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ARCHAEOLOGICAL MAIZE FROM NORTHERN CHILE

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INTRODUCTION

Now that the modern races of maize of the countries of this hemisphere have been classified and described in a series of eleven publications issued by the National Academy of Sciences-National Research Council, it has become a common procedure for botanists analyzing collections of prehistoric remains of corn of a particular country to relate the ancient specimens, so far as is possible, to the living races of that country. The modern maize of Chile has been described by Timothy *et al.* (1961), who recognized nineteen more or less distinct races.

As part of a study of prehispanic cultural development in the Atacama Desert of northern Chile, the junior author of this report obtained several collections of maize cobs from archaeological sites found near the town of Chiu Chiu, which lies beside the middle section of the Loa River. The vicinity of Chiu Chiu, at an elevation of 2500 meters, is a small oasis along the river which supports a narrow band of vegetation in the extreme

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desert environment. The region around the town has a long and almost unbroken archaeological sequence beginning at least 10,000 B.C. and lasting until post-Conquest times. A summary of the cultural sequence since the introduction of ceramic technology (ca. 500 B.C.) is found in Pollard (1971). The appearance of maize cultivation in the archaeological record (ca. A.D. 100) is associated with artificial irrigation technology.

Maize from the Earliest Site

The earliest site found with associated maize is designated RAnL 100. Although no prehispanic structures are preserved, the site is believed to be the earliest agricultural village settlement along the middle Loa River. Sections of the site include a small intact refuse mound, a looted cemetery, ancient agricultural terraces and irrigation canals, and ruins of a historic-period house. A 1.0 × 2.5 m. cut was excavated in the refuse mound, revealing five well separated, but culturally homogeneous layers, the deepest of which (layer 5) was as much as 55 cm. below ground surface. Each layer yielded an abundance of sherds, various lithic artifacts, and sizeable quantities of *Lama* sp. bones. Layers 2–5 each contained varying amounts of *Lama* sp. wool and mesquite seeds (*Prosopis chilensis*). Layers 3 and 5 also contained several gourd fragments (*Lagenaria* sp.). Twenty maize cobs and several fragments were recovered from layers 2–5. Radiocarbon analysis of a sample of *Lama* sp. wool and skin from layer 5 resulted in a date of A.D. 105 ± 105 (GX-1644). At present, this is the earliest date for maize agriculture in northern Chile.

Of the nineteen races of maize described by Timothy *et al.* (1961), we recognize three in the collection from site 100. Descriptions of these follow:

Capio Chico Chileno

Twenty of the oldest cobs are considered to be related to this modern race; their characteristics are set forth in Table 1. All of the cobs represented in this table came from the test excavation described above. Layer provenience is represented by the last number in the code, except that layer 2 is represented by two code numbers, 2 and 7. There is no clear relationship between the depth of the layer and the characteristics of the cobs. Within each layer the cobs are arranged in order of their lengths, for identification purposes.

We call particular attention to the last cob listed in Table 1. This was very small with a length of 2.6 cm., a diameter of 1.6 cm., and 12 kernel rows. The senior author, having shortly before studying the Chilean speci-

TABLE 1

Characteristics of the cobs from the earliest site (RAnL 100), dated at A.D. 105.

code no.	length (cm)	diameter (cm)	diam/length ratio	kernel-row no.
100–2	3.7	1.8	.49	22
100–3	3.6	1.1	.31	14
"	3.1	1.3	.42	18
"	3.4	1.4	.41	16
"	2.1	1.5	.72	16
100–7	6.3	1.8	.29	18
"	6.2	1.6	.26	12
"	6.1	1.7	.28	18
"	5.3	1.1	.21	12
100–4	5.6	2.1	.37	18
"	5.4	1.3	.24	16
"	5.7	1.6	.28	16
"	5.1	1.5	.29	16
100–5	7.0	2.8	.40	30
"	5.2	2.0	.38	18
"	4.2	1.6	.38	16
"	4.1	1.9	.46	22
"	3.6	2.0	.56	18
"	3.6	1.5	.42	16
"	2.6	0.8	.31	12
average	4.6	1.6	.35	17.2

mens been engaged in studies of the prehistoric wild corn of the Tehuacán Valley in Mexico, saw in this specimen some resemblance to the Mexican corn; this raised in his mind the question of whether there could once have been a wild corn in Chile. Subsequent correspondence with the junior author made it clear that this part of Chile could scarcely have provided a suitable habitat for wild corn, and we concluded that this specimen is probably that of a stunted ear, borne on a depauperate plant.

Except for their smaller size, these earlier Chilean cobs (see Plate XV, fig. A) are quite similar in their characteristics to cobs of the modern race Capio Chico. The average data for their lengths, diameters, diameter/length ratios, and kernel-row numbers are 4.6, 1.6, 0.35, and 17.2 respectively. For their modern counterparts, the corresponding averages, published by Timothy *et al.*, are 8.6, 2.3, 0.27, and 17.2 respectively. The similarity in kernel-row numbers is especially significant.

In their dimensions, the Chilean cobs resemble even more closely the prehistoric ears excavated by Dr. Dwight Wallace from the Los Cerillos site in the Ica Valley on the south coast of Peru, some 1100 km. north of the Chilean site. This corn, estimated to be 2300–2500 years old, has been briefly described by Grobman *et al.* (1961) as a prehistoric race, Confite Iqueño; three ears of this race are illustrated in their figure 19.

The specimens from the Los Cerillos site are unusually well preserved, the kernels still being attached to their cobs. To obtain estimates of the diameters of the cobs, we subtracted from the diameters of the ears 9/10 of the length of two average kernels, assuming that 1/10 of their length, on the average, was embedded in the cob; this figure is based on the data published by Timothy *et al.* for Capio Chico.

Estimates obtained in this manner from the Los Ceril-

los maize produced the following averages: 5.6, 1.8, 0.32, and 17.8. These are so similar to those set forth above for the prehistoric Chilean cobs that we may conclude, with some degree of confidence, that the two collections represent essentially the same race, Confite Iqueño. By the same token, we can assume that if the Chilean cobs had retained their kernels, the intact ears would have been similar in their general appearance to those of the Los Cerillos maize, illustrated by Grobman *et al.* in their figure 19.

Polulo

This race is represented among the oldest cobs by a single specimen which is so different from the remaining ones that it must be considered as that of a different race. This specimen is 3.4 cm. long, but it is probably not intact with respect to length, since it lacks a peduncle. Also, since it comprises only the rachis, the central stem of the cob, the floral bracts having been lost, its diameter/length is not comparable with other cobs in this collection. The kernel-row number is 10; the cupules are distinct, slightly longer than wide and are hairy; stumps of the rachillae are prominent.

We might not have been able to identify this single specimen had not we found counterparts of it in a collection from site RAnL 337-1. Cobs of that lot, illustrated in Plate XV, fig. B, were derived from the shallow fill within the foundation of an isolated house dating to the late prehispanic period.

Anticipating a description of this lot, to be set forth later, we can say that of the 115 cobs of site 337-1, thirty-five are of a very distinctive type. These have slender rachises and peduncles of about the same diameter as the rachises. The floral bracts that remain attached to the rachises are relatively long; both lower and upper

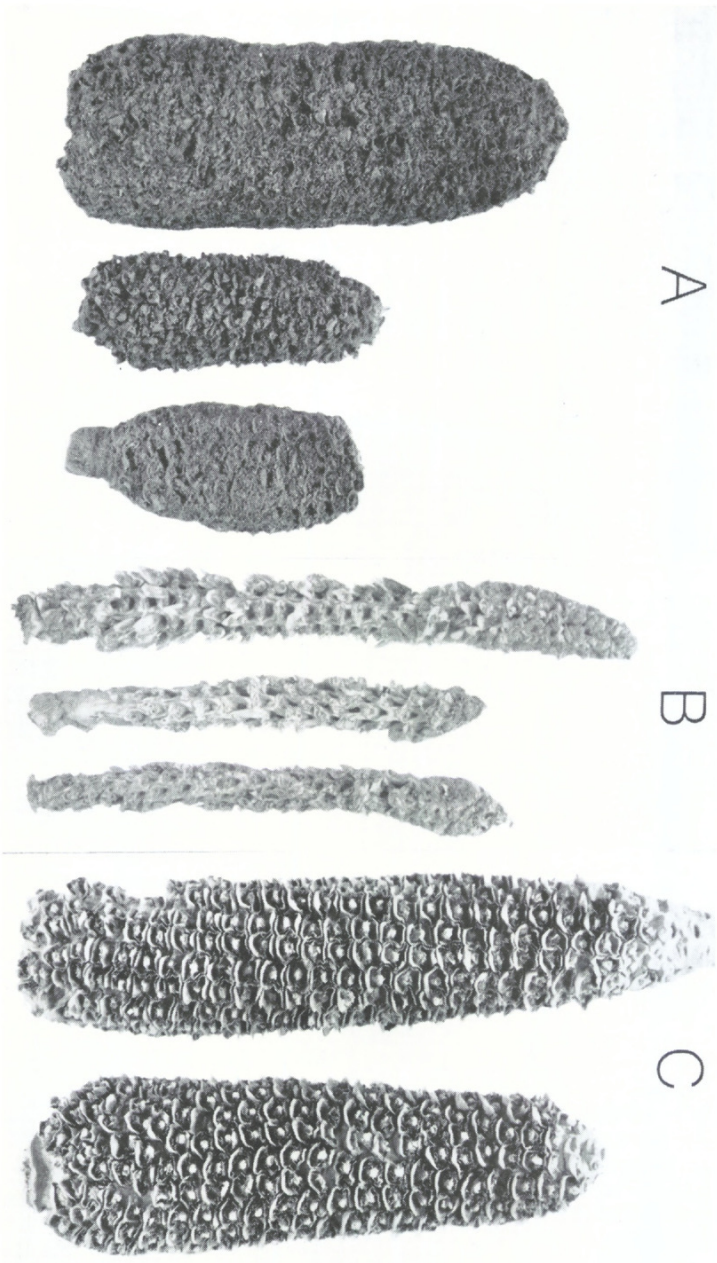
EXPLANATION OF THE PLATE

FIG. A. Three of the larger cobs from lot 100, dated at ca. A.D. 100. These are quite similar in the average dimensions to the prehistoric Peruvian race Confite Iqueño, and are related to the modern Chilean race Capio Chico Chileno. (Actual size.)

FIG. B. Three of the more slender cobs from lot 337-1, dated at ca. A.D. 1250. These are related to the modern Chilean race Polulo, which may in turn be related to the Peruvian popcorn Confite Morocho. (Actual size.)

FIG. C. Two cobs from lot 290, dating to the late prehispanic period. These are prehistoric counterparts of the modern Chilean race Chutucuno Chico, which may be related to the Peruvian race Confite Puntiagudo. Note the stiff, curved lower glumes, a characteristic which may have been derived from one of corn's relatives, teosinte or *Tripsacum*. (Actual size.)

PLATE XV



glumes are herbaceous and not at all indurated. They are typical of certain types of pod-corn involving lower alleles at the pod-corn locus in combination with *Ti*, a major tunicate-inhibiting gene (see Mangelsdorf 1974).

There is only one known modern Chilean race, Polulo, to which these slender cobs can be assigned. This is a finger-shaped popcorn with 10–16 kernel rows, grown at approximately 2700 meters. Its glumes are soft, the rachillae long and slender.

Timothy *et al.* state that the race Polulo seems not to be duplicated among collections made in other South American countries, but there seems to us a possibility that it is related to the Peruvian popcorn race Confite Morocho. Indeed one of the ears of Polulo illustrated in figure 5 of Timothy *et al.* resembles rather closely one of the ears of Confite Morocho illustrated in figure 48 of Grobman *et al.* (1961). Both have about the same length, 9.1 and 8.5 cm. respectively; both have 10 kernel rows and their rows are slightly irregular. One of the most distinctive characteristics of the archaeological specimens is their peduncles, which have about the same diameters as the rachises. The data of Grobman *et al.* show that this is true of Confite Morocho.

Galinat (1969) has isolated from the Peruvian race Confite Morocho types with cobs so slender that he calls them "string cobs." These slender cobs are found also in the Peruvian race Rabo de Zorro, which Grobman *et al.* regard as a hybrid derivative of Confite Morocho. Moulds thought to represent ears of Rabo de Zorro occur on a number of ceramic vessels of the Moche culture (Early Intermediate Period); several of these are illustrated in Grobman *et al.* (figs. 31 and 32), and one in Mangelsdorf (1974, fig. 17.13). These show that this slender-cob trait in South American races is an ancient one. The fact that it is not known in Mexican races may

lend some support to the hypothesis (Mangelsdorf 1974) that there may have been an independent domestication of maize in South America. It is in this connection that the slender-cobbed Chilean specimens are of particular interest.

Galinat (1972) has recently published a brief description of the archaeological maize turned up by MacNeish in a site in Ayacucho, Peru. He states that some of the cobs resemble those of the race Confite Morocho, but these are not among the earliest cobs from this site. They are tentatively dated at 3000 B.P.

Chutucuno Chico

This race, described by Timothy *et al.*, appears to be represented by one specimen obtained from near the top of looters' backdirt adjacent to the cemetery on site 100. This single cob is 7.6 cm. long; its most prominent feature is the stiff indurated lower glumes.

This specimen could be a precursor of cobs with stiff indurated lower glumes occurring in lots from sites RAnL 186, 268B, and 290, described briefly below. These in turn appear to be related to the living Chilean race Chutucuno Chico which is grown at altitudes of 2260 to 2500 meters. Timothy *et al.* describe this race as a small yellow popcorn with large cobs having 16–22 or more kernel rows. Both red and white cobs occur in the modern as well as the late prehistoric collections.

Chutucuno is in some respects similar to the fasciated form of the Peruvian primitive race Confite Puntiagudo described by Grobman *et al.* and illustrated in their fig. 56. These authors attribute the indurated tissues of the rachis and lower glumes to hybridization with corn's relative *Tripsacum*.

Maize from Later Sites

RAnL 2

This site is a cemetery of more than 100 niche and pit graves at the locality of Chiu Chiu, and appears to have been utilized ca. A.D. 800. All the burials were found to have been looted, with broken artifacts and organic remains, including maize cobs, strewn on the ground surface.

Fifty intact or almost intact cobs and six fragments were collected from the surface scatter. Of the intact cobs, twenty-nine are red and twenty-one white. Many are quite tripsacoid in having indurated tissues of the rachis and glumes. These cobs are quite similar to those of the lot from site RAnL 290 except that they are smaller. In shape they are tapered and rounded at the butts. The shanks are intermediate in thickness; the lower glumes are stiff, and the rachillae long. Measurements of five red and five white cobs show no significant differences in the two types except perhaps in kernel row numbers. The averages for lengths, diameters, and kernel row numbers are 7.6 cm., 1.7 cm., and 18.0 for the red cobs, and 7.5 cm., 1.6 cm., and 15.6 for the white.

RAnL 1

This is a village site located at the present dispersed settlement of Lasana beside the Loa River, and may have been occupied from ca. A.D. 800 until Spanish arrival in the early 16th century. Maize cobs were collected from scattered surface refuse, and comprise eleven intact or almost intact specimens and six fragments.

Three of the specimens resemble the slender cobs in the lot from site 337-1, and three resemble the thicker cobs from that same site. Five cobs are quite tripsacoid, with their tissues highly indurated either naturally or hardened through some kind of impregnation. One of the cobs has several single spikelets, a characteristic of corn's relatives teosinte and *Tripsacum;* both of the lat-

ter differ from corn in having solitary instead of paired pistillate spikelets. Three of the cobs have stumps of what may have been staminate spikes.

RAnL 290

This is a small burial site of niche and shaft graves near Chiu Chiu, dating to the late prehispanic period. All graves were found looted, but a collection of maize cobs was made from the surface of the burial chambers.

Thirty-seven cobs were collected, of which eighteen are red or pink, seven variegated, and twelve white. The predominating shape is tapering with rounded butts; the shanks are intermediate in thickness. The lower glumes are stiff, indurated and glabrous. On several of the cobs some of the lower glumes have spots of brown pigmentation characteristic of maize-teosinte or maize-*Tripsacum* hybrids. The rachillae are prominent and in some specimens protrude beyond the lower glumes.

There are no marked differences between the red cobs and the white. Averages for lengths, diameters, and kernel row numbers for eight red cobs are 9.0, 2.4, and 18.3; for six white cobs these measurements are 8.9, 2.6, and 18.3. Two of the red cobs from this site are illustrated in Plate XV, fig. C. Most of the cobs appear to be related to the modern race Chutucuno Chico, which still occurs in Antofagasta Province.

RAnL 186

Dating to the late prehispanic period, this site consists of a single isolated shelter/dwelling situated on barren terrain 2 km. from the Loa River. A cache of between 400 and 500 maize cobs was found in the earth floor of the structure.

The cobs are quite variable in shape and other characteristics. Some are tapering at both ends; others are

more slender and more nearly cylindrical. With respect to diameter/length ratios, the cobs in a selected sample of twenty specimens vary from 0.13 to 0.86. In kernel-row numbers these same specimens vary from ten to twenty-six. Many of the cobs are twisted and contorted, and some are fused into conglomerate masses. They must have been somewhat soft and pliable at one time, perhaps as the result of some chemical action in the soil.

With respect to race, these cobs appear to represent a kind of "melting pot" in which the principal participants were the races Capio Chico and Polulo; a minor component may have been Chutucuno Chico.

RAnL 268B

This is another small, looted cemetery of niche graves near Chiu Chiu, dating to the late prehispanic period. A cache of fifty-three cobs was found within one of the burial chambers.

The specimens are similar to the cobs from site 290 with respect to color; twenty-nine are red or pink, six variegated, and eighteen white, but are brighter due to better preservation. Another similarity is the stiff lower glumes, which in some specimens are curved like the teeth of a wood rasp. Most of the cobs appear to be related to the modern Chilean race Chutucuno Chico.

RAnL 337-1

This isolated house site is located beside the Loa River among scrub vegetation, and is at least 12 km. from the nearest prehispanic settlement. The remains consist of a surface scatter of artifacts and a 3.0 by 3.5 meter house foundation which contained a maximum of 28 cm. of unstratified refuse. A sample of wood from the excavation yielded a radiocarbon date of A.D. 1250 ± 90 years (I-5399), thus placing the site within the late prehispanic period.

In one respect, the maize from the refuse is the most interesting of all of the lots recovered because it contains cobs of a slender type not previously described in the archaeological record of South America.

The lot comprises 115 cobs, of which fifty are rather thick, tapering at both ends. The diameter/length ratios of these vary from 0.25 to 0.32 in five typical cobs that were measured; the kernel-row number varied from fourteen to eighteen. These cobs appear to be related to the modern Chilean race Capio Chico Chileno.

The slender cobs (see Plate XV, fig. B) are thirty-five in number. In five cobs measured, diameter/length ratios varied from 0.09 to 0.14, and kernel row numbers from twelve to sixteen. Both upper and lower glumes are herbaceous, quite different from the stiff, indurated glumes of Chutucuno Chico, and they probably represent a form of pod-corn. As mentioned earlier in this report, they appear to be related to the Chilean race Polulo, which in turn may be a descendant of the primitive popcorn race Confite Morocho.

Four kernels were found in this collection. All are popcorn: three are yellow in color and one is brown.

Discussion

The cobs of these collections, the earliest as well as the more recent, appear to be related to three still living Chilean races: Capio Chico Chileno, Polulo, and Chutucuno Chico. These in turn are related respectively to three prehistoric Peruvian races: Confite Iqueño, the popcorn race Confite Morocho, and the popcorn race Confite Puntiagudo. The last-named race resembles in a number of characteristics the Mexican popcorn Polomero Toluqueño, but the remaining two races have no close counterparts in Mexican maize, either prehistoric or modern. This fact is consistent with the suggestion

(see Mangelsdorf 1974) that there may have been an independent domestication of corn in South America.

Acknowledgments

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