cultivated plots and terraces and is still seen practiced amongst the Pueblo Indians.

The third was artificial irrigation by means of diversion where water is diverted from its natural course by means of artificial ditches to the higher lands. Irrigation by diversion was an early development in the arid and semi-arid countries of both the new and the old world where it was known in Mesopotamia from the earliest days of agriculture. In the new world such traces are found amongst the ancient people of Arizona in the Verde Valley near Montezuma's Castle, were Roosevelt lake now exists, Casa Grande, Florence, Mesa, Tempe, Phoenix, Tulo, etc. Irrigation had developed to such a stage amongst the Indians that it may be called a science. It has developed by observation and necessity.

taking at least a thousand or more years of development to reach that stage found from remains existing on this continent. It had been practiced by the Aztec and their predecessors on the South, in Colorado by the Cliff Dwellers on the North, in California on the West and along the Mississippi River on the east by the Mound Builders.

The part that the Cliff Dwellers in this State took in irrigation is not clearly evident, because of a somewhat misty re=lation between the late cliff dwellers and early Pueblo ruins in the open valleys, because these pueblos adjoined the Cliff Dwelling Caves. As the number of these Cliff Dwellers increased and the supply of well protected caves became limited, they undoubtedly were forced to the open, but perhaps not reluctantly, for as they became stronger, they left the Caves, and migrated to the adjoining valleys. Here they built pueblos along canyon streams or by springs in the proximity of their fields in order to protect their crops against marauding enemies. Their old cliff houses were used as battlements in case of a last resort, or during the inclement weather of the winter. However we can be fairly safe in saying that the Cliff Dwellers were first to introduce the art of irrigation in Arizona although definite evidence is lacking, while with the later Pueblos it became a science. That irrigation took place at an early date in the Southwest seems established by the fact that irrigation ditches beneath a lava formation were found to exist eighteen miles from Santa Fe, New Mexico.

When the ancient civilization of the pueblos flourished in the Verde, Salt, Gila and Little Colorado River Valleys and their tributaries, it has been estimated by F.W. Hodge that in

Salt River Valley alone, there was an aggregate of one hundred and fifty miles of canals with sufficient capacity to supply 250,000 acres of land. Some of these canals were deeper than the height of a man and as wide as thirty feet with sloping sides believed to have been tamped baked and evenly terraced on both sides, supposedly to lessen evaporation. What seems to me also to be a reasonable object, was to confine the varying heads of water, lessing the surface resistance and subjecting it to a greater pressure in order to accelerate the rapidity of the flow and carry the rich alluvial sediments found in these muddy rivers onto their fields. Here it acted as a fertilizing agent and a mulch instead of being deposited in the bottom of their canals from a slow, sluggish current and causing the incalculable labor of excavating the silt. Often these canals were used by the pioneer Mormons at the saving of considerable expenditure of money. Canals and reservoirs, (settling basins, which attests the presence of silt) built on as perfect a grade as can be built today by modern engineers, extending for ten or more miles onto the higher lands, once irrigating bountious crops of corn, cotton, beans and squash, were even centuries before the advent of white man these same fertile and once blooming valleys had become dessicated.

FERTILIZATION

Fertilization of the soil as with irrigation was known in Mesopotamia and Egypt as long as agricultural records are traceable. Methods of fertilization and its benefits had been realized in the New World by the cultured Aztecs and Incas. Where bat guana was plentiful they placed it in trenches in sandy soil, but no indications have been found that the Cliff Dwellers had knowledge of artificial fertilizers. To pre-suppose, such a conclusion, it can be substantiated by the following knowledge of lack of available fertilizers in their region. Bat caves are almost unknown, fish were not plentiful, (as were used by some Eastern Indians in the colonial days), scarcity of shells of a calcarious nature, no natural or artificial deposits of fertilizer and no faecal domesticated animals. The turkey was the only domesticated fowl, and it alone could be the source of their fertilizers, but evidence shown by the accumulated debris in the turkey cages from their excavations shows that they did not place high value upon these offals. To their lack of knowledge of fertilization as applied to the soil, can be attributed one of the causes of retardation of early horticultural development until the science of irrigation became known in the later days and sediments of muddy waters furnished the required plant nutrients.

CROP ROTATION

Again, there is no evidence to the contrary to make us believe that the primitive man of this state had not become acquainted with the knowledge of crop rotation, such as the ancient Egyptians had acquired. Such phenomena, if they observed any, was thru lack of scientific explanation laid to some superstitious or supernatural cause as in the custom of these savages. Had they understood, practically, the value of their legumes, (beans) which they could have rotated with foresight and precision with their corn, at the same time accomplishing a rotation of deep and shallow rooted crops, the knowledge would have been a boon to lessen another one of their distressing impediments, the food problem.

PRIMITIVE AGRICULTURE AND RELIGION

From the earliest agricultural planting in Asia estimated as far back as 10,000 B. C., there has always been more or less of a religious veneration associated with agriculture as handed down by mythology and by divinitation as preserved and often taught by priests of the ancients. In China, 2700 B. C., ceremonies were instituted by Imperial decree where every year five of the most useful plants were sown. In Mexico a goddess bore the name derived from that of maise (Cinteull, from Cintli) to whom the first fruits of the season were offered and sacrifices of bread made from Indian corn, (De Condolle).

The American native depending upon agriculture for his livelihood and in an attempted explanation of its production deified all the environmental influences that gave and preserved life. The Hopi Snake Dance is an instance of a religious ceremony carried on as a propitiation to the Rain Gods, that they may receive rainfall to mature their crops. The origin of the snake dance itself is recorded in a legend as arising thru a drouth in the early times and the altars are decorated with corn. In numerous Cliff Dwellings pictographs of snakes are seen on walls of the caves which are supposed to have been inhabited by the Snake clan. According to Dr. Fewkes in the Tusayan ritual, the girls in the flute ceremony and snake maidens represent corn or germ maidens, being decorated with a corn painting, corn and carrying corn dolls. In the Navajo Sand Painting which serves the same purpose as the Hopi altar, corn is the backbone of the earth, hence personified and signifies life. Because of this apotheosization, their sacred clan symbols were often named after a plant or animal which

had been adopted by o. for the female progenitor and handed down thru the successive female progeny, thus perpetuating their clan like the object had after which they were named.

Distribution of land was based upon possessory right. The pecuniary greed, yet upon a logical basis was recorded as early as 4000-3500 B. C. In Asia, where an obelisk had been found under fifty feet of debris, upon which was recorded the scale of land fixed by the value of the crop. Such mercenary methods had not yet permeated the temperment of the aborigine, for theirs' was an agricultural affiliation with a religious struggle for existence and a life of consecration to their patron deities.

Agriculture has never been looked down upon by the Indian, because extensive slavery did not exist amongst them as in Asia, nor the feudalistic, autocratic system of the middle ages. Even in the earliest days of Mexico, the Padres spread and taught agriculture to the natives and established schools, and according to an early Spanish print (1650), the"Franciscian fathers taught native pueblo children in addition to non-agricultural subjects, the use of the horse, cow and sheep; they followed the plow and sowed seed with their own hands, thus supplementing the primitive with more scientific and fruitful methods of agriculture brought from the Old World."

CONCLUSION

This evolution of the origin of primitive horticultural agriculture in America, its relation to the early agriculture of Arizona, with some details of that Arizonian culture, is in a very crude way, nothing but a theoretical and practical narration of some of the facts and readings of records and legends, observed articles and deposits left as remains in dwellings, caves and burials by our pre-historic Americans. They, with thots of the happy hunting grounds, unavoidably, or for sake of self preservation, left behind them these relics, which by our seeking enabled us to acquire evidence of what was once attained by them. From them, in a meager way, we have been enabled to mark the march of agricultural development upon this continent and by no means should we throw discredit upon their inability, because we are still ignorant of their primitiveness. A small boy in the museum, so aptly expressed himself when their implements were being explained, by saying--"Gee, they were great people to do something with nothing." So from the primitive, by the discovery and use of the elements that surround men, or that he has revealed in since creation, man is continually reaching out and bringing within his grasp the knowledge of the once mysterious elements which now enable him to climb the ladder of achievement, and he takes with dignity a retrospective view of the past from that sixth step of the ladder, the electrical age, looking back into the days when primitive people were building this same ladder upon which he now stands, wondering at their ignorance and depriving them of their merited credit for it is known, that--"The road to

knowledge crosses the plain of ignorance " and that "The wise man gets his wisdom from those who have none."

As with accidents,"they come not singly," so with the discoveries of man when the vault of one age is unlocked, we profit by it and move up the ladder of advancement from one step or age to the next with even greater acceleration.

To the deeds of the brave and sturdy people, who subdued the wilds, helped to bring fowl, beast and plant under subjugation as a contribution to us of today, to them we owe our heartiest commendations.

BIBLIOGRAPHY

Bigger, Howard H.,

The Old and New in Corn Culture.
Yearbook of the Department of Agriculture, 1918.

Bureau of American Ethnology.

Handbook of American Indians, Bulletin No. 30, 1910.

Collins, G. N.

Drouth Resisting Adaptations in Seedlings of Hopi
Maize, Vol. I, No. 4, Journal of Agricultural Research.

Cummings, Byron.

The Ancient Inhabitants of the San Juan Valley.
Bulletin of the University of Utah, 2nd. Archaeological
number, vol II, No., 4, April 1912, Guide Leaflet No. 6.

De Candolle,

Origin of Cultivated Plants, 1908.

Elliot, George Francis, M.A., B.Sc.

Prehistoric Man and His Story, 1915.

Forbes, R. H.

Irrigation and Agricultural Practice in Arizona,
University of Arizona Experimental Station Bulletin,
No. 63, 1911.

Freeman, G. F.

Southwestern Beans and Teparies,. University of Arizona,
College of Agriculture Experiment Station, Bulletin No.
68, 1912.

Hewett, Edgar L.

Pajaritian Culture.

Kidder, Alfred Vincent and Guernsey, Samuel J.

Archaeological Explorations in Northeastern Arizona,
Bulletin, Bureau of American Ethnology, Bulletin 65, 1919.

Keane, A. H.

Stanford's Compendium of Geography. Central and South
America, Vol II.

Nadaillac, Jean Francois Albert du Pouget,

Prehistoric America, 1884.

Peet, Stephen D.

Prehistoric America. The Cliff Dwellers and Pueblos. Chicago: American Antiquarian, 1899.

Prehistoric American. Mound Builders, Chicago: American Antiquarian, 1903.

Popper, George H.

The Ancient Basketmakers of Southeastern Utah. American Museum of Natural History. Supplement to American Museum Journal. Vol. II, No. 4, April 1912. Guide Leaflet No. 6.