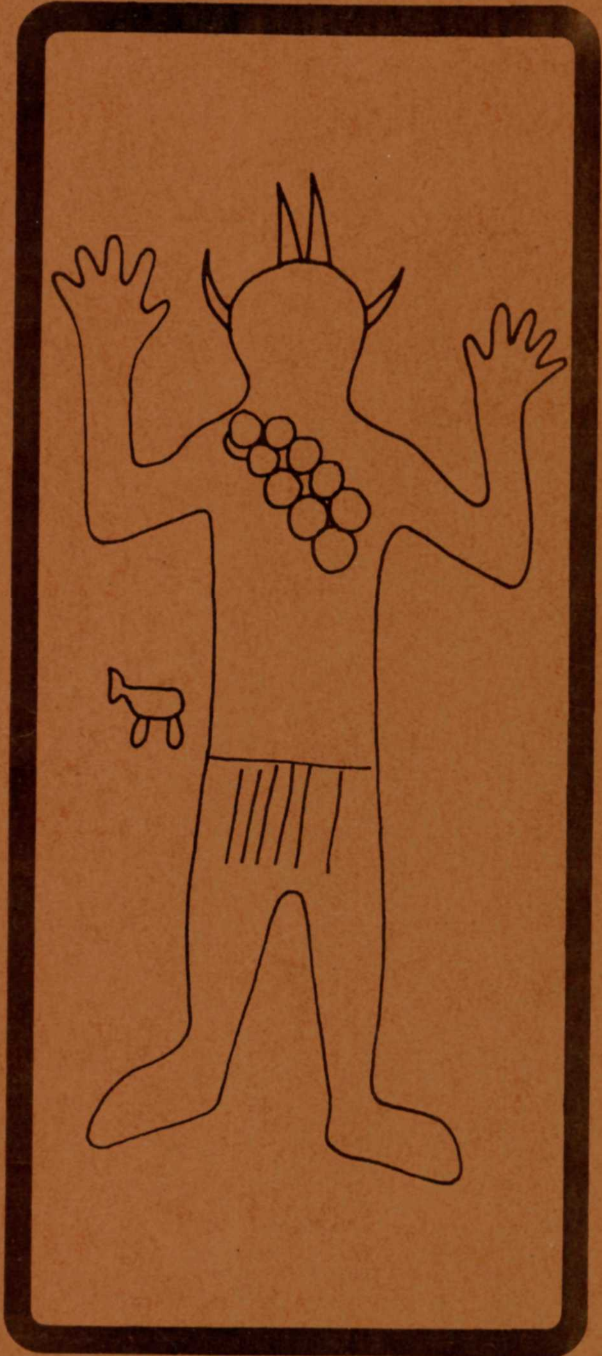

HOHOKAM SUBSISTENCE:

A 2,000 YEAR CONTINUUM IN THE INDIGENOUS EXPLOITATION OF THE LOWER SONORAN DESERT

By

ROBERT E. GASSER

July 1976

ARCHEOLOGICAL REPORT

USDA FOREST SERVICE
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Each of the above cited persons made useful contributions to this report; however, the use or misuse of their ideas is entirely my responsibility.

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INTRODUCTION

The basic hypothesis of this study is that given an environment that is relatively unchanged and given an indigenous population in such an environment, an ethnoarcheological approach can be taken that tentatively connects history and prehistory. Precisely, if the subsistence remains of the prehistoric Hohokam show a strong similarity to historic Pima and Papago foodstuffs, we can safely assume much of the perishable foodstuffs used by the historic peoples was also utilized by the Hohokam. The Pima, Papago, and Hohokam live or have lived in southern Arizona, an area that is part of the Lower Sonoran Desert. With parallels in positive evidence (that is, prehistoric food remains), one can argue for parallels in negative evidence, the perishable plant and animal foods.

First, it will be demonstrated there has been little or no climatic or floristic changes in the Lower Sonoran Desert for at least the last 2,000 years. The fact that the environment has not changed in the recent past allows one to argue that the exploitation potential of the environment has not changed.

Second, it will be demonstrated that the indigenous population has exploited the environment continuously through at least the past 2,000 years. For supportive evidence, the presence of exploited plants in the archeological context will be compared to historic plant use. Plant remains are used as the test evidence in this report; however, a section will also deal with comparisons between early Papago and Hohokam faunal foodstuff remains.

Although it is commonly believed, Weaver (1972), that the Pima and Papago and perhaps the extinct San Pedro Sobaipuri are the cultural descendants of the Hohokam, the possible cultural continuum is not critical to the basic premise of this paper. The important aspect of the discussion of the Pima, Papago, and Hohokam in this report is that they all exploited the same environment in a similar manner. We shall see that there are indications that a similar human exploitation of the natural environment does exist from the time of the Hohokam to the present day. Most wild foodstuffs and native varieties of cultigens continued to be used up to the 1930's; some continue in use today.

The archeological record will be presented by providing a synthesis of literature dealing with Hohokam ethnobotany which will be supplemented by my analysis of floral material from two small sites on the Salt River, plus the large villages of Pueblo Grande, La Ciudad, and Mesa Grande (see Figure 1). In addition, plant food remains from two sites near Superior, Arizona, and two nearby site areas in the Papagueria will be discussed. One of the sites in the Papagueria is Hohokam and is located in the Santa Rosa Wash area. For comparison, the other sites in the Papagueria are historic Papago in the Slate Mountains, only a few miles away from Santa Rosa Wash.

The aim of the presentation is to allow a clearer perspective of Hohokam subsistence and to reanalyze, in part, Hohokam subsistence strategies presented by Bohrer (1970) and Doelle (1975). The synthesis of the old data and the presentation of the new floral data indicate that gathered foods may have shared importance with cultigens as a food source both in volume and nutrition. Much of the expansive fields of the Hohokam may have been allotted to grow cotton as a cash crop for trade rather than entirely devoted to the corn, beans, and squash trade to provide the basis of Hohokam subsistence (cf. McGregor 1965:15). This research certainly will not provide a definitive statement on Hohokam subsistence. Much more data are needed, and a final section in this report is presented as a simple field method to retrieve more archeobotanical data from sites.

Before proceeding further, a few statements should be made about the treatment of botanical names in this report and about the matter of differential preservation of plant parts used as food.

The style used in this report for the treatment of scientific names of plants is as follows. A common name followed by a Latin name not in parenthesis indicates the commonly accepted botanical usage of the Latin designation. A Latin name followed by another Latin name in parenthesis indicates that the name in parenthesis was once used but is no longer applicable. For example, saguaro, _Cereus giganteus_, (_Carnegiea gigantea_), indicates that today the proper name of saguaro is _Cereus giganteus_, not _Carnegiea gigantea_ as used in the past. A Latin name in parenthesis preceded by an asterisk indicates that the name within the parenthesis was once used in the literature, but when used it was incorrectly applied. For example, mesquite, _Prosopis velutina_, (*_P. juliflora_), indicates that mesquite has been incorrectly called Prosopis juliflora in discussing the flora of Arizona. Prosopis juliflora is a mesquite native to Texas that has not been known to have grown in Arizona (Pinkava, personal communication).

The matter of perishable plant parts is important in reconstructing a diet from the archeological record and is a key factor in this report. With differential preservation of plant parts, we find that seeds represent the greater part of data from the archeological record. The fleshy parts tend to disintegrate and are not usually found in archeological sites.

The floral material recovered is a result of preservation as well as behavioral factors. One has to consider that some plant foods may have been utilized immediately on collecting at the gathering sites and, although important, were not removed to habitation sites. At the same time, different plant food assemblages at sites may reflect a functional difference in types of sites for the same group of peoples. Although these variables cannot be isolated at the current level of understanding, it is hoped that the relative abundance and/or frequency of various plants from archeological sites will indicate relative degree of utilization. Archeobotanical remains, by their very nature, do not lend themselves to statistical tests.

The Hohokam (300 B. C. to A. D. 1450) have been, and the historic Papago and Pima are, dwellers in southern Arizona and are characteristically associated with the Gila River and Salt River Valleys, although their range was more extensive. This part of southern Arizona is known as the Lower Sonoran Desert, an environment that will now be examined insofar as it pertains to this study.

THE ENVIRONMENT

The Hohokam and the historic Pima and Papago occupied that part of southern Arizona roughly bounded on the west by the Painted Rock Mountains beyond Gila Bend, on the south by the current United States-Mexican border, on the east by Benson, and somewhat above Phoenix to the north. This is part of an area known as the Lower Sonoran Desert (Dice 1939, Lowe 1964) that is characterized by a warm, arid climate and vegetation that ranges from a Cercidium-Cereus association in the rough mountains and foothills to a Larrea-Ambrosia association on the dry lower bajadas. A Prosopis-Atriplex association often exists along water courses. The vegetation of southern Arizona is covered in a comprehensive manner by Shreve and Wiggens (1964), Kearney and Peebles (1969), and Benson (1974).

The saguaro, Cereus giganteus, (Carnegiea gigantea), and mesquite, Prosopis velutina, often erroneously listed as P. juliflora, are important native flora that were used by the aborigines. The saguaro's reproduction and survival are affected more by man's intrusion than by environmental extremes. An excellent study of the ecology of the saguaro (Niering, et al., 1963) indicates that the biggest threat to the giant cactus is rodents which eat the young seedlings, and cattle. Man has attempted to reduce the coyote, Canis latrans, population which partially once controlled the rodent population. At the same time the cattle industry, especially during the period 1870-1900, caused overgrazing and greatly reduced the "mother plant" equilibrium which is necessary for the survival of the saguaro. The shade and protection of a larger plant are essential to cactii seedlings. The palo-verde, Cercidium sp., is often the "mother plant" of the saguaro. Apparently, there has been an overall reduction in the number of saguaro in the historic past, yet their spatial distribution has remained approximately the same (Niering, et al., 1963; Norris 1950).

Dense populations of mesquite once bordered the bottom lands of the San Pedro River (remnants of which still exist), the Santa Cruz River, and the lower Gila River. Early Anglo settlers in Arizona widely exploited this virgin wood source for construction purposes and fuel, and most of the original stands are now removed (Nichol 1937). No doubt the construction of dams which have now made dry river beds of the Gila and Salt Rivers in much of southern Arizona and the lowering of the water table because of the pumping of irrigation water has also affected mesquite depopulation.

The climate of southern Arizona has been explored in detail by Sellers (1960), Smith (1956), and Ives (1949). Climatic changes have been investigated by Martin (1963), Schulman (1956), and Schoenwetter (1970, 1971).

Palynological studies have indicated that, since 2000 B. C., the climate of southern Arizona has remained basically unchanged (Martin 1963). The last 4,000 years have been characterized by a biseasonal regime of winter and summer precipitation and spring and fall drought (Dorroh 1946, Ives 1949, Jurwitz 1953, Sellers 1960). Pollen studies indicate the Gila Valley pollen sequence from A. D. 1 to A. D. 1700 is like that of present. In the Salt River Valley, indications of drought or rather effective moisture deficiencies occurred between A. D. 1075-1125, 1275-1325, and 1550-1600. Higher effective moisture periods probably occurred between A. D. 1025-1075 and A. D. 1325-1475 (Schoenwetter 1970:42). Otherwise, climatic conditions are similar to today from at least A. D. 1-1700. Weaver (1972) thinks the dry periods probably had little effect on the xeric adapted natural vegetation, but probably would have affected cultigens as water run-off from higher elevations into the valley would be greatly reduced.

There appears to be an ecological continuum in terms of both the climate and vegetation in southern Arizona from the beginnings of Hohokam culture up to the widespread settlement by Anglos in the late 1870's. It was not really until the beginning of World War II that Anglo population boomed in Arizona.

HUMAN EXPLOITATION OF THE NATURAL ENVIRONMENT

Gathering wild resources may have played a vital role in Hohokam subsistence. The saguaro was the most popular and perhaps the most important economic plant in the ethnobotany of the Pima, Papago, and archeologically, the Hohokam. The saguaro fruit was distilled to make a liquor and widely used as a food source. The historic Pima are known to use the seeds also for tanning and to make saguaro "cakes" for trade items. A harvest ceremony was also involved. References to this giant cactus are found throughout Pima tales, song, and mythology (Russell 1975). The Papago are known to have utilized hunting and gathering camps away from their villages for periods long enough so whole families went along. The men hunted but also assisted in gathering. If excursions were closer to camp, the women would go and would return home the same day (Castetter and Underhill 1935). It seems that small unofficial groups and exchanged labor are the rule-of-thumb in Papago hunting and gathering activities (Underhill 1939). Historic Papago gathering sites on the slopes of the Slate Mountains in the Papagueria have been extensively investigated by Bruder (1975). In the same area, Goodyear (1975) and Raab (1973) have documented Hohokam cactus camps. Goodyear (1975) has indicated the nonrandom relationship of prehistoric gathering camps to the current saguaro population. A spatial analysis of a Hohokam gathering/processing camp in the Verde Valley, indicating what lithic tools were probably used together in the processing of wild resources, was undertaken by Gasser and Bayham (1975).

Gathering, of course, is not limited to the saguaro fruit harvest. Mesquite beans appear to be a regular food item in the indigenous diet. This salt-tolerant riparian legume was widely exploited by the Pima, Papago, and Hohokam. Mesquite tends to grow in dense groves along waterways; and at certain small geographical areas, large quantities of foodstuff could be easily obtained. The Cercidium-Cereus community is rich in legumes and a variety of edible cacti. Goodyear (1975) has conducted two vegetation transects from talus slope to the lower bajada in the Papagueria that include the Cercidium-Cereus, Prosopis-Atriplex, and Larrea-Ambrosia communities and gives quantitative data and interpretations of the cultural ecology of this study area.

Hunters leave little archeological evidence behind them. Projectile points are about the only archeological remnant of hunting activities in open air sites in the Sonoran Desert. Despite a rather extensive literature on projectile points, no one has yet attempted a correlation between the spatial distribution of projectile points and probable hunting localities. Admittedly, such an undertaking might prove futile because of the real paucity of exact data.

Canal irrigated agriculture is the hallmark of the Hohokam in the American Southwest. The literature on Hohokam agriculture is almost entirely related to canal irrigation (Patrick 1903; Turney 1929; Southworth 1931; Haury 1936, 1965; Woodbury 1960, 1961, 1962; Midvale 1968). James B. Rodgers, an archeology graduate student at the Arizona State University, is currently engaged in research on Hohokam agriculture that encompasses a wider diversity of physical systems; for example, check dams, canals tapping washes and minor tributaries, and so-called "waffle gardens" similar to those on the Colorado Plateau (cf. Grady, et al., 1973; Vivian 1974). Rodgers sees variations in the adaptation of the physical systems to this arid environment. In the Estrellas and on Sacaton and South Mountains, Rodgers has found evidence of check dams--the placement of rocks transverse to a wash to catch sediments and water run-off for dry farming. On the Gila flood plain near Snaketown, Rodgers found evidence of grid or waffle gardens. Perhaps most interesting is his discovery of small canals not fed by major streams or their tributaries, but by intermittent drainages in the Buckeye area (Rodgers 1975, personal communication). Rodgers has also found definite indications that the Hohokam did not rely entirely on canal irrigation for growing their cultigens.

Nevertheless, canal irrigation obviously provided stability for the Hohokam that allowed sedentary villages such as Snaketown to exist. Snaketown was occupied continuously from 300 B.C. to about A.D. 1100. The incipient date of canal irrigation is not critical to this report, but of some interest. Haury has suggested that canal irrigation began at Snaketown on the Gila River as early as 300 B.C. (Haury 1965:10), although his data for assigning such an early date is tenuous. Earlier, Haury, with more data to work from, suggested circa A.D. 500 was the date assigned to the oldest canals at Snaketown (Gladwin, et al., 1937). Aside from the canals on the Gila River, there was the extensive canal system off the Salt River (Turney 1929, see Figure 1). Other canals have been observed along the Agua Fria, Verde, Santa Cruz, and San Pedro Rivers (Woodbury 1961).

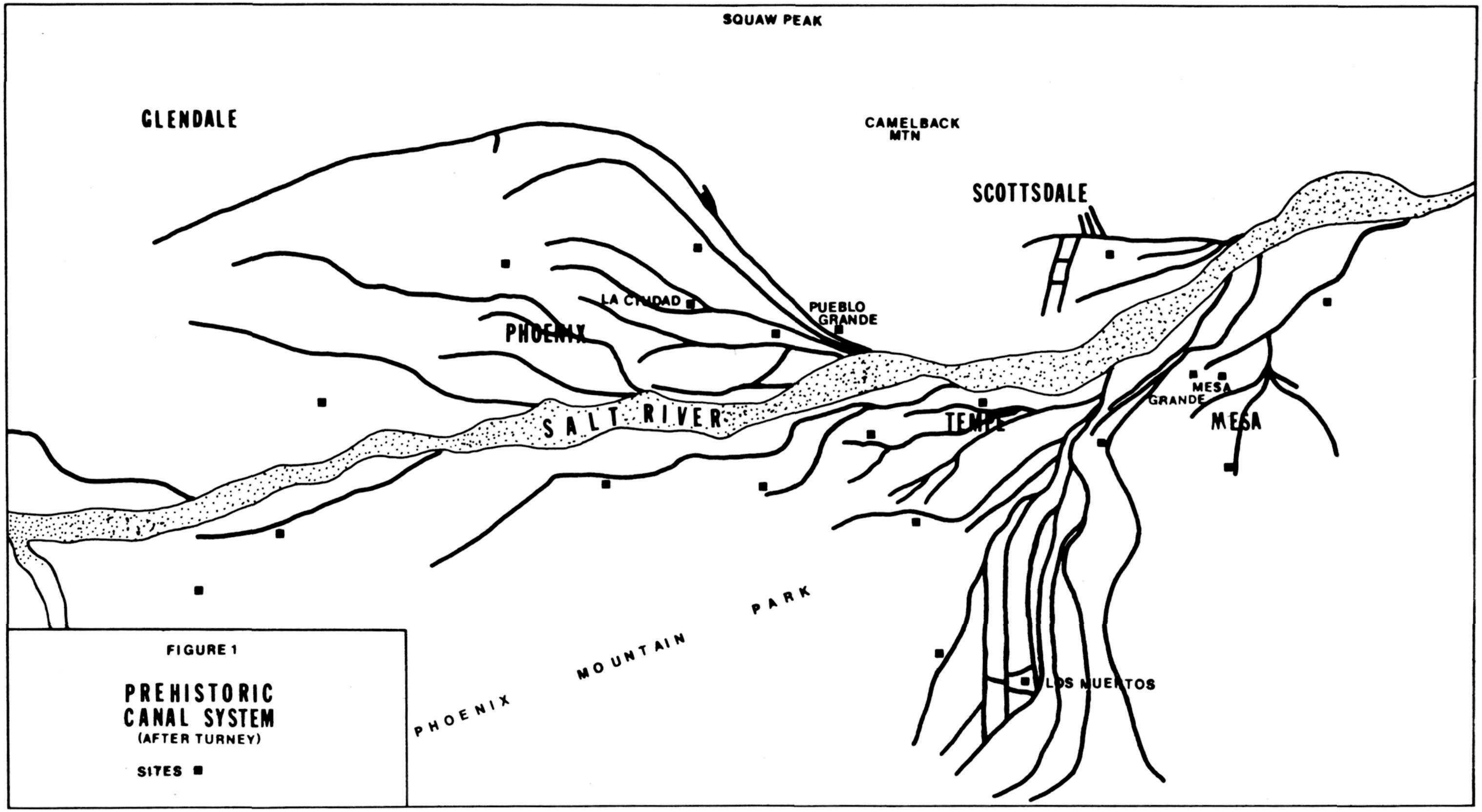

FIGURE 1

PREHISTORIC CANAL SYSTEM (AFTER TURNEY)

The Hohokam exploitation of the environment involved a system of diversified methods that ran the gamut from hunting and gathering to incipient horticulture and thence to what some might call extensive agriculture. What is important, however, is that all of the exploitative systems were probably operative at the same time.

The diversity seen in the Hohokam exploitation of the natural environment has parallels to the Pima and Papago. One need only compare it with Castetter and Bell (1942), who examined in detail Pima and Papago agriculture and gathering in the environment under question from early historic times to relatively modern times. Hackenberg (1974) is informative regarding the extent of dams, canals, and irrigated areas during the period 1850-1915 that were used by the Pima and Maricopa.

Early travelers to the Pima area have written that the Pima possessed canals larger than they required and that Piman agriculture was developed well beyond its initial stages prior to Anglo contact. Pima agriculture was so intensive that in 1861, the Pima sold one Mr. White, a purchasing agent for Fort Breckenridge, 300,000 pounds of wheat, 50,000 pounds of corn, 20,000 pounds of beans, and large quantities of pumpkins that were all surplus crops (Russell 1975:87-90). The Pima knew how to deal with the problem of soil salinity that is characteristic in arid environments in which irrigation is employed for agriculture. The Pima flooded their garden tracts repeatedly to wash out the alkali buildup. They declared they never abandoned a piece of ground because of the heavily impregnated waters of the Gila and Salt Rivers that deposit salts in the soil (Russell 1975:87). However, Woodbury (1962) sees soil salinity as a cultural and environmental limitation upon Hohokam agriculture. If the early Pima were acquainted with methods to wash away alkali in the soil, it seems likely the Hohokam were also acquainted with methods to rid themselves of the pernicious effects of irrigation in an arid environment.

The Pima were capable of producing surplus crops. Much of their incentive to do this was that surplus crops could be converted into cash or trade goods from the Anglos. There is no reason to doubt the Hohokam were also capable of producing surplus crops for trade. The Pima and Papago gathered whenever native flora became harvestable, often despite having crops in the fields. Apparently personal preference, ease of access with less labor expenditure than agriculture, and continuing a tradition made gathering native flora desirable to the Pima and Papago. When crops failed, they tended to rely entirely on wild foodstuffs. Indications are that a similar human exploitation of the natural environment reaches back in time to the beginning of the Hohokam culture.

A continuum has been indicated in the biotic potential of the environment, and indications are that a continuum existed in the indigenous exploitation of the same environment. This latter aspect will be explored in more detail in the following sections by examination of historic Pima and Papago foodstuffs as compared to Hohokam food remains that have been recovered from prehistoric sites.

The author was privileged to be a member of the field crew of the Hecla II and III seasons of the Lakeshore Project (Goodyear 1975) in the Papagueria south of Casa Grande, Arizona. The crew of the Lakeshore Project had occasion to interview John Andrews, a Papago miner, and his family in the village of Gu Komelik. John Andrews earned a salary at the nearby Hecla mines that adequately supported his family, yet his wife and daughter annually harvested the fruit of the saguaro and the flower bud of several species of cholla. These Papago women stated they gathered these native flora as a matter of pleasure and tradition. The saguaro fruit was used to make jelly, jam, and wine (cf. Bowen 1939; Castetter, et al., 1937; Thackery and Leding 1929).

Ross (1944) conducted a study at 12 Papago reservation communities in 1940 and 1941 to test the adequacy of the school lunch program and recommended improvements in the Papago diet (see appendix). The Papago of the 1940's preferred store-bought items such as white flour, white sugar, coffee, beans, and meat; however, a variety of wild flora were included in their diet. Ross documents the use of cholla buds, mescal pulp, saguaro fruit and seeds, mesquite beans, the fruit of the yucca and prickly-pear, and the seeds of tansy mustard and chia, Salvia columbariae.

During the 1930's and early 1940's, the University of New Mexico published an important and comprehensive series of monographs and books dealing with the ethnobiology of various Southwestern Indians. Of particular importance to the study area under question are: Castetter 1935; Castetter and Opler 1936; Bell and Castetter 1937; Castetter and Bell 1937; and Castetter, et al., 1938. Castetter and Underhill's (1942) Pima and Papago Agriculture is of specific interest as well as Castetter and Underhill's (1935) study of the ethnobiology of the Papago Indians. The above sources are so comprehensive in their scope that it would be an injustice to attempt even a cursory review here. The methods of gathering and preparing wild flora are completely contained in the above references. For convenience, Table 1 lists those plant foods mentioned by Castetter and Underhill (1935) that were utilized by the Papago. The table indicates the plant part used and the season in which it was gathered.

Table 1

PAPAGO ETHNOBOTANY IN THE EARLY 1930's

(Adapted from Castetter and Underhill 1935:14-28)

NATIVE FLORA

GREENS

Bursage, Ambrosia confertiflora, (Franseria tenuifolia) stalks, summer
Lambsquarter, Chenopodium murale, stalks, summer
Pigweed, Amaranthus palmeri, leaves, July, August
Lambsquarter, Chenopodium sp., leaves, July, August
Canaigre, Rumex hymenosepalus, leaves, spring
Dandelion, Taraxacum officinale, leaves
Saltbush, Atriplex wrightii, branches, summer
Cane Cholla, Opuntia arborescens, (Opuntia imbricata), summer
Jumping cholla, Opuntia fulgida, young shoots and buds, summer
Tree cholla, Opuntia versicolor, young shoots and buds, summer
Cholla, Opuntia echinocarpa, buds, May
Prickly-pear, Opuntia phaecantha, (O. engelmannii), leaves with thorns removed, sliced, summer
Mescal, Century plant, Agave americana, crown with leaves removed, winter, central flowering stalk before it emerges, spring
Sotol, Dasylirion wheeleri, crown with leaves removed, central flowering stalk before it emerges, May
Barrell cactus, Ferocactus wislizeni, (Echinocactus wislizeni), pulp, May
Night-blooming cereus, Reina de la noche, Cereus greggii, stalks

ROOTS, TUBERS AND BULBS

Sand-root, Ammobroma sonorae, October
Wild potato, Solanum sp., summer
Bursage, Ambrosia confertiflora, (Franseria tenuifolia), summer
Wild onion, Allium unifolium, May
Papago blue bells, Dichelostema pulchellum, (*Brodiaea capitata), May

Table 1 continued

FRUITS

Squaw-bush, Condalia spathulata, summer
Mulberry, Morus microphylla, summer
Hackberry, Celtis reticulata, summer
Boxthorn, Lycium fremontii, August
Mistletoe, Phoradendren californicum, summer
Lote bush, Zizyphus obtusifolia, summer
Bird cayenne pepper, Capsicum frutescens, August
Black Oak, Quercus emoryi and Q. oblongifolia, July
Bucknut, jojoba, Simmondsia chinensis, (S. californica), August
Saguaro, Cereus giganteus, (Carnegia gigantea), July
Organ pipe cactus, Cereus thurberi, (Lemaireocereus thurberi), August
Prickly-pear, Opuntia phaeacantha, (O. engelmannii), June, October
Cholla, Opuntia fulgida and O. echinocarpa, August
Datil, Banana yucca, Yucca baccata, summer

CHEWING

Mesquite, Prosopis velutina, gum chewed
White brittlebush, Encelia farinosa, gum chewed
Milkweed vine, Sarcostemma cynanchoides, (Philibertella heterophylla), gum chewed
Ocotillo, Fouquieria splendens, honey chewed

SEEDS

Sacaton, Sporoblous wrightii, September
Peppergrass, Lipidium thurberi, September
Patata, Monolepis nuttallians, September
Pigweed, amaranth, Amaranthus palmeri, September
Tansy-mustard, Descurainia pinnata, (Sophia pinnata), September
Mesquite, Prosopis velutina, August
Little-leaf palo-verde, Cercidium microphylla, (Parkinsonia microphylla), August
Mexican palo-verde, Parkinsonia aculeata, August
Ironwood, Olneya tesota, August
Devil claw, Martynia fragrans

Table 1 continued

BEVERAGES

Saguaro, _Cereus giganteus_, (_Carnegia gigantea_), juice fermented
Organ pipe cactus, _Cereus thurberi_, (_Lemaireocereus thurberi_), juice fermented
Prickly-pear, Opuntia phaecantha, (O. engelmannii), juice fermented
Lote bush, _Zizyphus lycioides_, juice fermented
Jimson weed, _Datura meteloides_, root ground and infused
Tansy-mustard, _Descurainia pinnata_, (_Sophia pinnata_), made into tea
Chia sage, _Salvia columbaria_, made into tea
Broomweed, Desert broom, _Baccharis sarothroides_, made into tea
Joint-fir, Mormon-tea, _Ephedra nevadensis_, made into tea

CULTIGENS

LEGUMES

Tepary, _Phaseolus acutifolius_ var. _latifolius_
Kidney bean, _Phaseolus vulgaris_
Vetch, _Vicia sativa_
Lentil, _Lens esculenta_
Chick-pea, garabanzo, _Cicer arietinum_

CUCURBITS

Pumpkin, _Cucurbita pepo_
Crookneck pumpkin, _Cucurbita moschata_
Muskmelon, _Cucumis melo_
Watermelon, _Citrullus citrullus_

TOBACCO

Coyote tobacco, _Nicotiana trigonophylla_
Yaqui tobacco, _Nicotiana tabacum_

CORN

Corn, _Zea mays_, seven varieties

COTTON

Cotton, _Gossypium_ sp.

WHEAT

Wheat, _Triticum aestivum_

The ethnobiology of the Pima investigated by Russell (1975) at the turn of this century reads like that of the Papago. It contains the names of 22 native plants whose stems, leaves, or flowers were eaten; four that were exploited for their roots or bulbs; 15 that supplied fruits or berries; and 24 that supplied edible seeds or nuts. Paramount in importance were the fruit of the saguaro and the bean of the mesquite tree. Russell notes that the agriculture of the Pima was already well developed prior to white contact; wheat, oats, barley, watermelons, muskmelons, and probably some varieties of corn and domesticated beans were introduced by the Spanish or Anglos. Over six varieties of maize and at least five varieties of beans were being cultivated in 1900 by the Pima (Russell 1975:66-92).

Padre Kino brought wheat, oats, and cattle to the Pima and Papago in the latter half of the 17th century; and these foodstuffs were readily adopted into the diet and agricultural system of the aborigines (Spicer 1962).

The archeological site of San Cayetano del Tumacacori excavated by DiPeso (1956) provides us with some insight into the possible transition from Hohokam to Pima. San Cayetano del Tumacacori was a Pima compound (with earlier Hohokam components) that was being used at the time of Spanish contact (circa 1540-1560). Cutler (1956), who analyzed the vegetal remains from this site, states that the Upper Pima were essentially farmers, yet they relied heavily on native resources. Pima plant remains from San Cayetano ranked according to abundance were corn, mescal, and beans. Other plant remains included the wild potato, _Solanum_ sp.; wild onion, _Allium unifolium_; saguaro, organ-pipe cactus, _Cereus thurberi_; prickly-pear, _Opuntia_ sp.; sotol, _Dasylirion wheeleri_; Reina de la noche, _Cereus greggii_; black walnut, _Juglans repestris_; and blue palo-verde, _Cercidium floridum_. In addition, 250 seeds of grass, _Panicum fasiculatum_, and an equal number of pigweed or lambs-quarters seeds, _Chenopodium fremonti_, were associated with burials. Both were widely used as a food source. Cultivated beans included the tepary, _Phaseolus acutifolius_, and kidney, _P. vulgaris_. Cucurbits were represented by the pumpkin, _Cucurbita pepo_, and squash, _C. moschata_ (Cutler, 1956:458-463).

Despite the introduction of new cultigens concurrent with Spanish missionization, the Pima and Papago continued to utilize their traditional foodstuffs. Of the cultigens reported to be used by the

Papago in the 1930's (Table 1), less than half were introduced by the Spanish and/or Anglos. Introduced plant foods are the legumes, vetch, lentil, and chick-pea, plus muskmelons, watermelons, and wheat. All of the other plants mentioned are either native flora or domesticates that were known to the native Americans in pre-columbian times. Kaplan (1956) considers the tepary bean, Phaseolus acutifolius var. latifolius, a diagnostic of Hohokam agriculture. It is thought to have possibly originated in southern Arizona.

A review of Table 1 not only indicated that native flora had intensive utilization, but also indicated that the exploitation of native flora occurred from spring through fall with a peak in the summer. The data in Table 1 includes a wide variety of greens and other perishable plant parts. It is also noteworthy that Papago exploitation of native flora is not particularly conditioned by drought. In fact, the native flora is used at various stages throughout most of the year.

The test of the basic hypothesis of this report rests on the following archeological data. If prehistoric plant remains show similarity to historic flora used for subsistence, we should expect the Hohokam had a comparable vegetative diet; that is, similar to all the flora utilized in Table 1 except, of course, for those types introduced by Europeans. One must keep in mind that, due to differential preservation, seed remains represent the greater part of the archeological record.

ARCHEOLOGICAL REMAINS

Table 2 condenses the published floral data from Hohokam sites. The significance of this data will be discussed after presentation of the new floral evidence studied by this writer, but a few comments on the existing literature will be made.

The most comprehensive work done thus far on Hohokam ethnobotany has been undertaken by Vorsilla Bohrer. Bohrer (1969) studied the ethnobotanical remains present in one house structure dating between A.D. 1100-1200 at Arizona BB:13:41 and remains from an outdoor hearth and two houses at Arizona BB:13:50 (A.D. 700-122). Her important analysis of the Snaketown trash remains (Bohrer 1970) indicates: A commonality of plant uses between the Hohokam, Pima, and Maricopa; a proposed Hohokam two-crop-per-year harvest with two supplemental gathering activities in July and September similar to the Pima ecosystem; periods of intensified exploitation of wild flora which was conditioned by crop failure; and a detailed description of Snaketown ethnobotanical remains dating between 300 B.C. and A.D. 1200. Bohrer has also published a comprehensive analysis of ethnobotanical remains from Tonto National Monument near Lake Roosevelt (Bohrer 1962) which is an area peripheral to the Hohokam but closely associated in types of natural vegetation and in having had cultural contacts with the Hohokam. The Tonto ruins are considered to be Salado, which was heavily influenced by the Classic Hohokam.

Corn, Zea mays, was grown by the Hohokam as early as 300 B.C. (Bohrer 1970), and there is some dispute as to its classification by races. Bohrer (1962) states that all Hohokam corn was of the Hohokam-Basketmaker type. Frequently, however, Hohokam corn is described as belonging to the Pima-Papago race. Perhaps the types are the same yet called by different names. Hugh Cutler, who is considered an expert on corn in ethnobotany, found in the Gila Bend area (Cutler 1965) five races of Zea mays--the pop varieties, Chapalote and Reventador, and the flour races of Ovanevo, Harinoso de ocho, and Pima-Papago. Bohrer (1969) indicated a more limited but similar variation in corn from her two sites on the San Xeavier Indian Reservation.

Table 2 -- SYNTHESIS OF DATA ON PUBLISHED FLORAL REMAINS

X = presence only indicated

LOCATION	SOURCE	Corn	Tepary bean	Common bean	Jack bean	Canavalia bean	Scarlet runner	Mesquite	Screwbean	Palo-verde	Ironwood	Cucurbits	Saguaro	Opuntia	Tansy mustard	Cheno-ams	Grasses	Walnut	Cotton	Yucca	Jojoba	Acorn
Snaketown	Bohrer 1970						1	1422	226			1	1638	40		79	30	1	20			
Snaketown	Castetter & Bell 1942	X	X	X				X								X			X			
AZ:BB:13:41	Bohrer, et al., 1969	220 ml													400 ml							
AZ:BB:13:50	Bohrer, et al., 1969	972 ml	30		50			1 pod						360 ml bud		2040 ml						
Casa Grande	Fewkes 1912	X		X				X														
Casa Grande	Kaplan 1956			19																		
Hodges site	Kaplan 1956					6																
Escalante group	Hall 1974	X						X				X							X	X		
San Cayetano	DiPeso 1956																	X				
Los Muertos	Haury 1950	X		X				X				X										
Reeve ruin	Cutler 1958	X																				
Gila Bend area	Cutler 1965	X							X													
University ruin	Hayden 1956	X																				
Ventana cave	Haury 1950	X						X		X	X	X	X	X			X				X	
AZ:T:13:8	Greenleaf 1975	43 cobs	X	X				2				2				X						20

There is also some dispute over the proper classification of beans. Kaplan (1956) gives a comprehensive analysis of prehistoric cultivated beans in the Southwestern United States and also cites useful characteristics for identification of cultivated varieties. Mesquite, Prosopis velutina, (*P. juliflora), and screwbean, P. pubescens, are wild arboreal legumes that were utilized extensively by the Hohokam, Pima, and Papago. The seed pods of these two species are easily distinguished; but, in an archeological context, the fragmented pods and especially the seeds are extremely difficult to tell apart. Bohrer (1970) had to lump some of the two species together to account for percentages of the total leguminous seeds at Snaketown. Lima beans, Phaseolus lunatus, and Canavalia ensiformis are often confused; for example, at the Hodges site, Carter (1945) stated that six beans recovered from there were lima beans, yet subsequent reanalysis (Kaplan 1956) identified the same beans as Canavalia ensiformis. Another lima look-a-like, the scarlet runner bean, Phaseolus coccineus, presents another problem in archeological identification.

Volney Jones analyzed some botanical remains in houses from the original Snaketown excavation (Gladwin, et al., 1937). Jones found quite a few remains of corn, beans, cotton seeds, and of the Chenopodium-Amaranthus assemblage. He gives little quantitative data, but does indicate that over two gallons of Amaranthus sp. and about a quart of Chenopodium sp. seeds were recovered (Castetter 1942:32-33). Bohrer's (1970) analysis of the trash areas at Snaketown excavated by Emil Haury in 1964-1965 retrieved only 79 Chenopodium (or Trianthema portulacastrum) seeds. The grass seeds from Snaketown were mainly little barley grass, Hordeum pusillum, with lesser amounts of Panicum or Setaria. Aside from finding that the Hohokam were cultivating corn by 300 B.C., Bohrer found they grew the common bean, Phaseolus vulgaris, during the Estrella phase (100 B.C. to A.D. 100) and that cotton, Gossypium sp., was introduced no later than A.D. 300. Bohrer's high incidence of saguaro and mesquite seeds at Snaketown led her to assume the Hohokam exploited these two sources extensively. Her pollen analysis yielded high concentrations of Cylindropuntia pollen that indicates cholla bud utilization. The finding of actual cholla buds in the trash areas substantiates this. Bohrer believes the Hohokam perhaps encouraged "weeds" such as tansy mustard, little barley grass, and Panicum grasses and certain of the Amaranthaceae and Chenopodiaceae to grow in their gardens as supplemental greens and seeds (Bohrer 1970). There is no reason to doubt this.

At Casa Grande, Kaplan (1956) identified 19 common beans from earlier excavations carried out there. Fewkes (1912) notes the occurrence of corn, beans, and mesquite beans at Casa Grande without quantitative data.

Hall (1974) at the Escalante group ruin found that Zea mays was by far the most common plant food remain. Hall found three species of cucurbits present at Escalante, the cultivated pumpkin, Cucurbita pepo, and two kinds of wild gourds (C. digitata and C. foetidissima). Hayden (1954) found charred yucca plant remains at University Ruin, but Hall (1974) reports the only instance of Yucca baccata seeds at a Hohokam site. The fruit can be eaten raw, toasted, ground, or dried. Another new addition to Hohokam ethnobotany found at the Escalante ruin group was seeds of Ipomoea costellata, a narcotic plant related to the LSD family of hallucinogens (Hall 1974).

Haury's (1950) Ventana Cave vegetal food remains may either be Hohokam or Papago, or both. Most of the corn at Ventana Cave was in the form of cobs belonging, probably, to the Pima-Papago race. Two stems of squash, one Cucurbita moschata and the other C. maxima, were also found. Prickly-pear seeds, fruits, and stems were excavated in addition to mesquite and blue palo-verde, Cercidium floridum, pods and seeds. Ironwood, Olneya tesota; coffee-berry or jojoba, Simmondsia chinensis; and bear-grass, Nolina microcarpa, complete Haury's list of floral foodstuffs at Ventana Cave.

A fortified hill site near Gila Bend, Arizona, T:13:8, was originally settled by Hohokam habitants then apparently resettled by Tanque Verde phase (A.D. 1200-1300) migrants from the Tucson area. Twelve of the 43 corn cobs found at this site belong to the pop races of Chapalote or Reventador maize; 26 cobs are of the Onaveno or Mais Blanco de Sonora types; and the remaining five cobs are Pima-Papago. One of the cucurbit seeds is Cucurbita pepo; the other, C. mixta. It is interesting that the tepary bean representatives come from three separate burials at this site. This is the first time acorns, Quercus sp., are found in the Hohokam literature. Russell (1975:78) mentions that the Pima traded acorns of Quercus oblongifolia from the Papago, who apparently gathered them for food in July in a few hilly places in the southern Papagueria (Castetter and Underhill 1935).

Table 2 summarizes the floral data recovered and analyzed thus far from Hohokam sites. The following section will deal with new archeobotanical data recovered from the Salt River Valley, from sites near Superior, and from sites in the Papagueria.

NEW ARCHEOBOTANICAL EVIDENCE

The Salt River Valley

The archeological data from Mesa Grande comes from three excavations conducted by Arizona State University at this site in 1960, 1972, and 1973. Despite the number of excavations carried out at this site, there is a real paucity of archeobotanical remains. Two wooden paddles, two *Cucurbita maxima* seeds, 29 *Prosopis velutina* seeds, and 35 ml. of *Cereus giganteus* seeds represent the sum total of botanical remains recovered from this site. It is of interest that the large crook-necked squash, mesquite, and saguaro are the sole representatives from what was once a large Classic mound in the center of an agricultural area.

The diversity of plant remains from La Ciudad is even more limited. Pueblo Grande Museum retains 70 ml. of *Zea mays* kernels excavated from La Ciudad. The Frank Midvale Collection, now deposited in the Archeology Laboratory at the Arizona State University, contains 89 corn kernels and two small cob fragments documented as being from La Ciudad. Perhaps most important are 431 cotton seeds from three loci at La Ciudad that are probably *Gossypium hopi*. In two loci, cotton seeds were found in association with human cremation remains in pottery ollas.

Following is a listing of floral remains from Pueblo Grande that are extant in the Pueblo Grande Museum collection. These remains were excavated by Odd Halseth, Julian Hayden, and others in the late 1930's and early 1940's. Unfortunately, there is no exact provenence data for them; however, it is significant that many type specimens come from more than one loci at the Pueblo Grande ruin.

- small corn cobs, *Zea mays*, 12 from 10 loci
- corn kernels, 111 ml. from 12 loci in addition to 18.2 liters from 1 locus
- little-leaf palo-verde beans, *Cercidium microphyllum*, 38 ml. from 10 loci
- blue palo-verde beans, *Cercidium floridum*, 5 from 3 loci
- cotton seeds, *Gossypium* sp., 7 from 1 locus
- mesquite seeds, *Prosopis velutina*, 8 ml. from 1 locus
- *Phaseolus lunatus* or *Canavalia ensiformis*, 1 bean from 1 locus

scarlet runner bean, Phaseolus cocoineus, 1 from 1 locus
wild gourd, Cucurbita digitata, 3 seeds from 1 locus
squash, Cucurbita maxima, 8 seeds from 2 loci
walnut, Juglans sp., 1 from 1 locus
hedgehog cactus, Echinocereus engelmannii, seeds, 24 ml. from 4 loci
saguaro, Cereus giganteus, seeds, 4 ml. from 1 locus

In addition to the above remains from Pueblo Grande, the writer, along with Jon Scott Wood and David E. Ward, excavated a portion of a Soho phase structure that extended beyond the west wall of the Pueblo Grande mound during the summer of 1975 (Wood, et al., 1975). The most distinguishing feature of the structure, archeobotanically speaking, was a rather dense lense of little-leaf palo-verde beans that were associated with the roof fall of the burned structure. The quantity of these beans, and the time restrictions imposed on the actual excavation, prevented collection of all of the palo-verde beans, but a "representative sample" of 437 ml. was retrieved. The palo-verde lense in the roof fall was attributed to probable granaries on the roof containing stored quantities of the beans that were burned in the fire after the second occupation of the structure. In addition to the 437 ml. of little-leaf palo-verde beans in this structure, 70 corn kernels, half a lima bean, Phaseolus lunatus (or possibly Canavalia ensiformis), and eight wild gourd seeds, Cucurbita digitata, were found.

AZ U:10:7 (PGM), a Classic period trash mound, contained two small corn cobs, three corn kernels, and two cotton seeds. This site is also in the vicinity of Phoenix on the first Pleistocene terrace of the Salt River.

Another Salt River site, AZ T:12:3 (PGM), belonging to the Sacaton phase, yielded eight small corn cobs and 11 mesquite pod fragments.

AZ U:9:100 (ASU) was a large Hohokam site on the Salt River terrace that was excavated by the Arizona State University, but which has not yet been reported. Schoenwetter (1975, personal communication) analyzed some pollen samples from this site and found that there were sufficient pollen sums of Cylindropuntia to indicate cholla bud utilization by the prehistoric inhabitants (cf. Bohrer 1970).

Despite the fact that the above sites are in what might be termed the "garden basket" of the Hohokam (Figure 1), it is evident that the prehistoric inhabitants of the Salt River Valley utilized a great deal of the native flora. Quantitatively, corn appears to rank as the most important food crop. This is not surprising, but it may be to some to find such a wide variety and frequency of native flora being used in an area known for its extensive canal systems and supposed reliance on cultigens.

The Papagueria

Bruder (1975) has already explored the archeological manifestations of historic Papago sites in the Slate Mountains of the Papagueria. She and this writer floated 27 soil samples (cf. Struever 1968) from three sites in the Hecla study area, and the flotation residue was subsequently examined for incorporation into this report. For comparative purposes, eight soil samples from the Santa Rosa Wash Project carried out by L. Mark Raab under the auspices of the Arizona State Museum, Tucson, were also floated and the seed residue examined.

Five of the eight Santa Rosa Wash soil flotation samples yielded botanical remains. AZ AA:5:43 (ASM), FN 28, Feature 1, was a large late Classic trash mound one mile west of the mesquite bosques of the Santa Rosa Wash. Soil samples (1^2 m. x 10 cm.) were floated at 20 centimeter intervals to the base of the trash mound to obtain indications of plant foods from this site. The only seed remains from this flotation process were five mesquite beans, one from the 20-30 cm. level, three from the 50-60 cm. level, and one from the basal 80-90 cm. level. AZ AA:5:43 (ASM), Locus 1, Feature 4, was a Classic Hohokam house. An exterior hearth from the same feature yielded eight mesquite beans. The Santa Rosa Wash area investigated by Raab is believed to be a center for sedentary populations from the Sacaton phase through the late Classic. It is also presumed this sedentary population exploited the slopes of the nearby Slate Mountains for the diversity of wild species in the _Cercidium_-_Cereus_ complex (Raab and Goodyear 1973, personal communication). While this hypothesis is probably true, the flotation data from the Santa Rosa Wash area indicate the prehistoric population took full advantage of the adjacent mesquite bosques.

Let us turn now to the remains of historic Papago sites located some five to eight miles southeast of the Santa Rosa Wash. Of the sites which were first investigated by Bruder (1975), three will be examined to determine if there is historic evidence of the exploitation of wild flora in an area where its use has been documented prehistorically by Goodyear (1975).

AZ AA:5:7 (ASU), Feature 61, is a large site possibly utilized repeatedly from A. D. 1700-1930. Part of this site is of particular interest for its manifestations that include a saguaro gathering implement, a metate, and two hearths, one of which had an associated ash pile mixed with fire-cracked rocks (Bruder 1975:298-300). Recovered economic plant remains from five soil flotation samples at this site included one saguaro seed and one blue palo-verde bean, Cercidium floridum, from the main hearth, and 24 cholla, Opuntia sp., seeds from the main hearth's associated ash/fire-cracked rock soil sample. This evidence indicates that the main hearth was once used to roast cholla buds; and, after the roasting was completed, the fire residue was dumped on the adjacent ash pile. The soil sample from around the metate yielded only one saguaro seed. As this could be a modern specimen, no conclusions can safely be drawn regarding it.

AZ AA:9:1 (ASU), Feature 108, is believed to be a saguaro fruit harvest camp because of the probable presence of a ramada and a number of associated rock rings, some of which are believed to have been used as hearths and roasting areas. This site was probably utilized between 1860-1915 (Bruder 1975:313-316). Out of 12 soil samples, the only economic floral remains from this site were two saguaro seeds from two loci. A single seed from each locus again prevents any safe conclusions; but, at least, the fact of their being saguaro seeds fits into Bruder's hypothesis that this site was a saguaro fruit harvesting camp.

Ten soil flotation samples were taken from AZ AA:9:1 (ASU), Feature 109. This large site, again, is believed to be a saguaro fruit harvesting camp that may have been repeatedly occupied from A. D. 1700 to the recent present, that is, the 1930's. Feature 109, like feature 108, also had indications of a ramada and the presence of several rock rings. It contained a rather rare trash mound with two rock rings on top of it (Bruder 1975: 316-328). This complex site yielded a total of 57 saguaro seeds from three loci. One soil locus contained 51 saguaro seeds. All three loci are associated with the probable ramada. In addition, this site yielded 11 cholla seeds from a soil sample peripheral to a rock ring and another single cholla seed from the trash area in the ramada. One charred mesquite seed was also found. It was disappointing that the trash mound sample contained no floral elements. The rather large number of saguaro seeds from this site documents, in the opinion of this writer, Bruder's thesis that the site was a saguaro fruit harvesting camp. The presence of 12 cholla seeds indicates cholla bud utilization at the site and further indicates the multifunctional aspect of this gathering camp.

The archeological floral material from the sites in the Papagueria substantiates the theory that the peoples in this area extensively exploited wild flora for their subsistence. The historic Papago sites on the southern slopes of the Slate Mountains indicate a continuum in the gathering system of the indigenous population.

Turning now to another area that is north of the Papagueria, we find that the Hohokam in outlying areas from the Gila and Salt River Valleys had, like the peoples in the Papagueria, relied heavily on noncultigens.

Superior

The Microbell sites, AZ U:12:2 (ASU) and AZ U:12:5 (ASU) are on the outskirts of Superior in Pinal County. Both sites lie within the boundaries of the Tonto National Forest.

The Microbell sites have tentatively been dated to A. D. 1275-1325 and are designated as being Hohokam, based on cultural affinities in ceramics, lithics, and architecture (Smith, personal communication). Smith believes this site complex was occupied during a period of effective moisture deficiency (based on the analysis of 30 pollen samples) and that it represents, as a site complex, a Hohokam adaptation to a gathering economy conditioned by lower crop yields such as suggested in Bohrer (1970).

The floral remains from the Microbell sites show similarity to other Hohokam sites. Not one representative of a domesticate was found despite careful screening of all excavated earth and analysis of 12 soil flotation samples from both sites.

Floral remains were retrieved from AZ U:12:2 (ASU) and AZ U:12:5 (ASU) as well as from a roasting pit associated with the latter site. The economic plant remains from these sites are summarized below.

AZ U:12:5 (ASU)

This is a rock cobble masonry structure that probably supported a wattel and daub roofed superstructure.

The fill soil flotation samples from this structure contained three Opuntia sp. seeds that are probably cholla, one fishook cactus, Mammalaria microcarpa, seed, and two bear-grass, Nolina microcarpa, seeds. The floor samples from this house included two Gramineae seeds, two fishook cactus seeds, one cholla seed, and five bear-grass seeds (bear-grass is of the Liliaceae family, yucca being a well known representative, not a Gramineae as the common name implies).

Perhaps most interesting was the find of 22 blue palo-verde, Cercidium floridum, seeds in direct association with a mano and metate on the floor of this structure. Palo-verde beans have been documented ethnohistorically to have been ground into flour for future consumption (Castetter and Underhill 1937, Russell 1975).

Approximately 100 meters from AZ U:12:5 (ASU), a roasting pit was excavated. The flotation sample from this pit yielded a single bear-grass seed.

AZ U:12:2 (ASU)

This house is generally similar to the other site in the Microbell complex, both structurally and in its recovered floral remains.

Two blue palo-verde seeds were found, one near and the other on the floor of this structure. Also found on the floor was one cholla bud that had apparently been roasted. In addition, a fragment of the epidermis of a hedgehog cactus, Echinocereus engelmannii, was found near the floor. There has been no known use for the body of this plant, but the fruit with its seeds is considered quite tasty. Hedgehog cactus seeds have been found at other Hohokam sites. For example, at Pueblo Grande (this report) and at Snaketown (Bohrer 1970).

The floral remains from the Microbell sites perhaps represent a Hohokam adaptation to a primarily gathering, in lieu of agriculture, subsistence pattern. Sites such as the Microbell complex may represent the predecessors of groups who survived the Hohokam collapse circa A.D. 1450 (Smith, personal communication). One can also theorize that the wild seeds recovered may reflect an ongoing gathering tradition in this area that was not conditioned by long periods of low rainfall. Hunting and gathering may have provided adequate subsistence needs, and personal preferences may not have necessitated the laborious task of practicing agriculture. Another interpretation is that the Microbell site economic floral remains may not differ that drastically from other Hohokam sites, even in villages in the center of agricultural areas in the Gila and Salt River Valleys. Wild plant foods provided a large part of the Hohokam diet. The apparent lack of remains of cultigens at the Microbell complex could also be explained by differential preservation. Any clearcut definition of the subsistence patterns of Hohokam groups in this area of Arizona will have to depend on further investigation in what is now not a clearly defined cultural area.

The floral data has now been presented to test the continuum hypothesis of this report. Before making any concluding statements, it is appropriate to add information on faunal remains to see if there are also parallels between the Pima and Papago exploitation of wild game and that of the Hohokam.

FAUNAL REMAINS

Tables 3 and 4 give the only quantitative data on Hohokam faunal remains. Table 3 shows the percentage by species of the faunal remains recovered from Ventana Cave (Haury 1950). The Papago and Hohokam levels were separated to see if there were parallels in the utilization of game by species. The degree of similarity is remarkable. This table indicates that basically the Papago and Hohokam exploitation of wild game was identical. The four sites with faunal bone at the Escalante group ruins were analyzed by Sparling (1974) and are combined in Table 4. The Escalante group remains show a remarkable parallel to the Hohokam and Papago remains from Ventana Cave. Occupation at Ventana Cave ceased around A. D. 1700 (Haury 1950). It is quite obvious that rabbit and deer were the primary meat sources for the Hohokam and early Papago, the deer remains possibly being under-represented. The Hohokam may have had to travel some distance from their homes at times to secure deer meat, and it would be far more expedient to butcher such a large animal in the field, cut the meat into sections or strips devoid of bones, and carry less weight home. The same would not be necessary for rabbit. Haury's reporting of faunal remains at Snaketown (Gladwin, et al., 1937) reads like the Ventana Cave and Escanante ruin group remains, yet at Snaketown, two additional mammals, one bird, and one fish were represented. At Snaketown, remains of muskrat, Ondatra zibethicus; American bison, Bison bison bison; golden eagle, Aquila cryseatos; and sturgeon, Acipenser, were found. Four positive individuals of bison were found at Snaketown. Haury states that the only mammal representatives from the earliest phases of the Pioneer period (up to A. D. 300) were rabbit, deer, and bison. The other animals and an increase in rodent bones follow after A. D. 300 up to A. D. 1200 (Haury, in Gladwin, et al., 1937:156-158). The list of Hohokam and early Papago animal food remains reads like a listing out of Russell (1975) for the Pima exploitation of native fauna. The red-tailed hawk and golden eagle were probably kept for their feathers. Gophers, mice, and rats were eaten by the Pima, while lizards and snakes were repudiated with scorn (Russell 1975:80-83).

Tanque Verde phase faunal remains from the fortified hill site near Gila Bend yielded the following mammals in descending order of importance: mule deer; cottontail and jackrabbit; raccoon,

Table 3

PAPAGO AND HOHOKAM FAUNAL REMAINS FROM VENTANA CAVE

(Adapted from Haury 1950, Table 10)

Mammals and Rodents Species	Papago levels 1	2	Hohokam levels 3	4	5	Percent of Total Papago	Hohokam
Jackrabbit (*Lepus* sp.)	37	35	20	19	21	18.56	18.29
Cottontail (*Sylvilagus* sp.)	9	9	9	7	11	4.64	8.23
Mule deer (*Odocoileus hemionus*)'	38	29	20	17	18	17.27	16.77
Sonoran deer (*Odocoileus virginianus*)	1	3		3	2	1.03	1.52
Coyote (*Canis latrans*)	34	29	19	14	22	16.23	16.77
Pronghorn antelope (*Antilocarpa americana*)	17	13	4	9	9	7.73	6.71
Bighorn sheep (*Ovis canadensis*)	15	15	10	6	3	7.73	5.79
Badger (*Taxidea taxus*)	22	12	16	14	20	8.76	15.24
Prairie dog (*Cynomys ludovicanus arizonensis*)	3	1		1	1	1.03	0.61
Wildcat (*Lynx rufus baileyi*)	3	4	2	2	5	1.80	2.74
Rock squirrel (*Citellus variegatus grammurus*)	4	8	3	4	3	3.09	3.05

Table 3 Continued

Mammals and Rodents Species	Papago levels 1	2	Hohokam levels 3	4	5	Percent of Total Papago	Hohokam
Porcupine (*Erethizon epixantum covesi*)	13	3	1		1	4.12	0.61
Gray fox (*Urocyron cinereoargenteus*)	4	3		3	1	1.80	1.22
Kit fox (*Vulpes macrotis arispus*)	1	6	1	1	2	1.80	1.22
Wood rat (*Neotoma* sp.)	2	2		1		1.03	0.30
Pocket gopher (*Thomomys bottae*)			1			0.00	0.30
Cacomistle (*Bassariscus astuns flavus*)	1	1		1		0.52	0.30
Mountain lion (*Felis concolor azteca*)	3	2				1.29	0.00
Wolf (*Canis lupis*)	2					0.52	0.00
Spotted skunk (*Spilogale arizonae*)	1		1			0.26	0.30
Black bear (*Ursus americanus amblyceps*)	1					0.26	0.00
Chipmunk (*Entamias* sp.)	1					0.26	0.00

Table 3 Continued

Mammals and Rodents Species	Papago levels 1	2	Hohokam levels 3	4	5	Percent of Total Papago	Hohokam
Kangaroo rat (*Dipodomys* sp.)	1					0.26	0.00
TOTALS	388			328		99.99	99.97

Domesticated Mammals	Papago levels 1	2	Hohokam levels 3	4	5	Percent of Total Papago	Hohokam
Dog (*Canis familiaris*)	1	2	2	2	1	18.75	100.00
Horse (*Equus caballus*)	5	2				43.75	0.00
Sheep or Goat (*Ovis aries* or *Capra hircus*)	4					25.00	0.00
Cow (*Bos taurus*)		2				12.50	0.00
TOTALS	16			5		100.00	100.00

(Adapted from Haury 1950, Table 11)

Reptiles Species	Papago levels 1	2	Hohokam levels 3	4	5	Percent of Total Papago	Hohokam
Beriander's tortoise (*Gopherus berlandieri*)	6	6	7	4		85.71	100.00
Horned-toad (*Phrynosoma* sp.)		1				7.14	0.00
Snakes and Lizards	1					7.14	0.00
TOTALS	14			11		99.99	100.00

Table 3 Continued

Birds Species	Papago levels 1	 2	Hohokam levels 3	 4	 5	Percent of Total Papago	 Hohokam
Red-tailed hawk (*Buteo borealis*)	5	3	2	3	4	34.77	52.94
Raven (*Corvus corax*)	1	2	2			13.04	11.76
Horned owl (*Bubo virginianus*)	1		1	1	1	4.35	17.65
Barn owl (*Tyto alba*)	1	2			1	13.04	5.88
Turkey vulture (*Cathartes aura*)	2		1		1	8.70	11.76
Roadrunner (*Geococcyx californianus*)	2					8.70	0.00
Brown pelican (*Pele canus occidentalis*)	2					8.70	0.00
Marsh hawk (*Circus hudsonius*)		1				4.35	0.00
White-winged dove (*Melopelia asiatica*)	1					4.35	0.00
TOTALS	23		17			100.00	99.99

Table 4

QUANTITATIVE DATA ON FAUNAL REMAINS FROM THE ESCALANTE GROUP RUINS: SITES AZ U:15:3 (ASM), AZ U:15:22 (ASM), AZ U:15:27 (ASM), AND AZ U:15:32 (ASM)

(Adapted from Sparling 1974)

Species	Total Number of Bones/Individuals	Percentage of Total Bones/Individuals
Cottontail (*Sylvilagus* sp.)	293/25	17.59/21.0
Jackrabbit (*Lepus* sp.)	619/26	37.17/21.8
Mule deer (*Odocoileus hemionus*)	262/9	15.73/7.6
White tail deer (*Odocoileus virginianus*)	5/2	0.30/1.7
Domestic dog (*Canis familiaris*)	28/7	1.68/5.9
Coyote (*Canis latrans*)	2/1	0.12/0.8
Gray fox (*Urocyon cinereoargenteus*)	3/1	0.18/0.8
Rock squirrel (*Ammospermophilus variegatus*)	13/4	0.78/3.4
Yellow mud turtle (*Kinosteron flavenscens*)	1/1	0.06/0.8
Ord kangaroo rat (*Dipodomys ordii*)	16/5	0.96/4.2
Hispis cotton rat (*Sigmodon hispidis*)	7/4	0.04/3.4

Table 4 Continued

Species	Total Number of Bones/Individuals	Percentage of Total Bones/Individuals
Whitethroated woodrat (*Neotoma albigula*)	5/3	0.03/2.5
Valley pocket gopher (*Thomomys bottae*)	2/1	0.12/0.8
Pocket mouse (*Perognathus* sp.)	13/7	0.78/5.9
Harvest mouse (*Reithrodontomys* sp.)	13/5	0.78/4.2
Gambel's quail (*Lophortyx gambelli*)	9/4	0.54/3.4
Turkey (*Meleagris gallopavo*)	38/2	2.28/1.7
Canada goose (*Branta canadensis*)	4/1	0.24/0.8
Swainson's hawk (*Buteo swainsoni*)	22/2	1.32/1.7
Screech owl (*Otus asio*)	10/2	0.60/1.7
Barred owl (*Strix varia*)	1/1	0.06/0.8
Regal horned lizard (*Phrynosoma solare*)	1/1	0.06/0.8
Snakes	23/3	1.38/2.5
Undetermined fragments	270/?	17.21/?
TOTALS	1665/119	99.77/99.99

Procyron lotor; and badger, Taxidea taxus. Turkey remains were also found in addition to some bones of the Colorado squawfish, Ptychocheilus lucius. This fish used to be in the Gila River and was known to attain a weight of 80-90 pounds (Greenleaf 1975).

Late Santa Cruz to Classic (A.D. 800-1200) faunal remains from Valshni village in the Papagueria (Withers 1944) also indicates that deer were most plentiful. Seventeen specimens of horns of mountain sheep, Ovis canadensis, indicate a more plentiful utilization of this animal. The jackrabbit, Lepus alleni, and cottontail rabbit, Sylvilagus sp., are typically represented and, a little atypical, the coyote, Canis latrans, and wildcat, Lynx.

It is surprising that the javelina or peccary, Pecari tajacu, was not found in any Hohokam sites. This wild boar which loves the habitat of prickly-pear clumps is rather common today in southern Arizona (Lowe 1964), and it was eaten in olden days by the Pima (Russell 1975:82).

Special attention should be paid to the computations of faunal bone percentages in Tables 3 and 4. By taxa, there is only slight variance in the degree of occurrence of individuals represented. Deer and rabbit are obviously the favorite meat staples in the diet. We have seen a wide variation in plant exploitation that centered around a few most important plant foods. The same pattern is found with animals.

CONCLUSIONS

It has been demonstrated that the archeobotanical remains reviewed herein show great similarity to known historic usage of plants. The major extraneous cultural influences on the indigenous population did not diminish the importance of native flora until recent Anglo industrialization took effect. There has been an obvious tendency to add introduced crops to the diet; but, basically, the same wild flora continued to be exploited for at least 2,000 years.

Viewed on a presence-absence basis (Table 5), wild flora species outnumber cultivated species two to one. Despite varieties within species, the number of cultigens is actually quite limited. Quantitatively, and on a presence-absence basis, corn or maize, Zea mays, is by far the dominant food plant in the Hohokam diet. Mesquite, Prosopis velutina, appears to be the second most important plant food source. Mesquite remains have been found at over half of all the sites surveyed herein; and, quantitatively, the remains at these sites indicate mesquite's status as a secondary plant staple. Table 5, which summarizes the ethnobotanical remains at 21 Hohokam sites on a presence basis, shows corn is present at 15 out of 21 sites, and mesquite at 11 out of 21 sites. If we lump the species of cultivated beans and squash together, we find that Phaseolus sp. and Canavalia ensiformis occur at 14 out of 21 sites, and cultivated cucurbits occur at 7 out of 21 sites. If we lump the wild legumes together (Prosopis sp., Cercidium sp., and Olneya tesota), they occur at 18 out of 21 sites. The commonly accepted statement that the Hohokam relied on corn, beans and squash as cultigens needs clarification. New evidence suggests a mixture of wild flora and cultigens in the beans and squash categories, and it is obvious that cotton must be added to the Hohokam list of crops.

Gathering apparently played a larger role in Hohokam subsistence than previously supposed. It also seems reasonable to assume that Hohokam gathering was not limited just to the months of July and September when the saguaro fruit and mesquite pod were harvested (cf. Bohrer 1970). I would argue for a year-round gathering cycle. Referring again to Table 1, the Papago exploited wild flora from spring through to winter. A continuum has been indicated between the Papago and the Hohokam exploitation of the natural environment, and there is no reason to doubt that the Hohokam also took advantage of wild perishable plants. Lack of evidence in the archeological

Table 5

PRESENCE, BY SPECIES, OF PLANT FOOD REMAINS AT TWENTY-ONE HOHOKAM SITES*

WILD SPECIES

Prosopis velutina	11	*Cucurbita digitata*	3
Prosopis pubescens	2	*Cucurbita foetidissima*	1
Cercidium floridum	3	*Chenopodium* sp.	1
Cercidium microphyllum	1	*Amaranthus* sp.	3
Olneya tesota	1	*Echinocereus engelmannii*	2
Cereus giganteus	4	*Mammalaria microcarpa*	1
Opuntia sp.	5	*Descurainia* sp.	1
Juglans sp.	3	*Panicum*	1
Simmondsia chinensis	1	*Setaria*	1
Quercus sp.	1	*Nolina microcarpa*	2
Yucca sp.	2	*Hordeum pusillum*	1

CULTIGENS

Zea mays	15	*Phaseolus vulgaris*	5
Gossypium sp.	5	*Phaseolus acutifolius*	3
Cucurbita pepo	3	*Phaseolus coccineus*	2
Cucurbita moschata	1	*Phaseolus lunatus*	2
Cucurbita maxima	2	*Canavalia ensiformis*	2
Cucurbita mixta	1		

*Numerals indicate number of sites where species were recovered.

record, by no means, indicates that a particular plant was not known and used by prehistoric peoples. The Hohokam should perhaps be viewed in the context of a constant interplay between utilization of cultigens and native plant and animal resources.

Bohrer (1970) believes wild plants were exploited as a response to low crop yields. Neither Doelle (1975) nor this writer believes Bohrer's explanation is sufficient to account for the presence of wild plant remains at Snaketown or elsewhere in the Hohokam area. Doelle (1975:24) offers four hypothetical subsistence strategies involving wild plant exploitation. Bohrer's (1970) strategy for the Hohokam would fall under Doelle's strategy three, that is, many wild plant species used by all the population as a major part of their diet only during periods of famine. The enthoarcheological record does not indicate this is probable. This study has revealed that wild plant remains are abundant and frequently equal to, or even dominant over, remains of cultigens. Wild plant remains are common in various types of Hohokam sites, even in villages in the center of agricultural areas. The wild plant remains reported herein are also diversified as to species. Based on this evidence, Hohokam subsistence appears to fall somewhere between Doelle's (1975:24) strategy one and two. In both strategies, wild plants contribute to a major portion of the diet on an annual basis. In strategy one, only a few wild plants are used by all the population. In strategy two, a few to many wild plants are used by some of the population. Strategy two appears to be more applicable to the Hohokam providing that "some" be changed to "most, if not all" of the population. The term "some" seems to infer an elitist class or segregated society, at least in its manner of exploitation of the environment for foodstuffs. Even if the Hohokam did have an elite class, indications are that elsewhere in the New World where there were stratified societies, the elite enjoyed wild foodstuffs just as much as the general populace. A steady diet of just corn, beans, and squash would be boring indeed to any individual who had the awareness of a much wider diversity of foodstuffs that were readily available with little labor expenditure.

The matter of cotton is intriguing, yet unanswerable. One could postulate that cotton growing land was extensive in the Hohokam area and that cotton was grown as a cash crop used for trade to the Anasazi of the Colorado Plateau. The Black Mesa area and other areas of the Colorado Plateau are not well suited for cotton agriculture, whereas the long hot days and long growing season of the Lower Sonoran Desert are well suited, with irrigation, to large-scale cotton agriculture (Large and Schoenwetter, personal communication). Cotton seeds have been found at Snaketown, the Escalante ruin group, Pueblo Grande, AZ U:10:7 (PGM), and, most abundantly, at La Ciudad. Cotton textiles, though somewhat scarce in the Hohokam area due to poor preservation, do show an advanced technical ability with some weaves. Black Mesa black-on-white and Jeddito black-on-yellow, two pottery types diagnostic of the Hopi area, are not uncommon intrusive ceremics in Classic Hohokam sites. The Hopi pottery in a Hohokam context and the potential for surplus cotton production in the Hohokam area indicate a possible trade relationship between the two areas. Hohokam cotton is frequently classified as *Gossypium hopi*; perhaps the "Hopi type" cotton originated in the Lower Sonoran Desert.

The matter of the Hohokam producing surplus cotton for trade can only be approached from a conjectural or hypothetical position at our current level of understanding. It is, however, a question worthy of being tested to find an answer.

The cotton question, and others, must remain moot until further investigation is undertaken. It is hoped this report sheds some light on our understanding of the rather complex issue of Hohokam subsistence.

FIELD METHODS

Many botanical remains are lost in site excavations out of a lack of regard for their retrieval. On the other hand, many potential specimens are not collected merely because the field archeologist lacks the necessary know-how. It is apparent by now that botanical specimens from archeological sites are of scientific value. This section will offer a simple method to the field archeologists that should increase retrieval of botanical data.

Soil flotation samples seem to provide the most data for the least expenditure of time and/or money. Soil samples are easy and quick to take in the field. The question is where to take them and how much to take. Standardized samples would allow for more precise intra-site and inter-site comparisons of floristic data. It is suggested that one liter be taken from each context sampled. Multiples of one liter may be appropriate for exceptional situations. For example, a deep roasting or storage pit should be sampled at, at least, two levels (one liter for each level). Soil flotation samples should be taken from all rock rings, hearths, ash lenses, roasting and storage pits, and trash and living/work areas as a matter of standard procedure. House floors should be quartered, and a one-liter sample should be taken from each quarter to determine the possibility of specific activity areas. In the case of a distinct activity area, for example a metate on a floor, a sample should be taken from the periphery and beneath the metate. Trash areas should be sampled from more than one locus within the trash area as the trash may have been patterned. The implication here is that the prehistoric peoples may have chosen, for reasons of odor, to dispose of meat refuge separate from the other trash, and that trash may not have been built up from the center, upward and outward, as commonly assumed. The above standard procedures for soil flotation samples should be taken, but an open mind must be kept in the field. Other areas may be sampled as is felt necessary for the situation. In the case of a large concentration of botanical material, for example, the dense palo-verde bean lense associated with the roof fall of the Soho phase structure at Pueblo Grande mentioned earlier, the archeologist might be compelled to opt for quick, partial recovery. In such a case, it is advisable to take two to four liters of soil samples, and estimate the portion of the total lense sampled. In this way, despite a partial sample, a rough idea of the total is represented.

Pollen samples have not been very successful in retrieving evidence of plant foodstuffs utilized in the past. Bohrer (1970) and Schoenwetter (personal communication) have indicated the probable utilization of cholla buds as a food source via pollen analysis by indicating sufficient quantities of Cylindropuntia in the archeological context. It is possible that fields can be tested for what was grown in the past, but this effort would prove to be expensive and possibly futile. Pollen samples would have to be taken from modern fields of various crops to indicate the amount of pollen rain represented by the particular crop. Then trenches or stratigraphic pits would have to be dug in assumed archeological fields and sampled at close intervals to see if there are any cultigen representatives comparable in pollen count to the modern control samples (Schoenwetter, personal communication). The problem with many cultigens is that they are insect pollinated and deposit very little pollen rain on the ground surface. For example, one might expect only a 10 grain Zea count from a sample from a modern corn field.

The archeologist must keep a constant look-out for macrofossil botanical remains. It is always advisable to screen the soil from cultural horizons that are being excavated. One should always be on the look-out for cast impressions in adobe or even on pottery. All can add to the botanical data.

Starch grains have a distinct size and structure that are distinguishable on the generic level. In addition, they are rather stable and might preserve well (Thompson, personal communication). Because of their stability, it is quite possible starch grains may be retrieved with some success out of archeological sites. Storage areas, vessel interiors, and coarse grained metates and manos would be prime candidates for looking for starch. A simple solution of one part iodine to one part potasium iodide will indicate starch content. Starch, if present, turns the reddish-brown iodine solution a blue to purple color. If the presence of starch is indicated, a polorizing filter on a microscope aids in identification (Thompson, personal communication).

The identification of starch grains in an archeological context may prove one day to greatly increase our ability to locate and identify macroscopically invisible floral remains. When combined with soil flotation samples, careful screening for macrofossils, and by taking pollen samples, it should be possible to greatly increase the quantity and quality of archeobotanical data.

Figure 2. Corn cob, Zea mays. This specimen was excavated near Saguaro Lake and is a dent variety common to Peru. 72/202 ASU

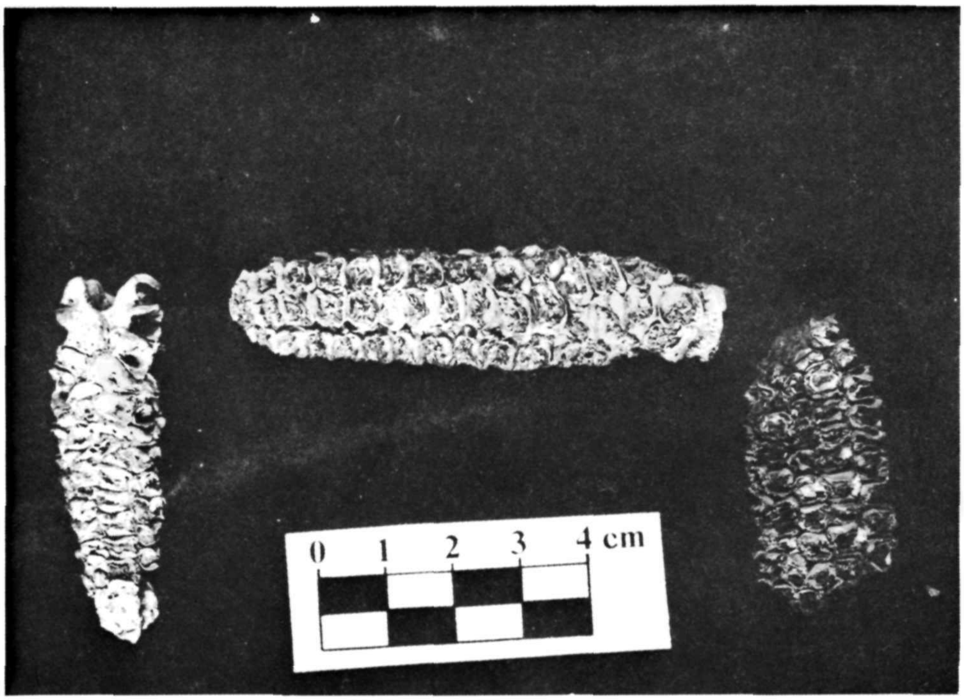

Figure 3. Corn cobs from the Fitch site, 61/445 ASU

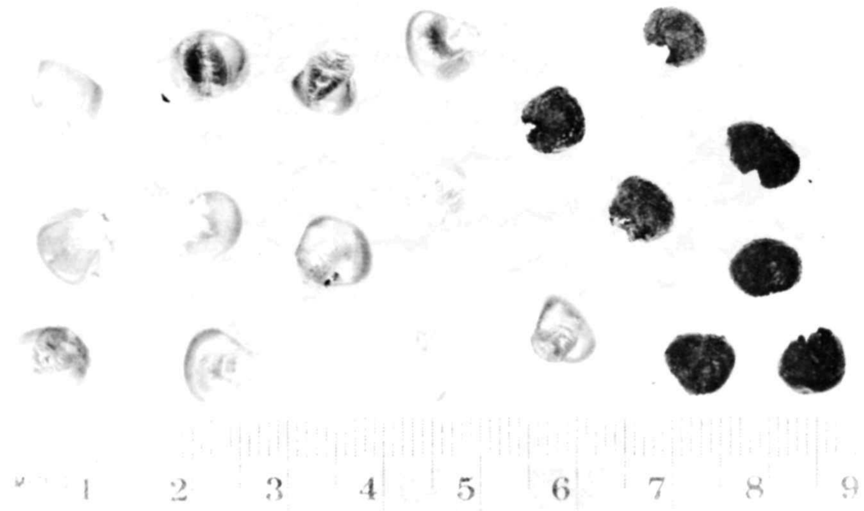

Figure 4. Corn kernels. Light kermels are historic and were found in an old Pima olla in a cave north of Gila Bend, 68/2 ASU. Charred kernels from La Ciudad, Midvale

Figure 5. Mesquite pods and beans. Light specimens are modern; charred specimens were found at Pueblo Grande.

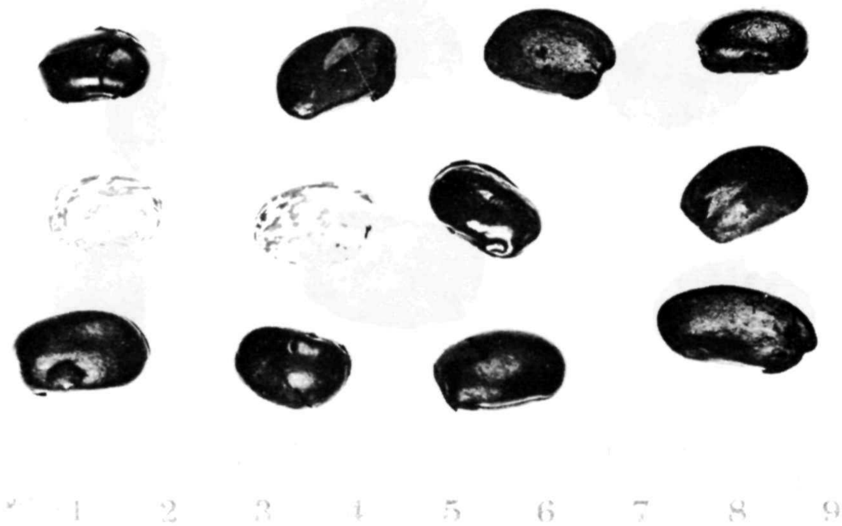

Figure 6. Common bean, *Phaseolus vulgaris*, var. *pinto.* Kaplan (1956) type C 13. All specimens are modern, charred by author.

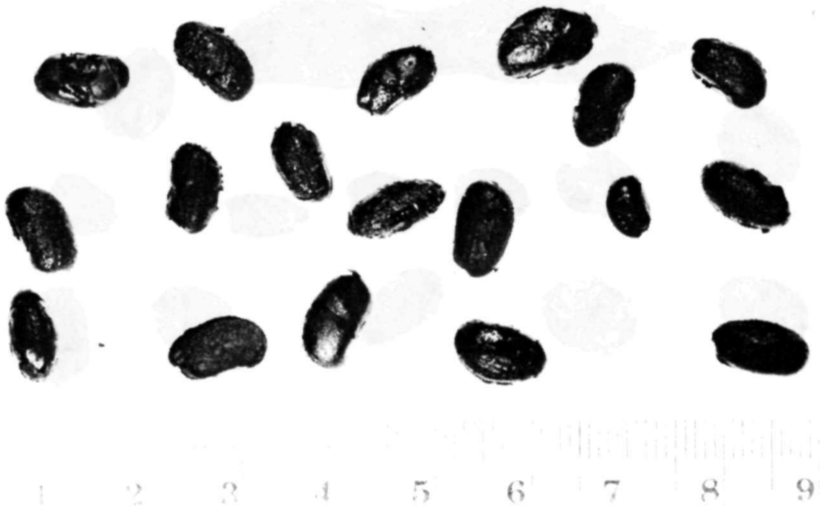

Figure 7. Common bean, white navy variety, Kaplan type C 2. Modern, charred by author.

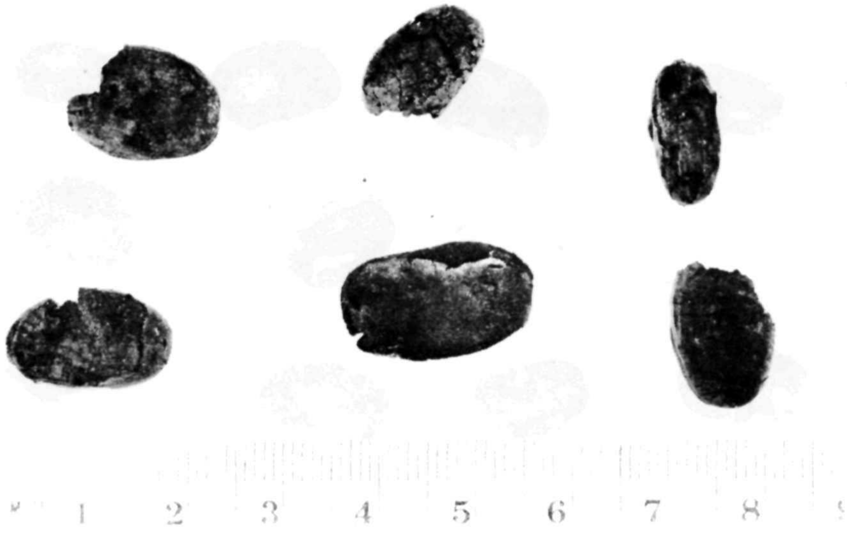

Figure 8. Scarlet runner bean, Phaseolus coccineus. Provenience unknown, probably Hohokam, Midvale Collection, ASU.

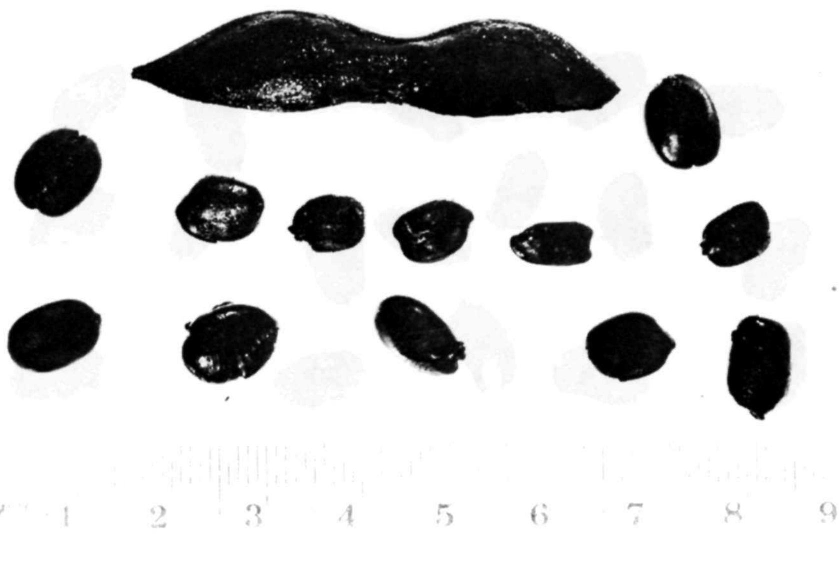

Figure 9. Blue palo-verde pod and beans, Cercidium floridum, modern charred.

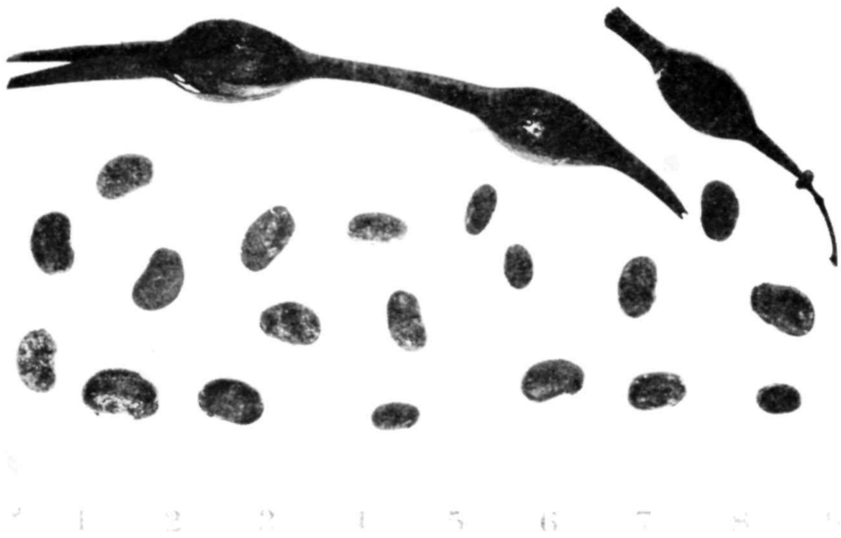

Figure 10. Little-leaf palo-verde beans and pods. Pods are modern charred samples; beans are from Pueblo Grande, 75/2 PGM.

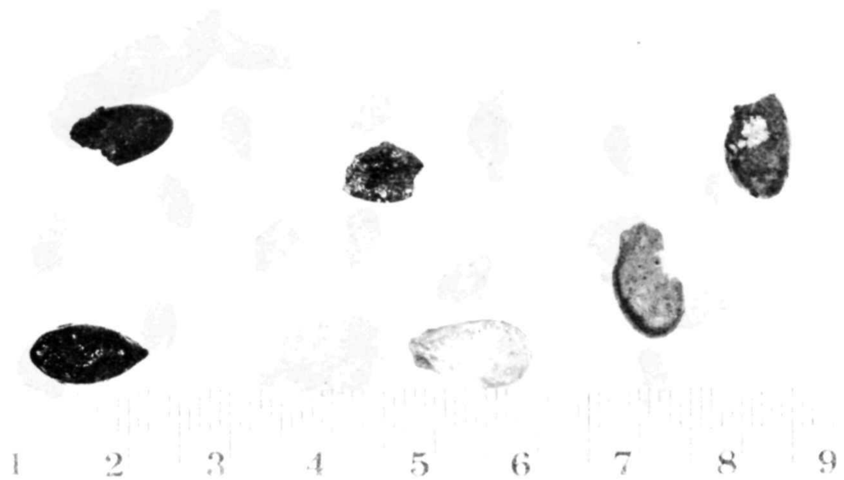

Figure 11. Wild gourd seeds, Cucurbita digitata, from Pueblo Grande, 75/2 PGM.

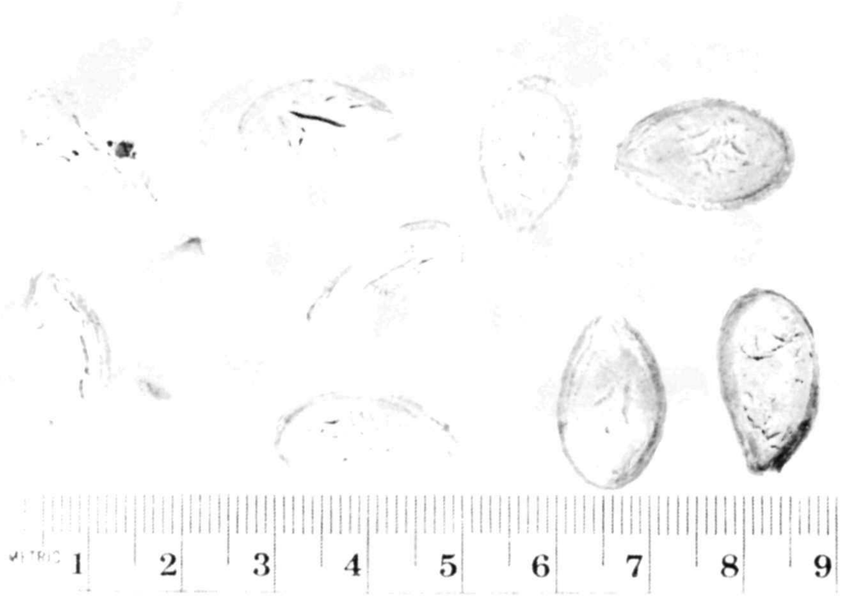

Figure 12. Pumpkin seeds, *Cucurbita pepo*, 7.48 liters of above found in an old Pima olla north of Gila Bend, 68/2 ASU.

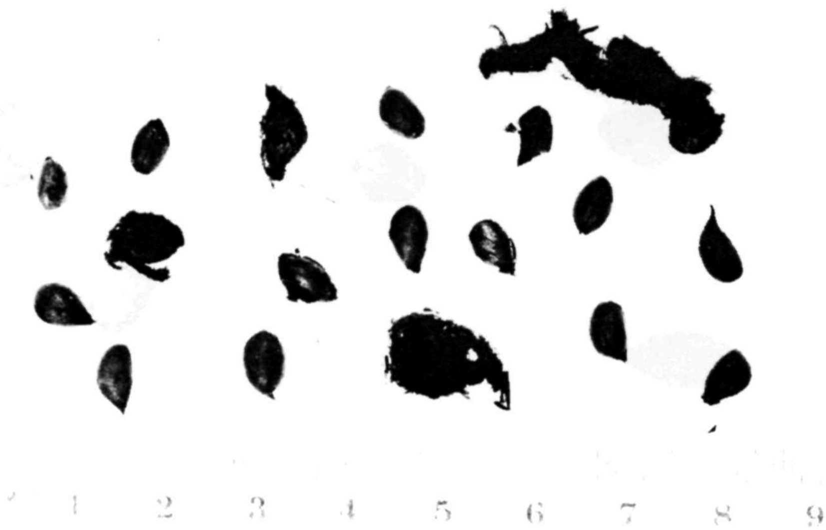

Figure 13. Cotton seeds from La Ciudad, Midvale Collection, ASU.

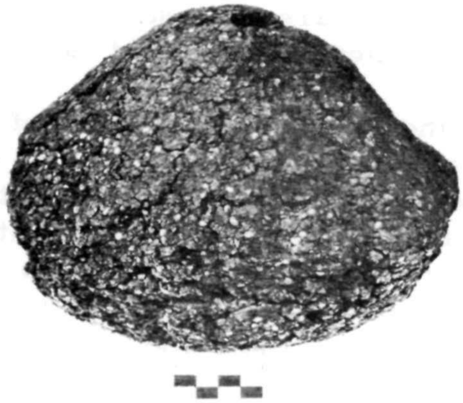

Figure 14. Prickly-pear "fruit cake" found in the Harquahala Valley. Iodine test indicated starch content. Side (above) and top (below) views. 61/644 ASU.

APPENDIX - NUTRITION

The following tables (Tables 6 and 7) indicate the nutritional value of some known Hohokam foodstuffs. The values reported by Watt and Merrill (1963) give the most complete nutritional data. Unfortunately, none of the sources note the amount of amino acids in any of the foods. Amino acids are necessary for the bodily utility of available protein and hence, are of great value.

Ross (1944) did her thesis for the University of Arizona School of Home Economics, and makes some significant statements in regard to the exploitation of wild plants. Ross states that unrefined native plants would make a valuable contribution of vitamins and minerals, especially calcium, to the present day Papago diet. She recommended that Papago community leaders and teachers encouraged the Papago people to supplement their diet more with easily gathered native flora. Wild plants, she suggests, would compensate for the existing deficiencies in the Papago diet due to excessive use of processed Anglo-type foods such as white bread, lard, candy, and coffee (Ross 1944:48).

Ross also states that the average Papago in 1940-1941 ate 300 grams of beans daily. Ross states that this amount of beans in the daily diet is an excellent source of calories, phosphorus, iron and thiamin. Smaller amounts of partially incomplete protein, calcium and riboflavin are also present in beans (Ross 1944:48). As beans obviously were a staple in the earlier indigenous diets, probably more so than today, we would expect even greater nutritional benefits. Corn was undoubtedly used more extensively in the past. D. B. Jones (1938) has indicated the complementary nature of bean and corn amino acids in providing dietary protein needs (Kaplan 1956:196). In other words, the amino acids of legumes and the amino acids of corn, if eaten together, combine a more complete protein which is like meat. Meat is normally considered a complete protein.

The Pima, Papago, and Hohokam did hunt and secure a variety of native fauna. This meat was probably a dietary supplement that played a lesser role to plant foods in the historic and prehistoric diet. Even if the meat supply was waning at times, the supposed lack of nutrients could be made up by balanced utilization of plant foods, especially wild plants.

COMPOSITION OF PLANT FOODS, 100 GRAMS, EDIBLE PORTION

Dashes denote lack of reliable data for a constituent believed to be present in measurable amount.

Source	Food & Description	Water	Food Energy	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Ash	Calcium	Phos-phorus	Iron	Sodium	Potas-sium	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid
		%	Calo-ries	grams	grams	grams	grams	grams	milli-grams	milli-grams	milli-grams	milli-grams	milli-grams	Inter-national units	milli-grams	milli-grams	milli-grams	milli-grams
1	Amaranth seeds, raw	86.9	36	3.5	.5	6.5	1.3	2.6	267	67	3.9	---	411	6,100	.08	.16	1.4	---
1	Beans, common, mature seeds, dry:																	
	White:																	
	Raw	10.9	340	22.3	1.6	61.3	4.3	3.9	144	425	7.8	19	1,196	0	.65	.22	2.4	---
	Cooked	69.0	118	7.8	.6	21.2	1.5	1.4	50	148	2.7	7	416	0	.14	.07	.7	0
	Red:																	
	Raw	10.4	343	22.5	1.5	61.9	4.2	3.7	110	406	6.9	10	984	20	.51	.20	2.3	---
	Cooked	69.0	118	7.8	.5	21.4	1.5	1.3	38	140	2.4	3	340	trace	.11	.06	.7	---
1	Pinto, calico, and red Mesican, raw	8.3	349	22.9	1.2	63.7	4.3	3.9	135	457	6.4	10	984	---	.84	.21	2.2	---
1	Beans, lima:																	
	Immature seeds:																	
	Raw	67.5	123	8.4	.5	22.1	1.8	1.5	52	142	2.8	2	650	290	.24	.12	1.4	29
1	Bean flour, lima	10.5	343	21.5	1.4	63.0	2.0	3.6	---	---	---	---	---	---	---	---	---	---
2	Bean, Tepary, dry	10.2	---	19.9	2.9	---	17.7	13.3	---	---	---	---	---	---	---	---	---	---
3	Bean, Mesquite, dry	---	419	14.9	3.0	73.0	---	5.2	---	---	---	---	---	---	---	---	---	---
4	Bean, Mesquite, whole ground	6.9	---	11.6	---	---	23.9	4.5	---	---	---	---	---	---	---	---	---	---
3	Cholla buds, dry	---	393	12.2	2.5	79.0	---	10.6	2.7	---	---	---	---	---	---	---	---	---
2	Cholla stems, fresh	77.8	---	1.6	.3	---	1.7	4.2	---	---	---	---	---	---	---	---	---	---

TABLE 6

Source	Food & Description	Water	Food Energy	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Ash	Calcium	Phos-phorus	Iron	Sodium	Potas-sium	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid
		%	Calo-ries	grams	grams	grams	grams	grams	milli-grams	milli-grams	milli-grams	milli-grams	milli-grams	Inter-national units	milli-grams	milli-grams	milli-grams	milli-grams
1	Corn, field, whole grain, raw	13.8	348	8.9	3.9	72.2	2.0	1.2	22	268	2.1	1	284	490	.37	.12	2.2	---
1	Corn, sweet: Raw, white & yellow	72.7	96	3.5	1.0	22.1	.7	.7	3	111	.7	trace	280	400	.15	.12	1.7	12
1	Corn flour	12.0	368	7.8	2.6	76.8	.7	.8	6	164	1.8	1	---	340	.20	.06	1.4	---
2	Corn, papago, sweet, dry	9.1	---	7.9	1.8	----	---	8.5	---	---	---	---	---	---	---	---	---	---
1	Lambsquarters: Raw, Chenopodium	84.3	43	4.2	.8	7.3	2.1	3.4	309	72	1.2	---	---	11,600	.16	.44	1.2	80
3	Mescal pulp	---	347	4.56	1.06	81.0	---	8.2	2.4	---	---	---	---	---	---	---	---	---
1	Prickly pears, raw	88.0	42	.5	.1	10.9	1.6	.5	20	28	.3	2	166	60	.01	.03	.4	22
2	Prickly pear stems, dry	---	---	3.9	1.7	---	11.5	18.3	---	---	---	---	---	---	---	---	---	---
3	Prickly pear fruit, dry	---	280	1.7	2.6	62.0	---	18.3	6.4	---	---	---	---	---	---	---	---	---
1	Pumpkin, raw	91.6	26	1.0	.1	6.5	1.1	.8	21	44	.8	1	340	1,600	.05	.11	.6	9
1	Pumpkin & squash seed kernels, dry	4.4	553	29.0	46.7	15.0	1.9	4.9	51	1,144	11.2	---	---	70	.24	.19	2.4	---
1	Squash, summer, all varieties, raw	94.0	19	1.1	.1	4.2	.6	.6	28	29	.4	1	202	410	.05	.09	1.0	22
1	Squash, winter, all varieties, raw	85.1	50	1.4	.3	12.4	1.4	.8	22	38	.6	1	369	3,700	.05	.11	.6	13

TABLE 6 (Continued)

Source	Food & Description	Water	Food Energy	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Ash	Calcium	Phos-phorus	Iron	Sodium	Potas-sium	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid
		%	Calo-ries	grams	grams	grams	grams	grams	milli-grams	milli-grams	milli-grams	milli-grams	milli-grams	Inter-national units	milli-grams	milli-grams	milli-grams	milli-grams
3	Saguaro fruit, dry	---	499	10.3	15.0	70.0	---	3.3	---	---	---	---	---	---	---	---	---	---
3	Saguaro seeds, dry	---	609	16.3	30.6	54.0	---	3.3	---	---	---	---	---	---	---	---	---	---
3	Salvia seed, dry	---	621	21.1	23.0	67.0	---	5.4	.7	---	---	---	---	---	---	---	---	---
3	Tansy mustard, seed	---	554	23.4	12.9	71.0	---	4.6	.5	---	---	---	---	---	---	---	---	---
1	Walnuts, Black	3.1	628	20.5	59.3	14.8	1.7	2.3	trace	570	6.0	3	460	300	.22	.11	.7	---
3	Yucca fruit, dry	---	394	1.5	1.0	92.0	---	2.1	---	---	---	---	---	---	---	---	---	---
2	Yucca stems, dry	---	---	7.5	1.5	---	16.1	5.6	---	---	---	---	---	---	---	---	---	---

Sources:

1. Watt and Merrill, 1963
2. Catlin, 1925
3. Ross, 1944 : 41
4. Walton, 1923

TABLE 6 (Continued)

COMPOSITION OF ANIMAL FOODS, 100 GRAMS, EDIBLE PORTION

Dashes denote lack of reliable data for a constituent believed to be present in measurable amount.

Food and Description	Water	Food Energy	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Ash	Calcium	Phosphorus	Iron	Sodium	Potassium	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid
	%	Calories	grams	grams	grams	grams	grams	milligrams	milligrams	milligrams	milligrams	milligrams	International units	milligrams	milligrams	milligrams	milligrams
Beaver, cooked, roasted	56.2	248	29.2	13.7	0	0	.9	---	---	---	---	---	---	.08	.38	---	---
Muskrat, cooked, roasted	67.3	153	27.2	4.1	0	0	1.4	---	---	---	---	---	---	.16	.21	---	---
Quail, raw:																	
Total edible	65.9	168	25.0	6.8	0	0	1.6	---	---	---	---	---	---	---	---	---	---
Flesh and skin	66.3	172	25.4	7.0	0	0	1.4	---	---	---	40	175	---	---	---	---	---
Rabbit, wild:																	
Flesh only, raw	73.0	135	21.0	5.0	0	0	1.0	---	---	---	---	---	---	---	---	---	---
Sturgeon:																	
Raw	78.7	94	18.1	1.9	0	0	1.4	---	---	---	---	---	---	---	---	---	---
Cooked, steamed	67.5	160	25.4	5.7	0	0	---	40	263	2.0	108	235	---	---	---	---	---
Venison, lean meat only, raw	74.0	126	21.0	4.0	0	0	1.0	10	249	---	---	---	---	.23	.48	6.3	---

From Watt and Merrill, 1963

TABLE 7

Vegetable greens often contain amino acids and are often a rich source of vitamins A and C (Bowes and Church 1969). A review of Table 6 will indicate that wild plants frequently contain greater amounts of vitamins A and C (ascorbic acid) than domesticates. Lambsquarters, Chenopodium sp., is especially rich in vitamins A and C. Saguaro fruit is another rich source of vitamin A. The only comparable cultigen with these vitamin values is pumpkin. It should be noted that vitamin C destructs on exposure to heat and oxygen at a rather rapid rate; and the amount of loss, and true value of the vitamin, can only be measured after cooking (if done) and prior to eating. Vitamin A, on the other hand, is rather stable (Griffith, personal communication). The Hohokam could have had an adequate diet subsisting mainly on the corn, beans and squash triad; but, without fruits and greens, they would have had a greater tendency to develop disease (Griffith, personal communication). Although it is true that little work has been done on Hohokam skeletal pathology to date, no obvious symptons of disease such as scurvy has been reported. Lack of vitamin C in the diet will cause scurvy.

There ought not to be significant variation in the nutritional quality of wild meat versus domesticated meat. The prime difference is that domesticated animals tend to have a greater fat content (Wooldridge and Griffith, personal communication). More fat or cholesterol in the diet is not considered advantageous. Just as Ross (1944) found nutritional variance among the same species of plants from different localities, we can and should expect variance in meat sources within a single species. The quality of a given animal's diet directly relates to that animal's food value to man (Short, personal communication).

Ross (1944:3) and Hrydlicka (1908) state the Indians were in better health prior to the coming of the white man. Ross attributes the improved health to the former, more intensive use of native foods, while Hrydlicka offers the explanation that unrefined foods, together with natural exercise, led to the Indians' better health in bygone days.

At present, the Lower Sonoran Desert is hardly exploited for its wild foodstuffs by the Indians and almost not at all by the remaining population, yet it still remains a valuable source of food, especially in the Cercidium-Cereus complex. Unfortunately, we still have hunger despite our advanced technology. The Lower Sonoran

Desert remains a viable alternative as a food source potential and, if managed properly, could be utilized by modern peoples to stave off hunger for generations to come. It is the ultimate goal of the archeologist and the historian to take what we have learned from the past and offer it to our contemporaries so they may benefit. If this can be achieved, we have received our reward.

REFERENCES

Bell, Willis H. and E. F. Castetter
1937 The Utilization of Mesquite and Screwbean by the Aborigines in the American Southwest. University of New Mexico Bulletin 314, Biological Series, Vol. 5, No. 2, Albuquerque.

Benson, Lyman
1974 The Cacti of Arizona. 3rd edition, University of Arizona Press, Tucson.

Bohrer, Vorsilla L.
1962 Ethnobotanical Material from Tonto National Monument. In, Archaeological Studies at Tonto National Monument, edited by L. R. Caywood. Southwestern Monuments Association Technical Series, Vol. 2, pp. 79-114, Globe.

1970 Ethnobotanical Aspects of Snaketown, A Hohokam Village in Southern Arizona. American Antiquity 35:413-430.

Bohrer, V. L., H. C. Cutler and J. D. Sauer
1969 Carbonized Plant Remains from Two Hohokam Sites, Arizona BB:13:41 and Arizona BB:13:50. Kiva 35:1:1-10.

Bowen, Ruby
1939 Saguaro Harvest in Papagoland. Desert Magazine II (8):3-5.

Bowes, J. and C. F. Church
1969 Food Values of Portions Commonly Used. 11th edition, J. D. Lippincott Co.

Bruder, J. Simon
1975 Historic Papago Archaeology. In, Hecla II and III, and Interpretive Study of Archaeological Remains from the Lakeshore Project, Papago Reservation, South Central Arizona. By Albert C. Goodyear III, Arizona State University, Anthropological Research Paper No. 9, Tempe.

Carter, George F.
1945 Plant Geography and Culture History in the American Southwest. Viking Fund Publication in Anthropology, No. 5.

Castetter, Edward F.
1935 Uncultivated Native Plants Used as Sources of Food. The University of New Mexico Bulletin, Biological Series, Vol. 4, No. 1.

Castetter, E. F. and R. M. Underhill
1935 The Ethnobiology of the Papago Indians. The University of New Mexico Bulletin 275, Biological Series 4 (3).

Castetter, E. F. and M. E. Opler
1936 The Ethnobiology of the Chiricahua and Mescalero Apache. University of New Mexico Bulletin 297, Biological Series, Vol. 4, No. 5.

Castetter, E. F., and W. H. Bell
1937 The Aboriginal Utilization of the Tall Cacti in the American Southwest. University of New Mexico Bulletin 307, Biological Series 5 (1).

Castetter, E. F., W. H. Bell, and A. R. Grove
1938 The Early Utilization and Distribution of Agave in the American Southwest. University of New Mexico Bulletin 335, Biological Series 5 (4).

Castetter, E. F. and W. H. Bell
1942 Pima and Papago Agriculture. University of New Mexico Press.

Catlin, C. N.
1925 Composition of Arizona Forages, With Comparative Data. University of Arizona Agricultural Experiment Station Bulletin No. 113, Tucson.

Cutler, Hugh C.
1956 Vegetal Material from the Site of San Cayetano. In, The Upper Pima of San Cayetano del Tumacacori by C. C. DiPeso. Amerind Foundation Publication No. 7, pp. 458-463, Dragoon.

1958 Corn from the Reeve Ruin (Arizona BB:11:12). In, The Reeve Ruin of Southeastern Arizona. by Charles C. DiPeso, The Amerind Foundation Publication No. 8, Dragoon.

Cutler, Hugh C.
1965 Prehistoric Plant Remains from the Gila Bend Area. In, Salvage Archaeology in Painted Rocks Reservoir, Western Arizona. Anthropological Papers of the University of Arizona, No. 9, Tucson.

DiPeso, Charles C.
1956 The Upper Pima of San Cayetano del Tumacacori. Amerind Foundation Publication No. 7, Dragoon.

Dice, L. R.
1939 The Sonoran Biotic Province. Ecology 20:118-129.

Doelle, William
1975 Prehistoric Resource Exploitation Within the Conoco Florence Project. Arizona State Museum, University of Arizona, Tucson.

Dorroh, J. R., Jr.
1946 Certain Hydrologic and Climatic Characteristics of the Southwest. University of New Mexico Publication in Engineering 1:1-64.

Fewkes, Jesse W.
1912 Casa Grande, Arizona. Twenty-eighth Annual Report of the Bureau of American Ethnology, pp. 25-179, Washington.

Gasser, Robert E., and Frank E. Bayham
1975 The Flores Site: A Spatial-Functional Analysis. Paper presented at the 40th annual meeting of the Society for American Archaeology, Dallas.

Gladwin, H. S., E. W. Haury, E. B. Salyes and N. Gladwin
1937 Excavations at Snaketown: Material Culture. Medallion Papers No. XXV.

Goodyear, Albert C. III
1975 Hecla II and III, An Interpretative Study of Archaeological Remains from the Lakeshore Project, Papago Reservation, South Central Arizona. Arizona State University, Anthropological Research Paper No. 9.

Grady, Mark, S. Kemrer, S. Schultz and W. Dodge
1973 An Archaeological Survey of the Gila-Salt Aqueduct. Arizona State Museum, The University of Arizona.

Greenleaf, J. Cameron
1975 The Fortified Hill Site Near Gila Bend, Arizona. Kiva 40:4:213-282.

Hackenberg, Robert A.
1974 Aboriginal Land Use and Occupancy of the Pima-Maricopa Indians. Vol. II, Garland Publishing Co., New York.

Hall, Robert L.
1974 Plant Remains from the Escalante Group. In, Excavations in the Escalante Ruin Group, Southern Arizona. David E. Doyle, ed., Arizona State Museum, University of Arizona.

Haury, Emil W.
1936 The Snaketown Canal. In, Symposium on Prehistoric Agriculture. University of New Mexico Bulletin 296, Anthropological Series, Vol. 1, No. 5, pp. 48-50.

1950 The Stratigraphy and Archaeology of Ventana Cave, Arizona. University of New Mexico Press, Albuquerque, University of Arizona Press, Tucson.

1965 Snaketown: 1964-1965. Kiva, 31:1:1-13.

Hayden, Julian D.
1954 Excavations, 1940, at University Ruin. Southwestern Monuments Association, Technical Series, Vol. 5, Gila Pueblo, Globe.

Hrydlicka, A.
1908 Tuberculosis in the Indian. Charities and the Commons 21:245-247.

Ives, R. L.
1949 Climate of the Sonoran Desert. Annual Association of American Geographers 34:143-187.

Jones, D. B., C. E. F. Gersdorff, and S. Phillips
1938 Proteins of the Black Bean of the Mayas, Phaseolus vulgaris. Journal Biological Chemistry 122:745-755.

Jurwitz, L. R.
1953 Arizona's Two-Season Rainfall Pattern. Weatherwise 6:96-99.

Kaplan, Lawrence
1956 The Cultivated Beans of the Prehistoric Southwest. Annals of the Missouri Botanical Garden, Vol. 43.

Kearney, Thomas, and Robert H. Peebles
1969 Arizona Flora. 3rd edition, University of California Press, Berkeley.

Lowe, Charles H. editor
1964 The Vertebrates of Arizona. The University of Arizona Press, Tucson.

McGregor, John C.
1965 Southwestern Archaeology. University of Illinois Press, Urbana.

Martin, Paul S.
1963 The Last 10,000 Years: A Fossil Pollen Record of the American Southwest. The University of Arizona Press, Tucson.

Midvale, Frank
1968 Prehistoric Irrigation in the Salt River Valley, Arizona. Kiva 34:1:28-32.

Norris, J. J.
1950 Effect of Rodents, Rabbits, and Cattle on Two Vegetation Types in the Semi-Desert Range Land. New Mexico Agricultural Experiment Station Bulletin 353:1-24.

Nichol, Andrew A.
1937 The Natural Vegetation of Arizona. University of Arizona College of Agriculture, Technical Bulletin, No. 68, Tucson.

Niering, W. H., H. Wittaker, and C. H. Lowe
1963 The Saguaro: A Population in Relation to Environment. Science 142:15-23.

Patrick, H. R.
1903 The Ancient Canal Systems and Pueblos of the Salt River Valley, Arizona. Phoenix Free Museum Bulletin 1.

Raab, L. Mark
1973 AZ AA:5:2 - A Prehistoric Cactus Camp in Papagueria. Journal of the Arizona Academy of Science 8:116-118.

Ross, Winifred
1944 The Present Day Dietary Habits of the Papago Indians. Unpublished M. A. Thesis, The University of Arizona, School of Home Economics.

Russell, Frank
1975 The Pima Indians. Re-edition of the Twenty-Sixth Annual Report of The Bureau of American Ethnology (1908), Bernard L. Fontana, ed. The University of Arizona Press, Tucson.

Sellers, W. D. editor
1960 Arizona Climate. The University of Arizona Press, Tucson.

Schoenwetter, James
1970 Archaeological Pollen Studies of the Colorado Plateau. American Antiquity 35:35-48.

Schoenwetter, James, and Larry A. Doerschlag
1971 Surficial Pollen Records from Central Arizona, I.: Sonoran Desert Scrub. Journal of the Arizona Academy of Science 6:216-221.

Schulman, E.
1956 Dendroclimatic Changes in Semiarid America. The University of Arizona Press, Tucson.

Shreve, Forest and Ira L. Wiggins
1964 Vegetation and Flora of the Sonoran Desert. Stanford University Press, Palo Alto.

Smith, H. V.
1956 The Climate of Arizona. University of Arizona Agricultural Experiment Station Bulletin 279:1-99, Tucson.

Southworth, C. H.
1931 Volume 1, Supplemental Exhibits, Gila River Survey Report. Manuscript on file Pueblo Grande Museum, Phoenix.

Sparling, John B.
1975 Analysis of Faunal Remains from the Escalante Ruin Group. In, Excavations in the Escalante Ruin Group, Southern Arizona. David E. Doyle, ed., Arizona State Museum, University of Arizona.

Spicer, Edward H.
1962 Cycles of Conquest. The University of Arizona Press, Tucson.

Struever, Stuart
1968 Flotation Techniques for the Recovery of Small-Scale Archaeological Remains. American Antiquity 33:3:353-361.

Thackery, F. A. and A. R. Leding
1929 The Giant Cactus of Arizona: The Use of its Fruit and Other Cactus Fruits by the Indians. Journal of Heredity 20:400-414.

Turney, Omar A.
1929 Prehistoric Irrigation. Arizona Historical Review, Vol. 2, No. 1, pp. 12-52, Phoenix.

Underhill, Ruth M.
1939 Social Organization of the Papago Indians. Columbia University Press, New York.

Vivian, Gwinn R.
1974 Conservation and Diversion: Water-Control Systems in the Anasazi Southwest. In, Irrigation's Impact on Society. T. Dowing and M. Gibson, eds. Anthropological Papers of the University of Arizona, No. 25, Tucson.

Watt, Bernice and A. L. Merrill
1963 Composition of Foods: Raw, Processed, Prepared. United States Department of Agriculture, Agriculture Handbook No. 8, Washington.

Walton, G. P.
1923 A Chemical and Structural Study of Mesquite, Carob, and Honey Locus Beans. United States Department of Agriculture Bulletin No. 1194.

Weaver, Donald E., Jr.
1972 A Cultural-Ecological Model for the Classic Period in the Lower Salt River Valley, Arizona. Kiva 38:43-52.

Withers, Arnold M.
1944 Excavations at Valshni Village, A Site on the Papago Indian Reservation. American Antiquity 10:33-47.

Wood, J. S., D. E. Ward, and R. E. Gasser
1975 Excavations at the West Wall of the Mound, Pueblo Grande. Manuscript on file, Pueblo Grande Museum, Phoenix; Arizona State Museum, Tucson; and the Arizona State University, Tempe.

Woodbury, Richard B.
1960 The Hohokam Canals at Pueblo Grande, Arizona. American Antiquity 26:267-270.

1961 A Reappraisal of Hohokam Irrigation. American Anthropologist 63:550-560.

1962 Effects of Environmental and Cultural Limitations Upon Hohokam Agriculture. In, Civilizations in Desert Lands. Richard B. Woodbury, ed., pp. 41-55, University of Utah Anthropological Papers, No. 62, Ogden.

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