4

The Physical Environment of the Guilá Naquitz Cave Group

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INTRODUCTION

During 1964 and 1966, the Oaxaca project visited more than 60 caves and rockshelters in a search for preceramic occupations in the eastern Valley of Oaxaca. About 10 sites were picked for testing, and on the basis of the test results, 4 were selected for more extensive excavation. All the best preceramic caves occurred in the amphitheater-shaped area mentioned in the previous chapter—a region bounded on the east by Mitla, on the west by Loma Larga, on the north by the Dan Ro? mountain range, and on the south by the Río Grande de Mitla.

Many of these caves are in the lower cliffs of the Dan Ro?, on ejido lands once owned by the ex-Hacienda El Fuerte, some 4–5 km northwest of Mitla and 2–3 km from the Postclassic Mitla Fortress (Fig. 4.1). The widespread distribution of ignimbrite, a volcanic rock that readily forms caves, has allowed the formation of several cave groups in this arm of the Valley of Oaxaca. The physical environment of the El Fuerte cave group, however, offers definite advantages over other caves for human occupance. The caves are natural and have formed in low cliffs at the base of the mountains forming the continental divide. Above the caves, the land rises steeply to the rich wild food resources of the oak–pine forest, and below them the steep slopes give way to the lower gradients of the alluvial fans and pediment surfaces that comprise the piedmont zone. Lower still, the piedmont grades into the alluvial deposits of the Río Grande de Mitla, whose course is now incised between 3 and 7 m into its own deposits at a distance of 3 km from the cave area. The caves are therefore located at the important boundary between the mountain and piedmont zones, so that people using the caves had direct access to the resources of several physiographic and ecological zones.

The caves that have been tested or excavated occur in two groups. The larger group, including Guilá Naquitz (OC-43), Martínez Rockshelter (OC-48), Silvia's Cave (OC-47), and Cueva de los Afligidos (OC-45), is situated along a continuous cliff at an elevation of ca. 1900 m. The smaller group, including Cueva Blanca (OC-30) and Cueva Redonda (OC-27), is found 1.5 km to the northeast along another cliff at an elevation of ca. 1800 m (Fig. 4.2).

The Guilá Naquitz cave group has formed at the base of a cliff that varies from south to east in aspect and from 20 to 40 m in height. It forms the rim of a small valley, only 0.4 km^2 in area, which is drained by a small ephemeral stream flowing 50 m below the base of the cliff. It is below the cliff on the steep slopes of this valley, and along the stream course, that some of the richest wild plant resources are to be found. Immediately above the cliff, the land flattens to form a plateau 1.5 km^2 in area, which provides another, though less important, source of wild plant foods. The plateau provides a flat area that can be used as marginal

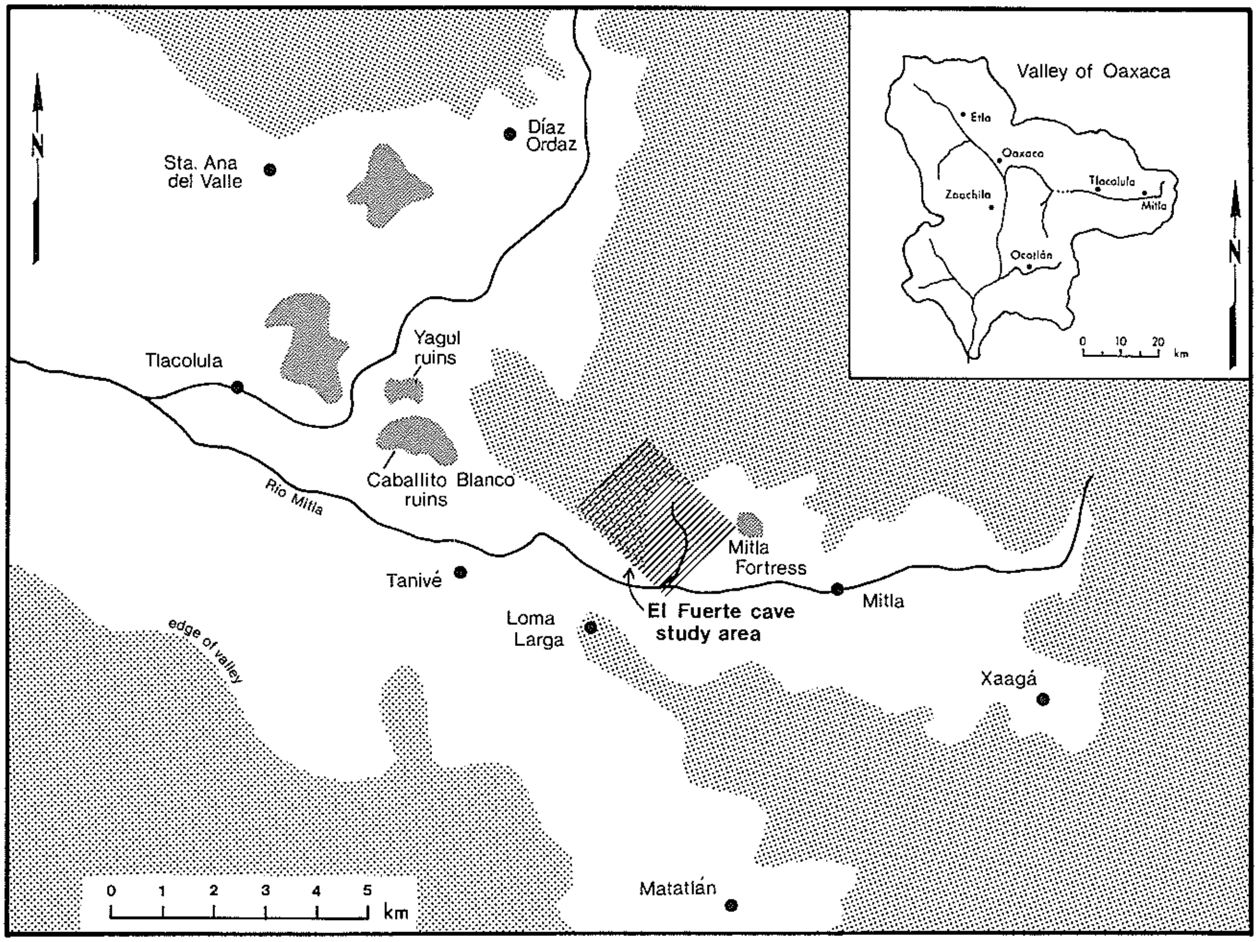

FIGURE 4.1. The eastern Tlacolula Valley, showing the El Fuerte cave area.

agricultural land, and across it passes an important route between the valley of Díaz Ordaz and the Mitla area (Fig. 4.3).

The Cueva Blanca group is situated at the base of a low cliff, only 10 m high, and the various caves face in different directions between west and south as the cliff curves around, following the direction of a stream that flows from the mountains. This ephemeral stream drains an area of 4.3 km^2, and in the vicinity of the caves its course changes from a 50-m-deep , V-shaped valley, characteristic of the mountain zone, to a shallow (2–5-m-incised) piedmont valley cutting into the surface of its own alluvial fan. This group of caves is located closer to piedmont land flat enough for cultivation, and with terracing even the 20° talus slope below the caves has been tilled at one time or another.

GEOLOGY AND SOILS

Most of the area is underlain by ignimbrite, but on the piedmont surface below the caves are thin deposits of consolidated sands derived from the ignimbrite (Fig. 4.4). Ignimbrite is a layered volcanic tuff. Each layer of debris is released in a single flow and becomes welded together as it cools. Earth movements since deposition have extensively uplifted and faulted the ignimbrites. Dips are generally less than 10° but are variable in inclination and direction. The layers are of variable thickness and resistance to erosion, and each layer tends to be most resistant in the middle (Williams and Heizer 1965). Caves form in the more resistant, cliff-forming layers, and appear to have been formed by weathering and collapse along alcove-shaped stress surfaces. Progressive deepening of alcoves leads to the formation of caves without the agency of water erosion, and this type of cave formation is most common in relatively arid regions such as the Valley of Oaxaca.

The dryness of the cave is important both for its selection as a prehistoric living and storage site and for the preservation of archaeological remains, particularly vegetable materials. The existence of dry caves is always to some extent a fortunate chance but is encouraged by a number of factors:

1. Potential evapotranspiration is greater than rainfall for most months of the year.

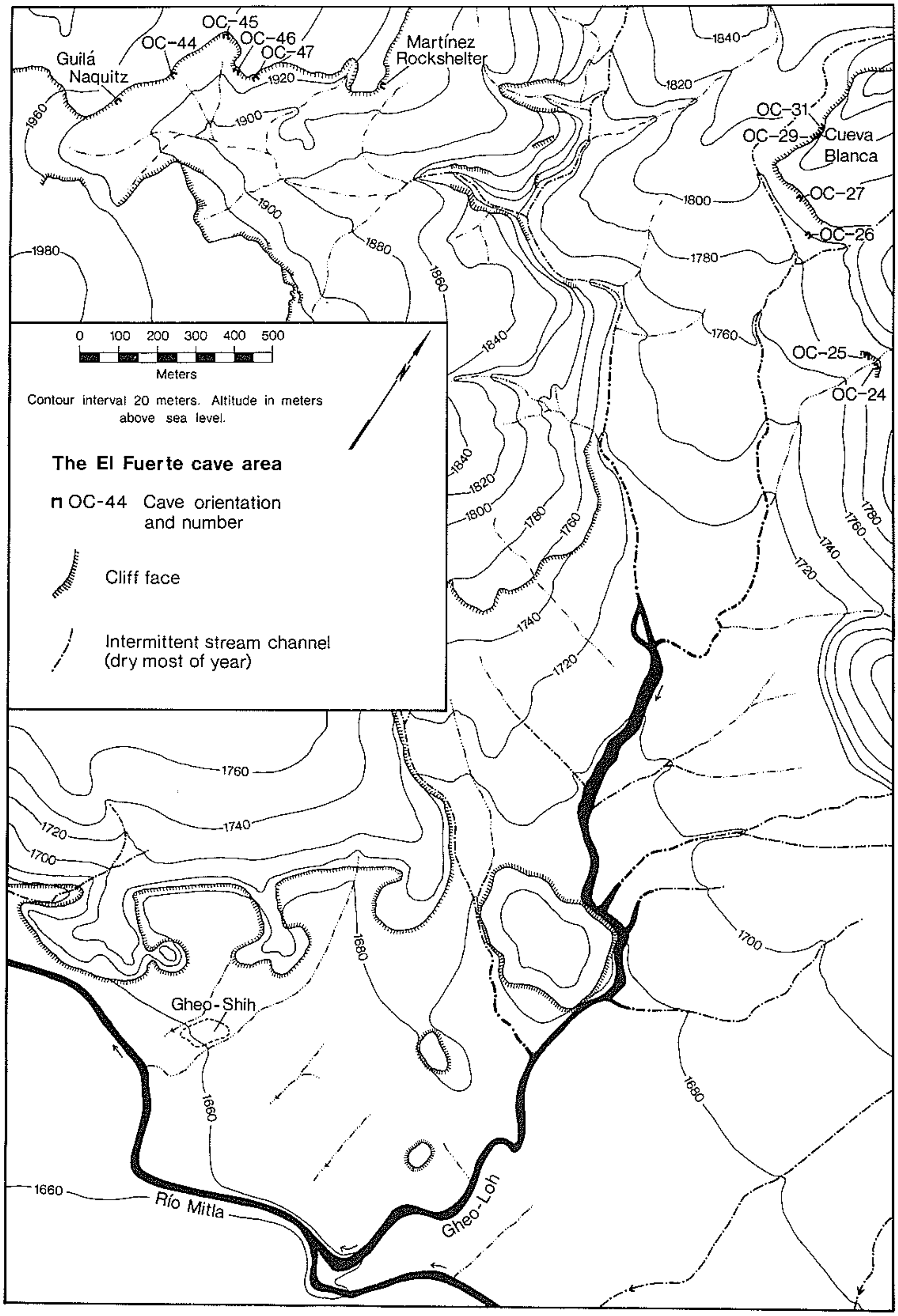

FIGURE 4.2. Topographic map of the El Fuerte cave area, showing stream channels, cliffs, and caves.

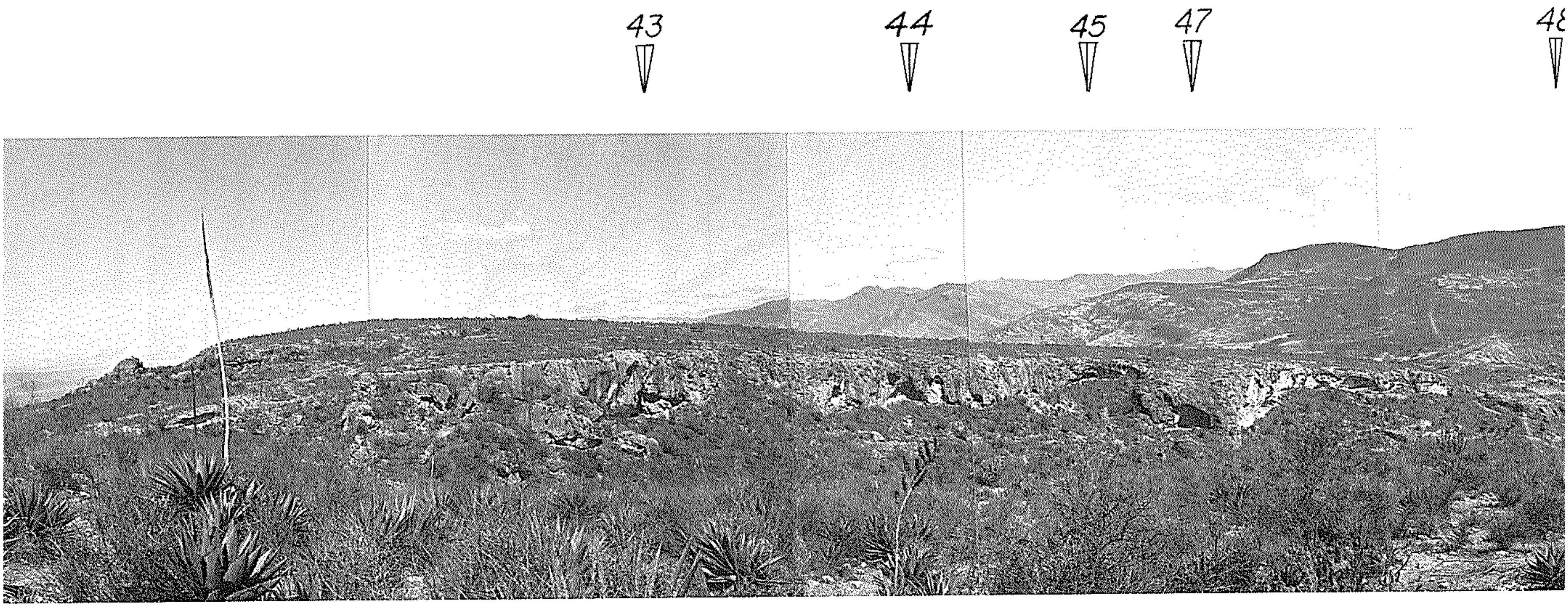

FIGURE 4.3. Photo mosaic of the Guilá Naquitz cliff, with locations of OC-43 (Guilá Naquitz), OC-44, OC-45 (Cueva de los Afligidos), OC-47 (Silvia's Cave), and OC-48 (Martínez Rockshelter) given by vertical lines. In the foreground are numerous examples of *Agave potatorum*, an edible maguey.

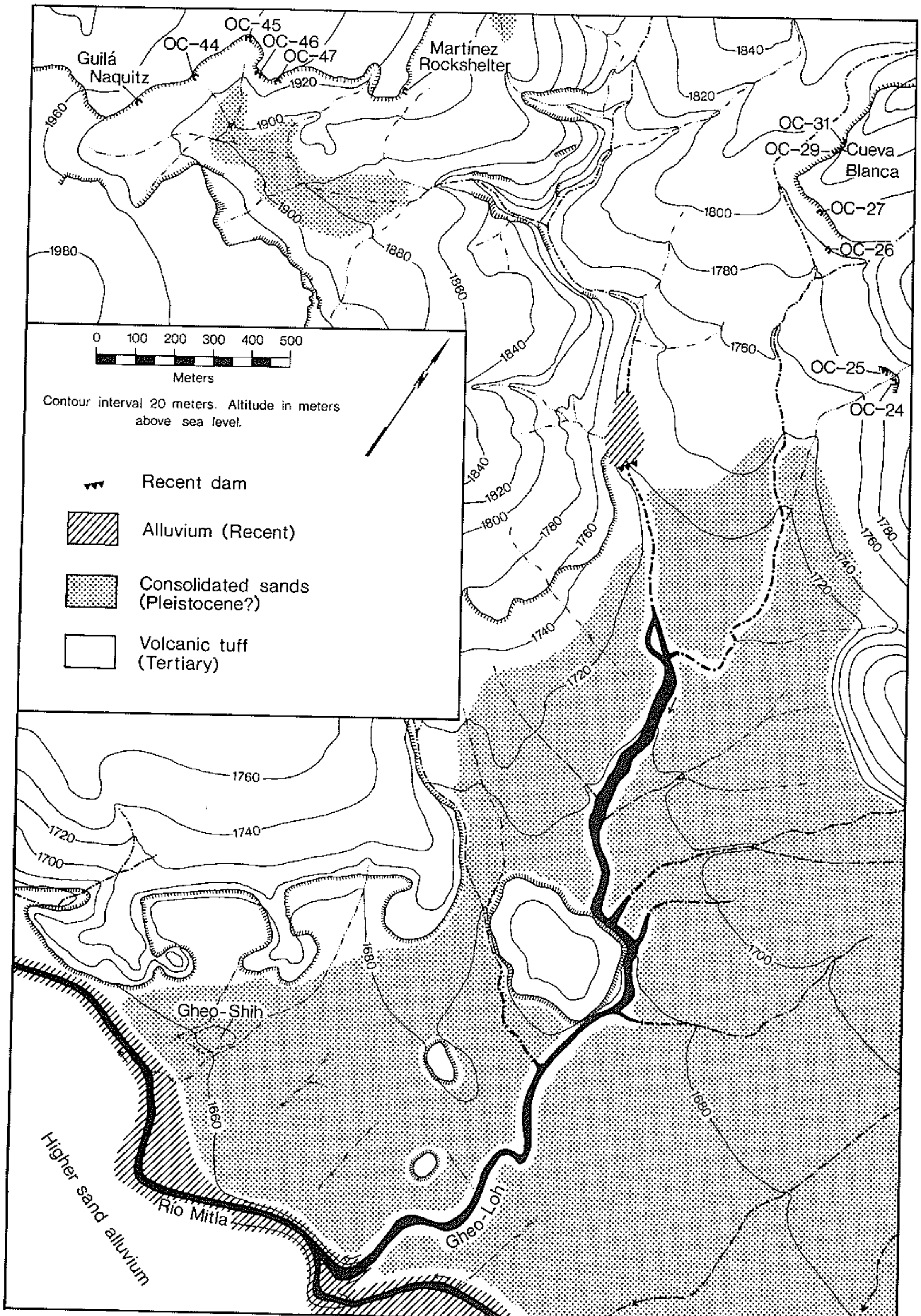

FIGURE 4.4. Geology and soils of the El Fuerte cave area.

2. The cliff overhang is sufficient to shield the cave from most of the direct rainfall.
3. The cave was not initially formed by running water.

The Mitla caves are particularly suitable for dry living and storage conditions and for good archaeological preservation because

1. They are located in the driest part of the Valley of Oaxaca.
2. The ignimbrite layers are less resistant at the top and bottom of each layer so that these weather out, and the cliff formed by the resistant middle part of each layer provides a protective overhang for the caves.
3. The ignimbrite is not a readily soluble rock, so that caves tend to be formed by arching rather than through solution by running water.

Below the caves, the piedmont surface is mainly covered by a thin (ca. 5-m) layer of consolidated sands, probably Pleistocene in age, derived from the ignimbrite. They contain no datable material and weather to soils very similar to those developed directly on the ignimbrite. Throughout the area, therefore, soils are generally stony sands (more than 15% of particles are coarser than 2 mm diameter) with low clay content (less than 5%). Except on the narrow stream floodplains, these soils are less than 25 cm deep, have low water-holding capacity, and are low in nutrients.

CLIMATE AND HYDROLOGY

The Mitla area is the driest part of the Valley of Oaxaca. Potential evapotranspiration exceeds mean rainfall for every month of the year, so that only specialized semiarid vegetation is able to grow; exceptions occur along watercourses and in bottomland areas with a water table at less than a 5-m depth. Estimated climatic figures for the Mitla valley bottom and the higher cave area are given in Table 4.1. The low ratios of rainfall to potential evapotranspiration for the Mitla valley bottom indicate that, under dry farming conditions, winter crops cannot be grown, perennial crops can only be grown if they are xerophytic (such as nopal or maguey), and the Mitla area is marginal for summer annual crops such as maize or beans. The cave area has higher ratios of rainfall to potential evapotranspiration than the bottom of the Mitla Valley (1.10 for the summer as opposed to 0.48), so that on climatic grounds alone an annual maize crop in the summer months near the caves has a good chance of survival.

There are no appreciable areas near the caves where the water table is at less than a 5-m depth, and wells are not used in the area. However, the local streams have only traveled short distances from their source areas in the mountains, so that perennial pools and seeps are common in the beds of the larger streams. The Cueva Blanca group of caves is situated only 60 m from the nearest suitable stream, whereas occupants of the Guilá Naquitz group had to travel over 1 km to reach perennial pools (Fig. 4.5). Although frosts occur in the Mitla cave area, it is the absence of available water that limits plant growth in the winter, rather than the occasional frosts.

The combination of (1) relatively steep slopes with poor, thin soils and (2) a marginal rainfall area without the benefit of available irrigation water severely limits the agricultural potential of the cave area for maize. Only the piedmont surface is flat enough for maize cultivation without terracing; and even here, the soils developed on the Quaternary sands are thin and low in nutrients. After a 3–5-year period of fallow, the productivity today from this type of land is about 0.2 metric tons/ha in an average year. Even today (and without considering the alternative of collecting wild plants), a farmer can barely work enough land to feed himself and a family of five with such low maize yields. Before the Postclassic period, corncob sizes (and hence yields) would have been impossible to subsist on maize grown in this area as the main food supply (A. Kirkby 1973: Fig. 48). However, cultivation of primitive varieties of cucurbits, such as seen in Guilá Naquitz, should have been possible in the upper Thorn Forest based on rainfall alone.

VEGETATION ZONES AND THEIR FACIES

The general pattern of natural vegetation (Fig. 4.6) probably provides a more sensitive indicator of variations in available moisture than the climatic estimates. Vegetational

TABLE 4.1
Estimated Climate for the Mitla Region[a]

Area	Elevation (m)	Mean annual temperature (°C)	No. of frosts per yr.	Mean annual rainfall (mm)	Mean annual potential evapotranspiration (mm)	Rainfall ÷ potential evapotranspiration whole year	June – Sept.
Valley bottom	1650	19.9	2	480	2000	0.24	0.48
Cave area	1900	18.6	5?	600	1300	0.46	1.10

[a]Values are based on the meteorological station data for Tlacolula and Oaxaca, with supplementary rainfall data collected by the Oaxaca project for Mitla village. Additional information provided by valley-wide correlations between potential evapotranspiration and monthly temperature and by the calculated environmental lapse rate.

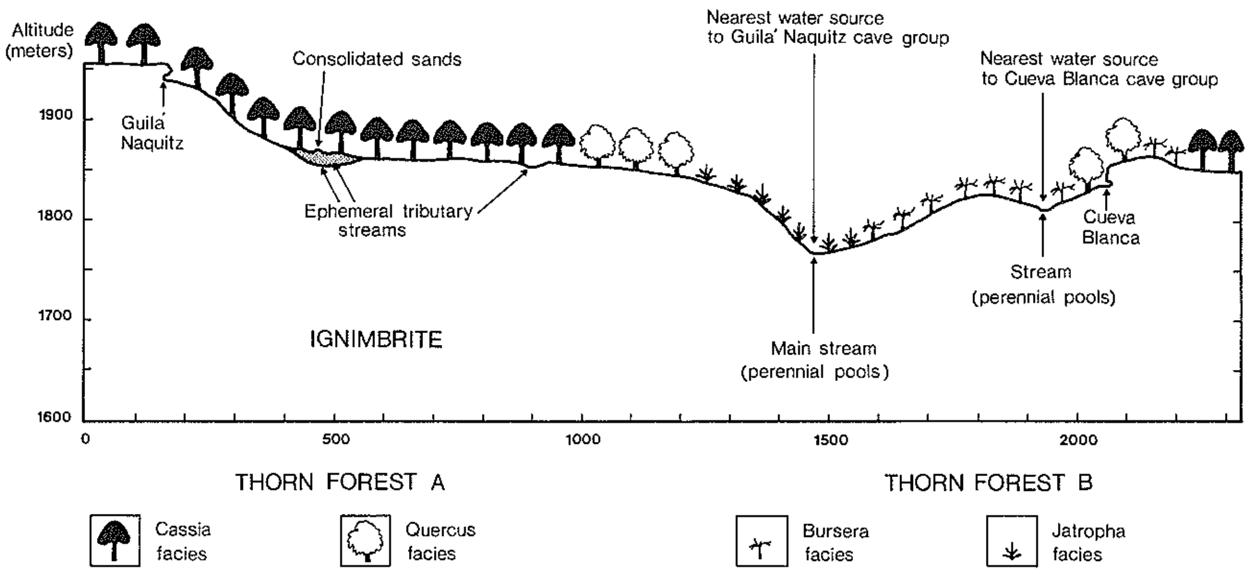

FIGURE 4.5. Cross section from Guilá Naquitz to Cueva Blanca showing geology, water sources, and vegetation zones.

zones show an overall altitudinal zonation, with an oak-dominated zone coming down to about 2000 m elevation, our Thorn Forest A zone (see below) descending to about 1800 m, and our Thorn Forest B zone extending to about 1750 m. The oak facies of our Thorn Forest A zone is mainly confined to steep north-facing slopes where there is less moisture loss through evapotranspiration. Along stream courses are concentrated the more moisture-loving plants such as *Baccaris* ("seep willow," or Zapotec *yak šeh*), *Diospyros* (wild black zapote), *Salix bonplandiana* (willow), and *Alnus* (alder), here presented in the order in which they first occur as one goes upstream. However, there appears to be little extension of the hillside vegetation zones down the valleys, showing that only the channels themselves are rich in moisture.

Lower Oak Zone

The Lower Oak zone, which today occurs some 100 m above Guilá Naquitz, probably represents an impoverished vestige of the "original" oak–pine zone reconstructed by Smith (1978). Pine trees have literally been eliminated from the vicinity of the cave, including the piñon pine whose nuts appear in the prehistoric refuse. According to Smith (1978), farther upslope one can find *Pinus michoacana*. The only oak left near Guilá Naquitz is *Quercus impressa*, which extends down into Thorn Forest A. Other useful trees of this zone are the manzanita (*Arctostaphylos polifolia*), whose wood was used as fuel for maguey-roasting pits (Fig. 4.7); the madroño (*Amelanchier denticulata*); the *tejocote*, or hawthorn (*Crataegus mexicana*), whose fruits were eaten at Cueva Blanca; and a wild black zapote (*Diospyros* sp.; Fig. 4.8).

Thorn Forest A

Thorn Forest A is the vegetation zone in which, under today's climatic conditions, Guilá Naquitz is located. It has at least two facies, (1) one in which oaks are present (*Quercus* facies) and (2) a second in which *tepeguaje* is common (*Cassia* facies). While present, oaks are never common in Thorn Forest A; *Agave* is common; and *Ferrocactus* is uncommon.

Thorn Forest A is characterized by a dense growth of thorny shrubs, trees of varying heights, and tall columnar cacti. The zone is extraordinarily rich in edible plants, and near the cave are relatively undisturbed patches that give us a glimpse of the "original" thorn–scrub–cactus vegetation reconstructed by Smith (1978) for the upper piedmont.

Among the obvious food resources of Thorn Forest A are the acorns supplied by the scattered oaks on north-facing slopes (Figs. 4.9 and 4.10). Legume trees are common; most preferred of these is the *guaje* (*Leucaena esculenta*), whose abundant pods contain edible seeds (Fig. 4.11), but there are also its less-favored relatives *tepeguajes* (*Lysiloma divaricata* and *Cassia polyantha*) or huizaches (*Acacia farnesiana*). Copal trees (*Bursera* sp.) grow right outside the cave (Fig. 4.12).

Distinctive features of the zone are monumental columnar cacti such as *Lemaireocereus treleasi* (Spanish *cardón* or *tunillo*, Zapotec *bidsz-lats*) and *Myrtillocactus schenkii* (Spanish *garambullo*, Zapotec *bidsz-žob*) (Figs. 4.13 and 4.14), both of which have edible fruit. Another common cactus is the prickly pear (*Opuntia* spp.), whose fruits (tunas) are edible raw and whose tender young stem sections (nopales) are edible if cooked (Fig. 4.15). Its relative the cholla, or jumping cactus (also *Opuntia* sp.), is equally abundant.

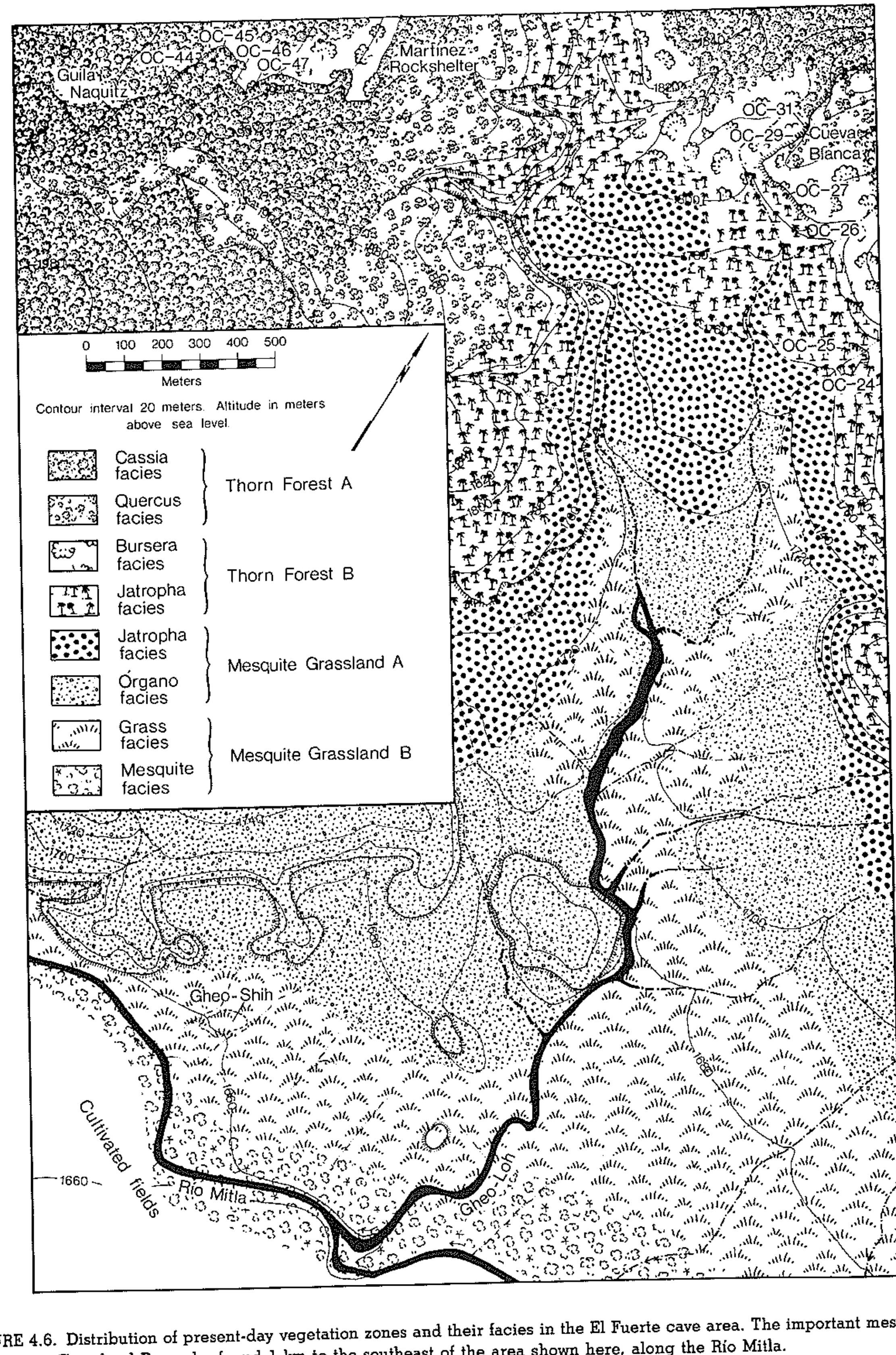

FIGURE 4.6. Distribution of present-day vegetation zones and their facies in the El Fuerte cave area. The important mesquite facies of Mesquite Grassland B can be found 1 km to the southeast of the area shown here, along the Río Mitla.

FIGURE 4.7. Manzanita (*Arctostaphylos polifolia*).

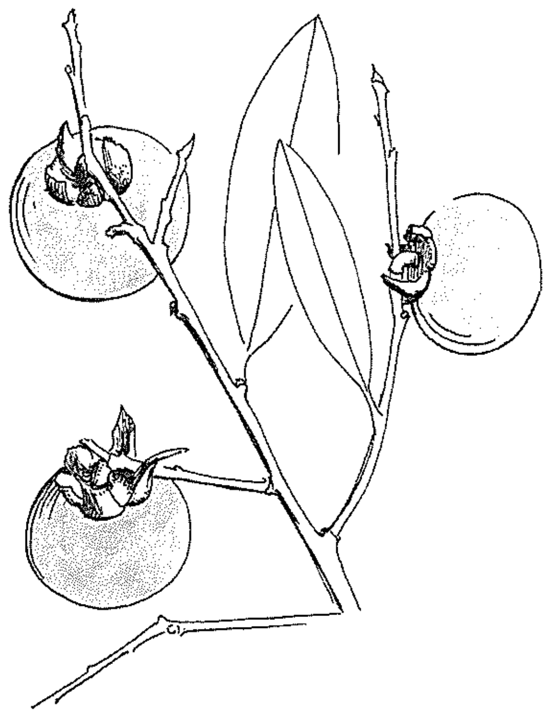

FIGURE 4.8. Wild black zapote (*Diospyros* sp.).

Thorn Forest A is characterized by many species of *Agave*, from the larger magueys *A. potatorum* (Zapotec, *dobh-gih*) and *A. marmorata* to the much smaller *lechuguilla* (*A. karwinskii*), whose inflorescence was sometimes used as a fire drill hearth in ancient times. *Agave potatorum* is edible, but only after the heart has been baked for 24 to 72 hours in a rock-lined earth oven or roasting pit (Flannery 1968: 70–71).

In addition to the wild black zapotes in stream canyons, this zone has trees and bushes of the nanche, or West Indian cherry (*Malpighia* sp.), whose fruits can be eaten raw. There are also a number of food plants for which we have only Zapotec names. Chief among these is the *yak susí* (*susí* tree), a low shrub with edible nuts encased in spherical seed coats that are borne in pairs (Fig. 4.16). The *susí* (*Jatropha neodioica*) is apparently the only edible member of its genus in the region; its relative the *mala mujer* (*Jatropha urens*) is one of the most avoided plants in the thorn forest since it produces a stinging rash that can last for days.

Other plants of this zone include the *chapuliztle* (*Dodonaea viscosa*), a bush that makes the whole region aromatic after rains; *Randia watsonii*, a thorny shrub with bittersweet fruits; the saw-edged sotol (*Dasylirion* sp.), whose prickly colonies cluster along blowouts and deflated areas; and *Hechtia*, a terrestrial bromeliad that can be used for fiber.

Thorn Forest B

Thorn Forest B has a somewhat less dense growth than Thorn Forest A, and a greater number of woody plants are shrubs rather than trees (Fig. 4.17). Oaks are absent; *Cassia* and *Agave* are less common; *Ferrocactus* is more common. The zone has *Bursera* and *Jatropha* facies.

As might be expected, Thorn Forest A and B share many species. Most of those already discussed grow more densely in A, but there are some that do very well in B also. These include the *pájaro bobo*, or morning glory tree (*Ipomoea pauciflora*), ocotillo (*Fouquieria* cf. *formosa*), and the pincushion cactus known as *chilillo* (*Mammillaria* sp.). The *chilillo's* name is derived from its red, chile pepper–shaped fruits, which are sweet (rather than spicy) and can be eaten raw (Fig. 4.18).

Other plants shared by Thorn Forest A and B include wild cucurbits such as the coyote melon (*Apodanthera aspera*) and wild runner beans (*Phaseolus heterophyllus* and *P. atropurpureus*). There are also special humid areas near springs and seeps where one can find clusters of wild onions (*Allium* sp.).

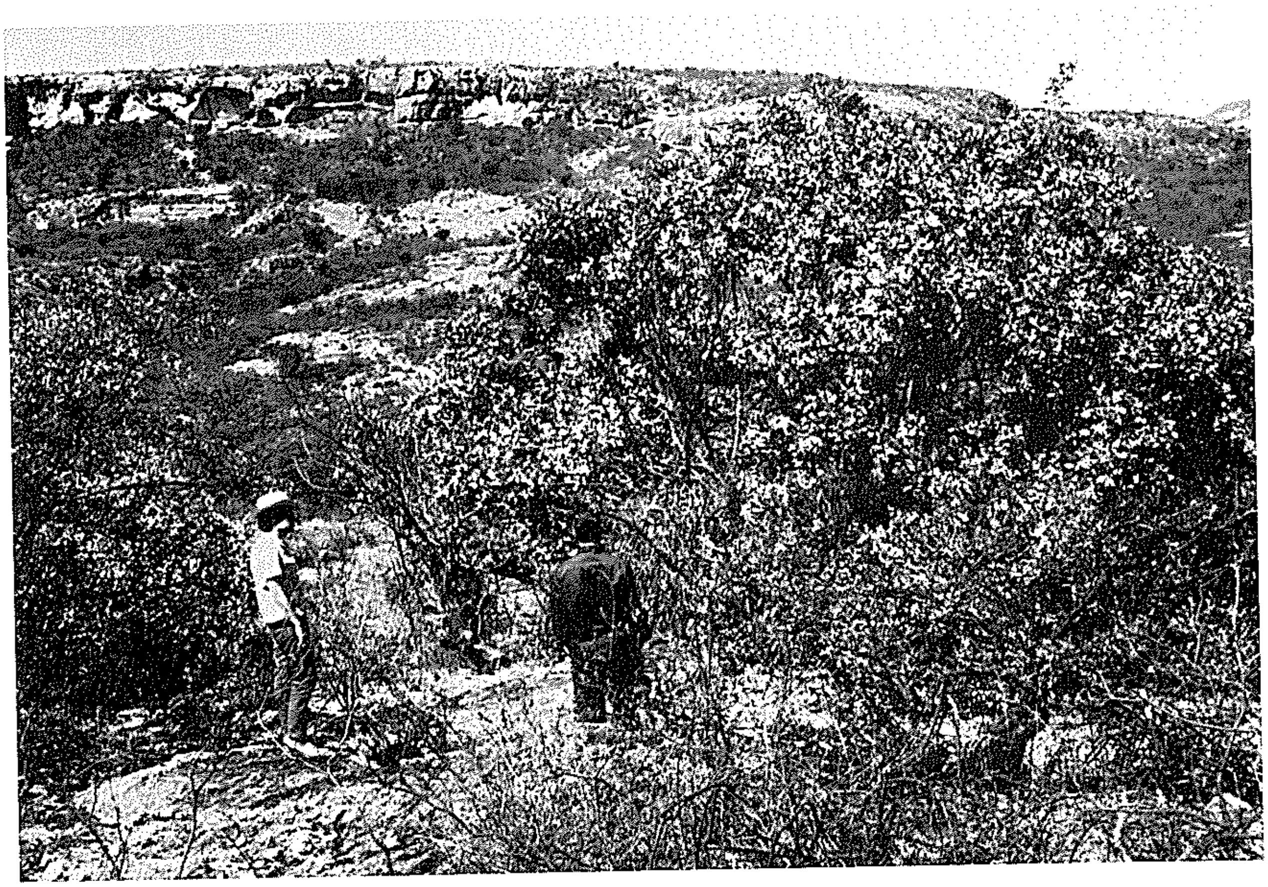

FIGURE 4.9. Thorn Forest A, *Quercus* facies. The oak tree in the right foreground bore more than 2000 acorns.

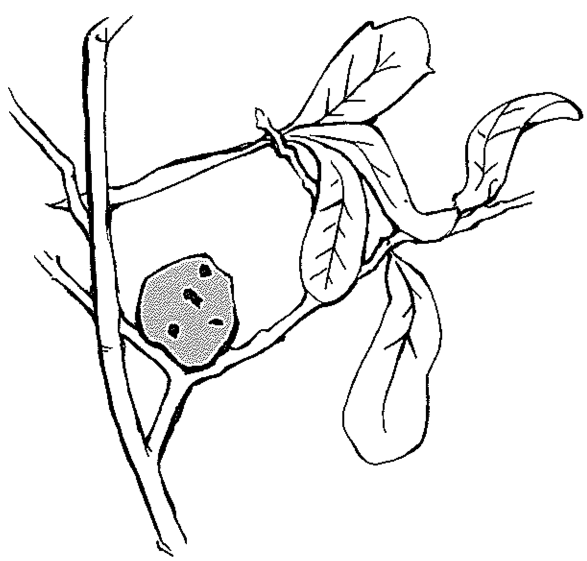

FIGURE 4.10. Oak gall from Thorn Forest A. These edible galls were sometimes collected by the occupants of Guilá Naquitz (see Chapter 19).

Mesquite Grassland A

Mesquite Grassland A has at least two facies: (1) In its *mala mujer* facies, *Jatropha urens* and/or *Dodonaea viscosa* are common, *Bursera* is absent, and the landscape is dominated by grass, with a relatively low density of shrubs and no trees at all. (2) In its organ cactus facies, *Jatropha urens* is rare and *Dodonaea* absent, columnar cacti are common, and mesquite (*Prosopis juliflora*) is present though not abundant. This facies is characterized by its preponderance of organ cactus and its relative paucity of shrubs.

While Mesquite Grassland A is a zone of transition, its relative impoverishment has undoubtedly been increased by overgrazing since the Spanish Conquest. It is perhaps the zone poorest in wild plant foods, except for such things as cactus fruits.

Mesquite Grassland B

Mesquite Grassland B is all that remains today of the "original" primary vegetation zone reconstructed by Smith (1978) as mesquite forest (Fig. 4.19). It has two facies: (1) Where most disturbed by man, it has a grass facies, with grass dominant, mesquite present but not abundant, and *Jatropha* and *Dodonaea* absent. The open-air site of Gheo-Shih lies

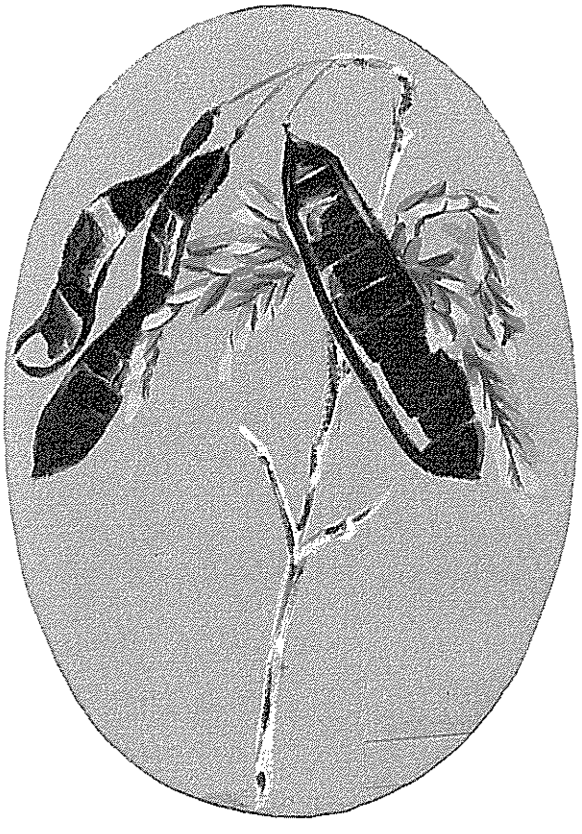

FIGURE 4.11. *Guaje* (*Leucaena esculenta*).

in this barren facies, where human activity will not allow the native vegetation to return (Fig. 4.20). (2) Where left undisturbed for a reasonable length of time, a mesquite facies develops that is dominated by *Prosopis juliflora*. The facies characteristically seeks out areas of relatively shallow subsurface water table (less than 5 m), where phreatophytes such as mesquite flourish and form a rather dense growth of trees up to 6 m tall (Fig. 4.21). The pods of these mesquite trees, producing up to 180–200 kg of edible portion per hectare, are one of the main resources of this facies (Fig. 4.22). Other important plants include the *rompecapa* or desert hackberry (*Celtis pallida*), whose fruits can be eaten raw (Fig. 4.23); the so-called crucifixion thorn (*Dalea* sp.); the milkweed-like *binya'a*, a member of the Asclepidaceae; the isote (*Yucca* sp.), whose fiber was used in ancient times; and *Acacia farnesiana* (Fig. 4.24).

NATIVE ANIMALS

The native animals of the Guilá Naquitz area are similar in species composition to the fauna of thorn forest areas in the Tehuacán Valley (Flannery 1967). In both areas, of course, land clearance and overhunting have caused some animals to seek refuge in the higher mountains, while the more tolerant species flourish even in second growth.

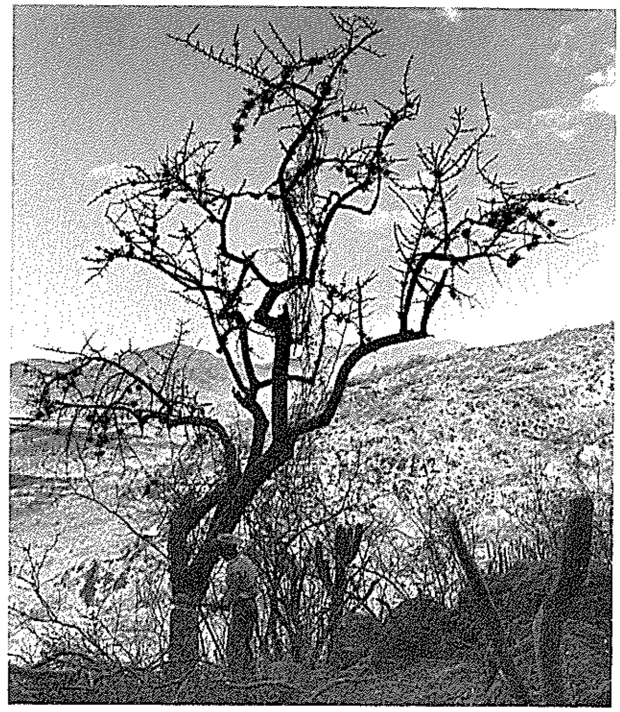

FIGURE 4.12. Copal tree (*Bursera* sp.) on the talus of Guilá Naquitz. Note epiphytes.

Surely the most important local animal was the white-tailed deer (*Odocoileus virginianus*), still present in the upper reaches of the Dan Ro? range but long since eliminated from the Guilá Naquitz area. The collared peccary (*Dicotyles tajacu*) tolerates human disturbance even more poorly and probably abandoned the area even sooner.

Smaller animals of the region include the coyote (*Canis latrans*), the gray fox (*Urocyon cinereoargenteus*), the opossum (*Didelphis marsupialis*), the raccoon (*Procyon lotor*), the cacomixtle (*Bassariscus astutus*), the coatimundi (*Nasua narica*), and three genera of skunks (*Mephitis, Conepatus,* and *Spilogale*). Of all the small mammals, however, the most important in the prehistoric diet appear to have been rabbits. Still common in the region are the jackrabbit (*Lepus mexicanus*), the *tepetoztle*, or large Mexican cottontail (*Sylvilagus cunicularius*), and the *conejito*, or small Eastern cottontail (*Sylvilagus floridanus connectens*).[1] The cottontails, in particular, are still abundant in the Guilá Naquitz area (see Chapter 18).

Present in virtually every level at Guilá Naquitz was the mud turtle (*Kinosternon integrum*), which inhabits pools of water near seeps and springs, as well as mudholes along the Río Grande de Mitla. Two small lizards, *Cnemidophorus* and

[1] *Sylvilagus floridanus connectens* is one of the smallest races of cottontail, as small as an Audubon cottontail and easily confused with the latter until one examines the tympanic bullae. Further work with the smaller cottontails Flannery collected in Tehuacán has convinced him they are also *S. floridanus connectens*, rather than *S. audubonii* as he originally reported (Flannery 1967).

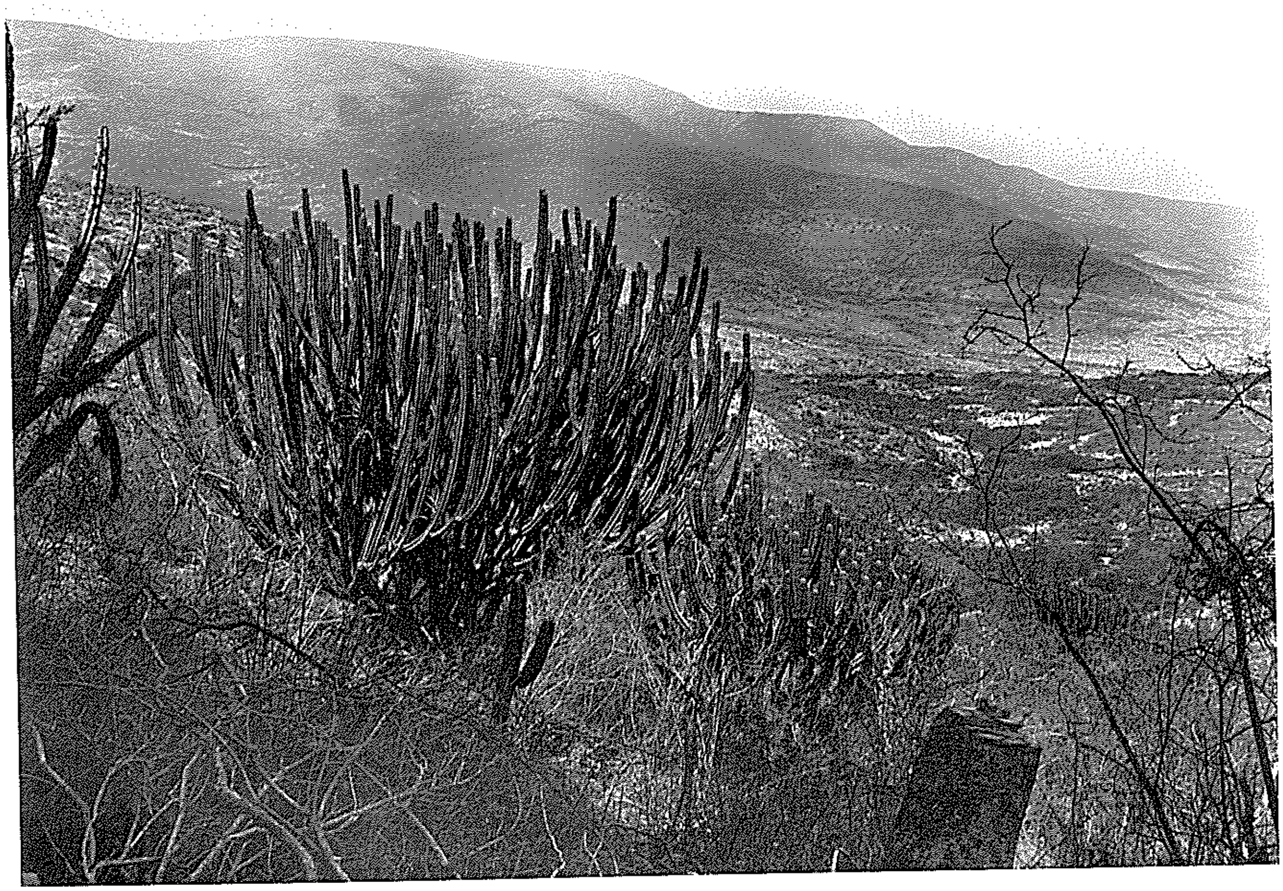

FIGURE 4.13. Thorn Forest A, *Cassia* facies. The organ cacti in the left foreground are *Myrtillocactus schenkii*.

Sceloporus, are among the reptiles common in the area. Small rodents are numerous and include *Liomys irroratus, Oryzomys couesi, Reithrodontomys* spp., *Peromyscus* spp., *Baiomys musculus, Sigmodon hispidus,* and *Neotoma mexicana* (see Chapter 16 for discussion).

The birdlife of the region is rich, and seems to flourish in spite of human modification of the landscape. Most important to the prehistoric foragers were the doves, pigeons, and quail, which still inhabit the thorn forest. Included are the band-tailed pigeon (*Columba fasciata*), the *huilota* or mourning dove (*Zenaidura macroura*), the *torcaz* or white-winged dove (*Zenaida asiatica*), the *paloma barranqueña* or white-fronted dove (*Leptotila verreauxi*), the *tortolita* or ground-dove (*Columbigallina passerina*), the bobwhite (*Colinus virginianus*), and the Montezuma quail (*Cyrtonyx montezumae*). The call of the chachalaca (*Ortalis poliocephala*) could be heard from the talus of Guilá Naquitz, and the barn owl (*Tyto alba*) roosted inside. Hawks, including *Buteo jamaicensis*, are common in the area and their feathers may have been used for fletching atlatl darts.

One animal that does seem to have vanished entirely from the Valley of Oaxaca fauna is the pocket gopher *Orthogeomys grandis*. Common in Formative sites, it seems to have been eliminated so thoroughly that our workmen could not recall ever having seen one.

MORE DISTANT ENVIRONMENTS

A word should be said about the environment zones that might have been encountered by hunter–gatherers entering or leaving the eastern Valley of Oaxaca. Travelers ascending further into the Dan Ro? mountains today eventually reach a cloud forest with tall pines, mosses, orchids, and numerous epiphytes (Fig. 4.25). This high montane forest remains humid even when the lower valley is in the grip of the dry season, and it may have provided crucial forage for deer, peccary, and other animals between January and March. This is an important point to bear in mind, because the resources of the valley and piedmont are extremely meager during this period. We do not know where the occupants of Guilá Naquitz went during the late dry season, but one possibility would be this mountain zone at nearly 3000 m. There are

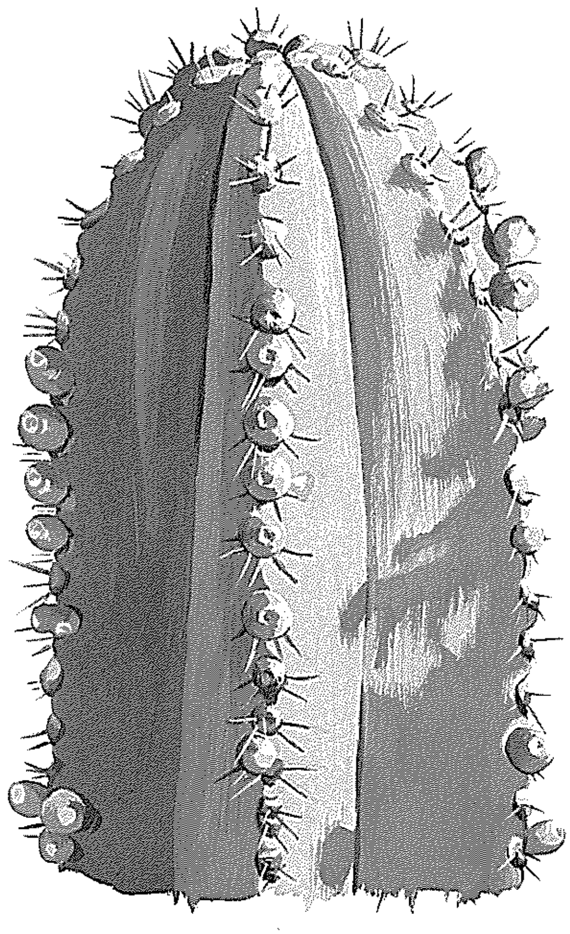

FIGURE 4.14. *Myrtillocactus* (Zapotec *bidsz-žob*), showing characteristic tiny fruits.

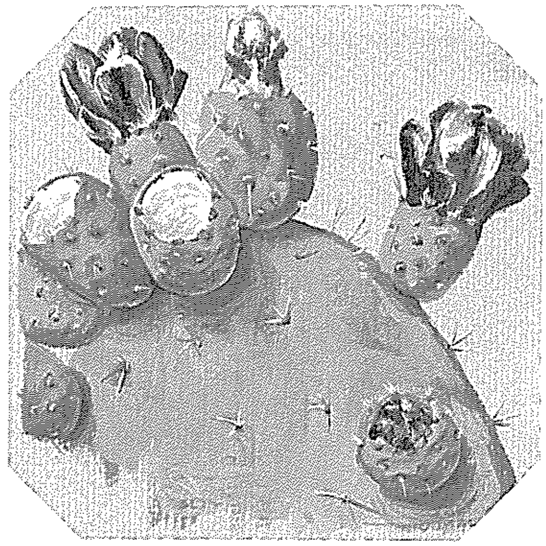

FIGURE 4.15. Prickly pear (*Opuntia* sp.), showing flowers, mature fruits (tunas), and stem section (nopal).

caves at the top of the Dan Ro?, such as *Biliyär Gusi?* ("Lightning's Cave") and *Biliyär Calaver* ("Skull Cave"), formerly used for ritual by the Mitla Zapotec (Parsons 1936:295).

Leaving Mitla to the south, enroute to the Isthmus of Tehuantepec, travelers today reach a zone of arid tropical thorn forest not unlike that surrounding Purrón Cave in the southern Tehuacán Valley. This hot, dry canyon area, below 1000 m elevation, features a magnificent complex of giant organ cactus (Fig. 4.26), including the pitahayo (*Lemaireocereus* cf. *pruinosus*) with its large red fruits (Fig. 4.27). Another native species is the pochote or silk-cotton tree (*Ceiba parvifolia*), whose tubers are edible and whose seeds (borne in pods) are available during the February dry season (Fig. 4.28). This zone also has tropical animals such as the black iguana (*Ctenosaura* sp.). Such are the resources that might have been available to the occupants of Guilá Naquitz should they have chosen to descend below the Valley of Oaxaca into the headwaters of the Tehuantepec River, a region our 1966 surveys showed to be well supplied with caves.

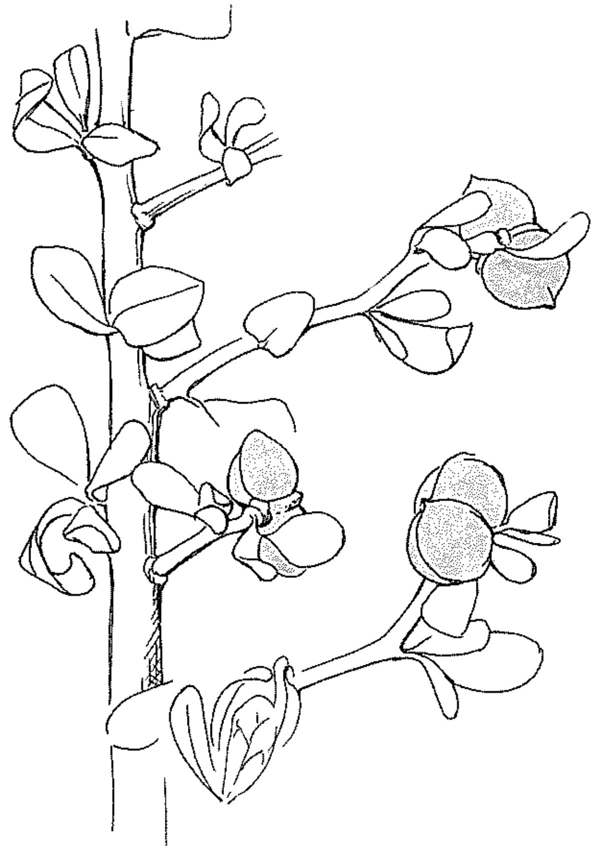

FIGURE 4.16. *Yak susí* (*Jatropha neodioica*), showing characteristic pairs of seeds in their spherical seed coats.

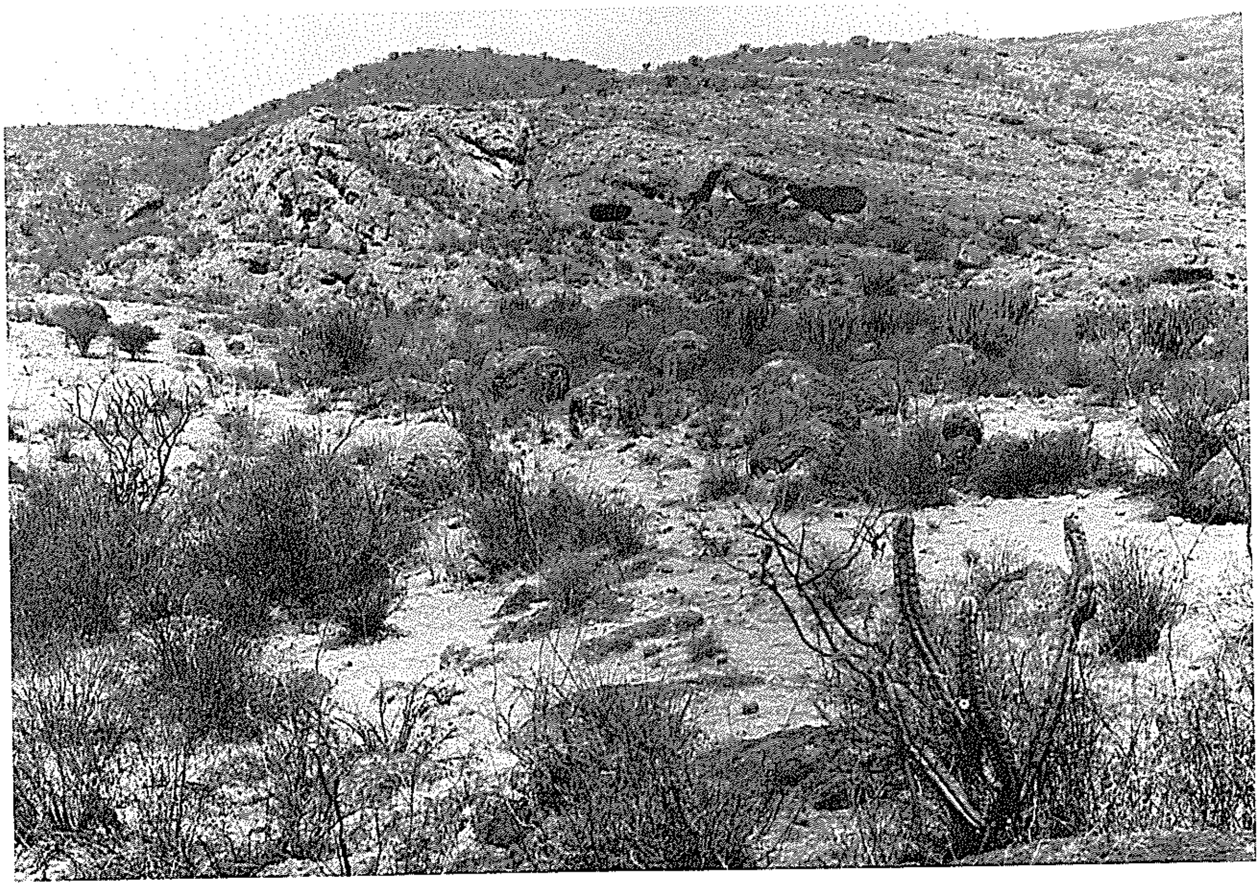

FIGURE 4.17. Thorn forest B, *Jatropha* facies, below caves OC-27 and OC-28.

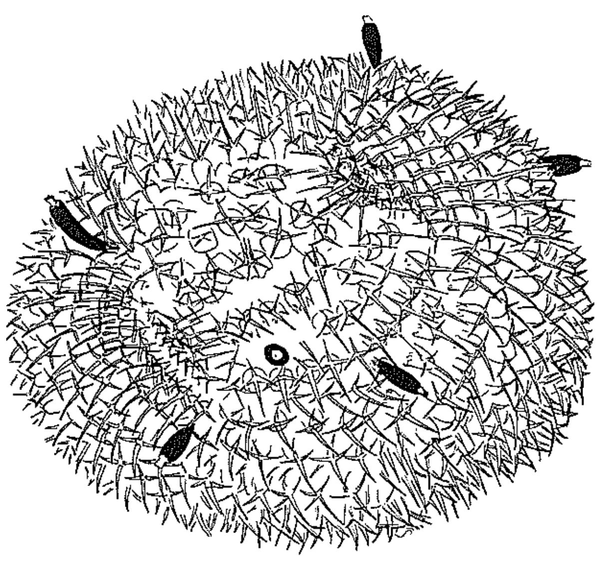

FIGURE 4.18. The *chilillo* (*Mammillaria* sp.), showing chile pepper-shaped fruits.

CONCLUSION: FACTORS IN PRECERAMIC SITE LOCATION

The distribution of caves in the ex-Hacienda El Fuerte region, especially those dry enough for habitation, is strictly limited by the physical environment. Considering the choice of locations available to preceramic hunter–gatherers, the caves they selected were *resource oriented*; that is, access to important natural resources was more important than access to other settlements with a similar subsistence economy.

The El Fuerte caves offer several advantages as seasonal camps.

1. They are close to permanent (although small) supplies of drinking water.
2. They are located with regard to a major natural resource: the wild plant foods of the Thorn Forest A zone. This is one of the two most important resource zones in the area today.
3. From the caves there is unusually easy access to other major resource zones: (a) Access to the important high-altitude hunting and collecting zones of the Dan Ro? mountains is afforded by a route following the course of the stream below Cueva Blanca; this route is still used

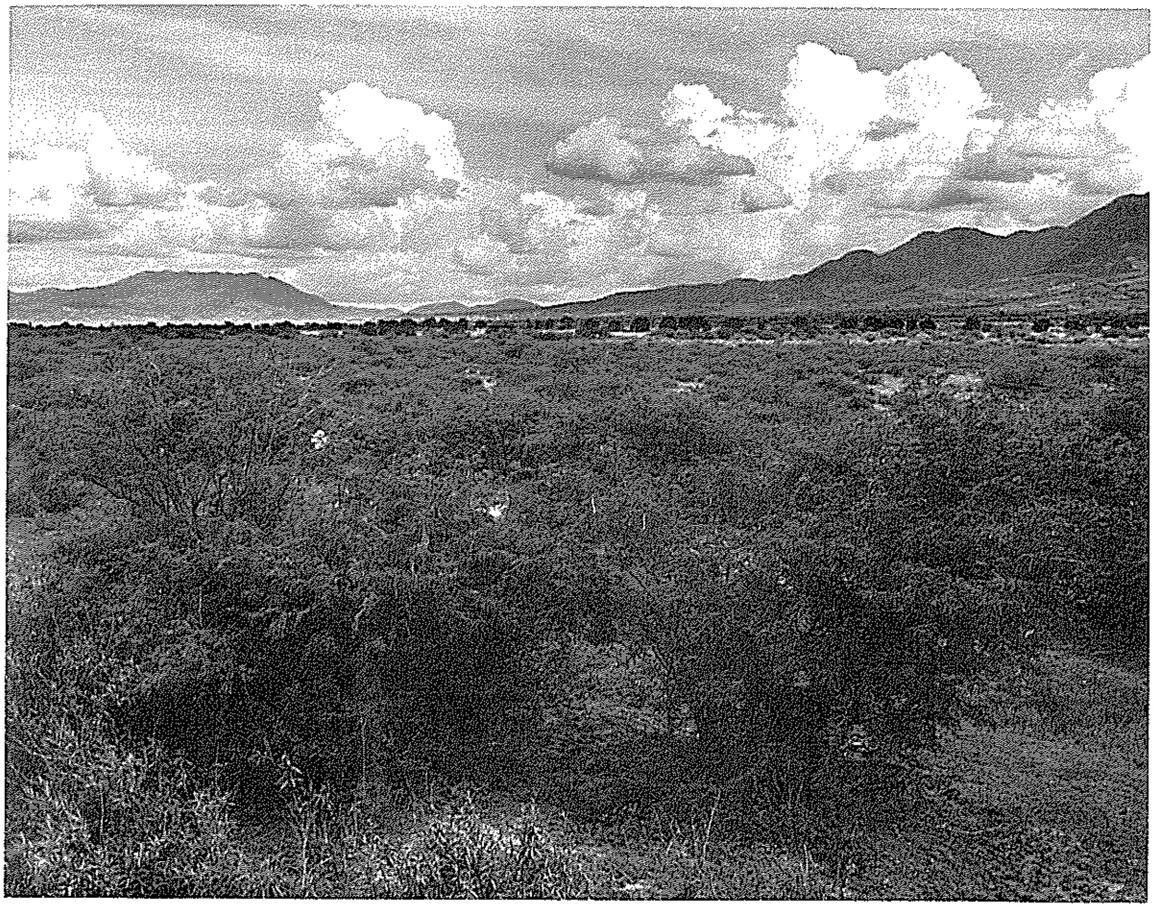

FIGURE 4.19. Expanse of stunted mesquite grassland near San Juan Guelavía, Oaxaca. This area, not farmed today because of its salinity, provides clues to what the aboriginal mesquite forest might have been like.

by hunters today. (b) The important food resources of the Mesquite Grassland B zone (mesquite facies) near the Río Grande de Mitla is only 3 km away over gently sloping land. This is the second of the two most important resource zones in the area today.

4. There are probably many caves close to important resources and dry enough for temporary occupation, especially higher in the mountains, but the El Fuerte caves have the added attraction of being dry enough for year-to-year storage. This undoubtedly enhanced their value to wild food collectors, who could bring food from the higher and wetter elevations and store it in the caves. Access to storage areas may have been equal in importance to access to collecting areas, and the El Fuerte caves are perhaps uniquely well located for this. This unusual dryness, combined with their access to the resources of several ecological zones, made the caves prime locations for early seasonal camps.

Thus geologic, topographic, climatic, and vegetational factors of the local physical environment have combined to provide caves well suited as sites for early storehouses and temporary camps, but their unique archaeological significance depends not only on their fitness as early sites but also on the unusual dryness of the caves that has allowed long-term preservation of perishable materials.

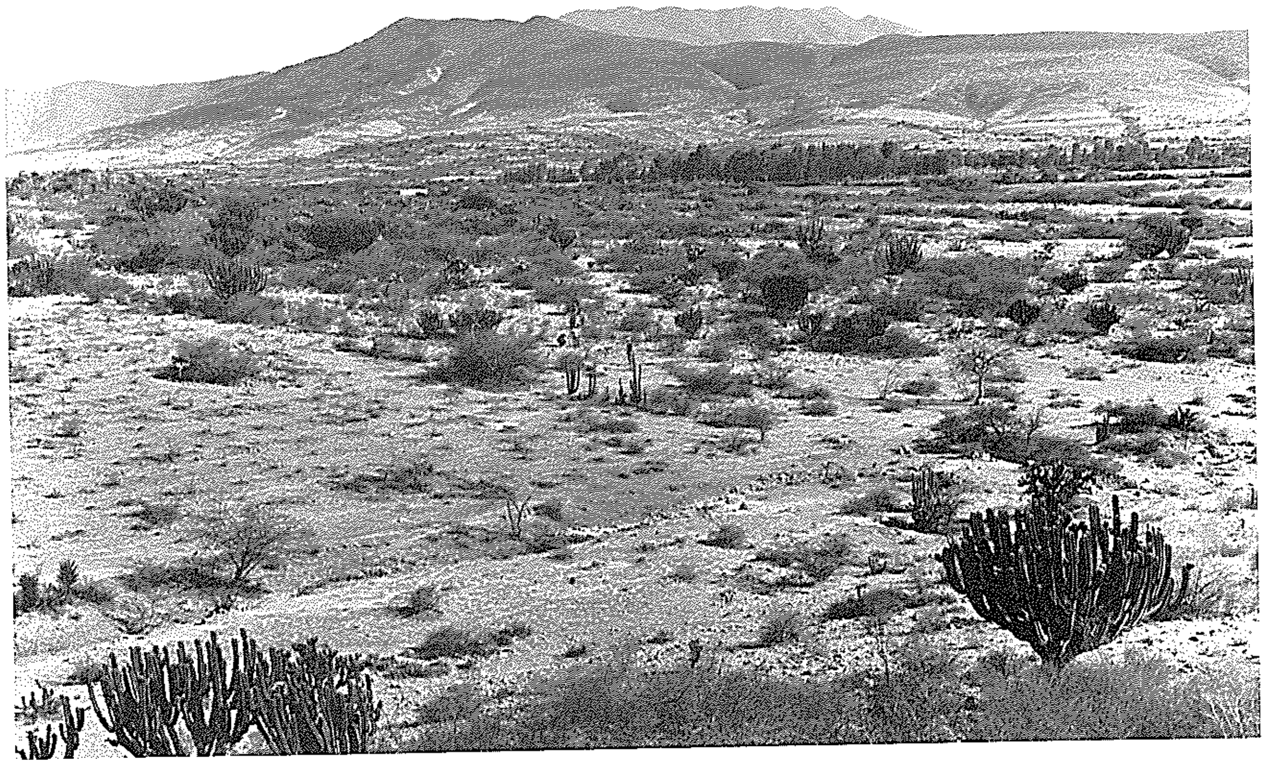

FIGURE 4.20. Mesquite Grassland B, grass facies. The preceramic site of Gheo-Shih lies in the foreground, the Río Mitla alluvium in the background.

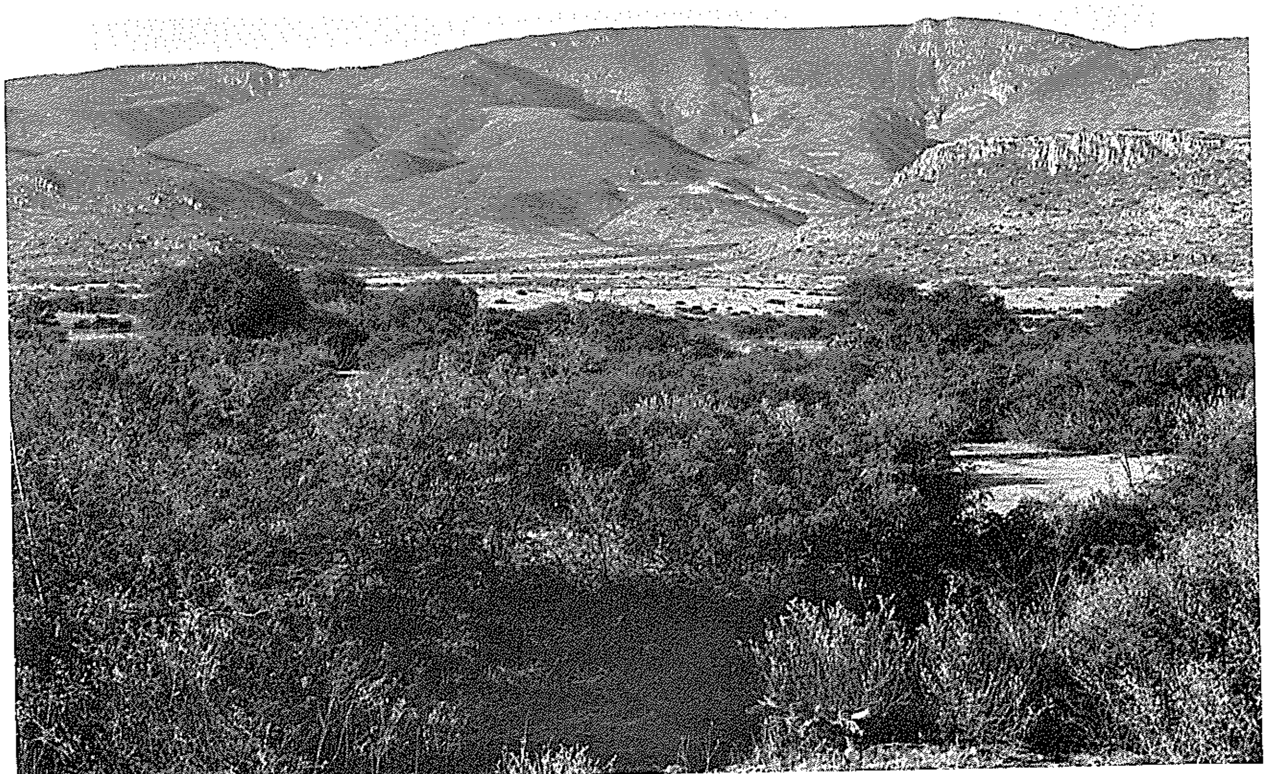

FIGURE 4.21. Mesquite Grassland B, mesquite facies. Groves of *Prosopis juliflora* lie in the foreground, the Dan Ro? range in the background.

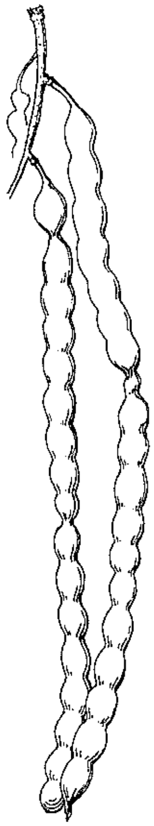

FIGURE 4.22. Pods of mesquite (*Prosopis juliflora*).

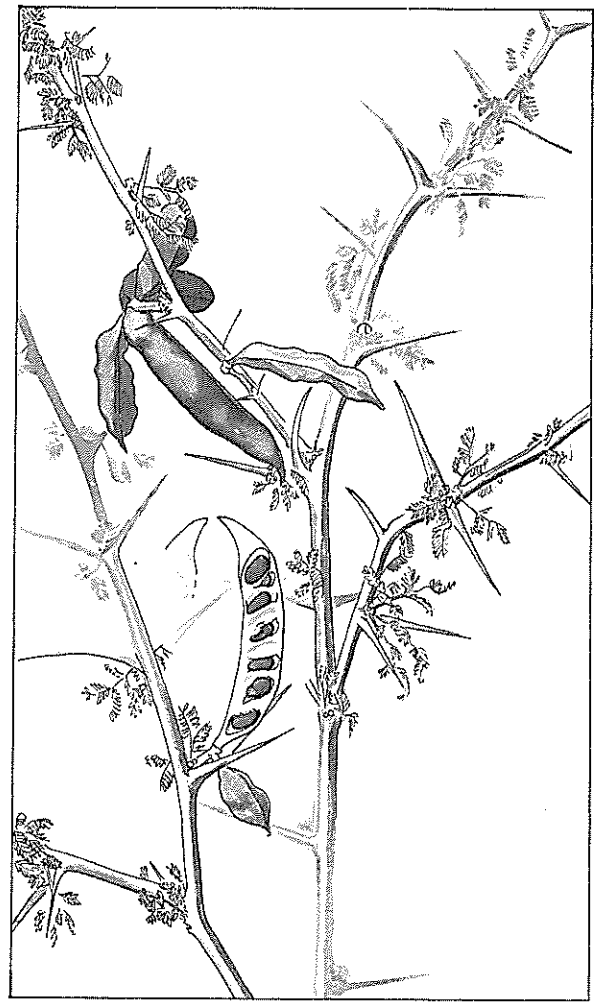

FIGURE 4.24. Huizache (*Acacia farnesiana*), showing pods, seeds, and thorns.

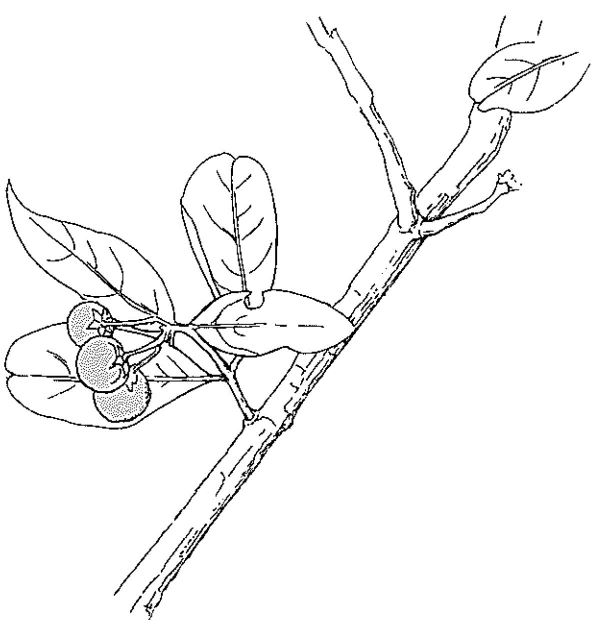

FIGURE 4.23. The *rompecapa* or hackberry (*Celtis pallida*), showing characteristic fruits.

FIGURE 4.25. Dense pine forest above the Valley of Oaxaca (ca. 2500 m elevation).

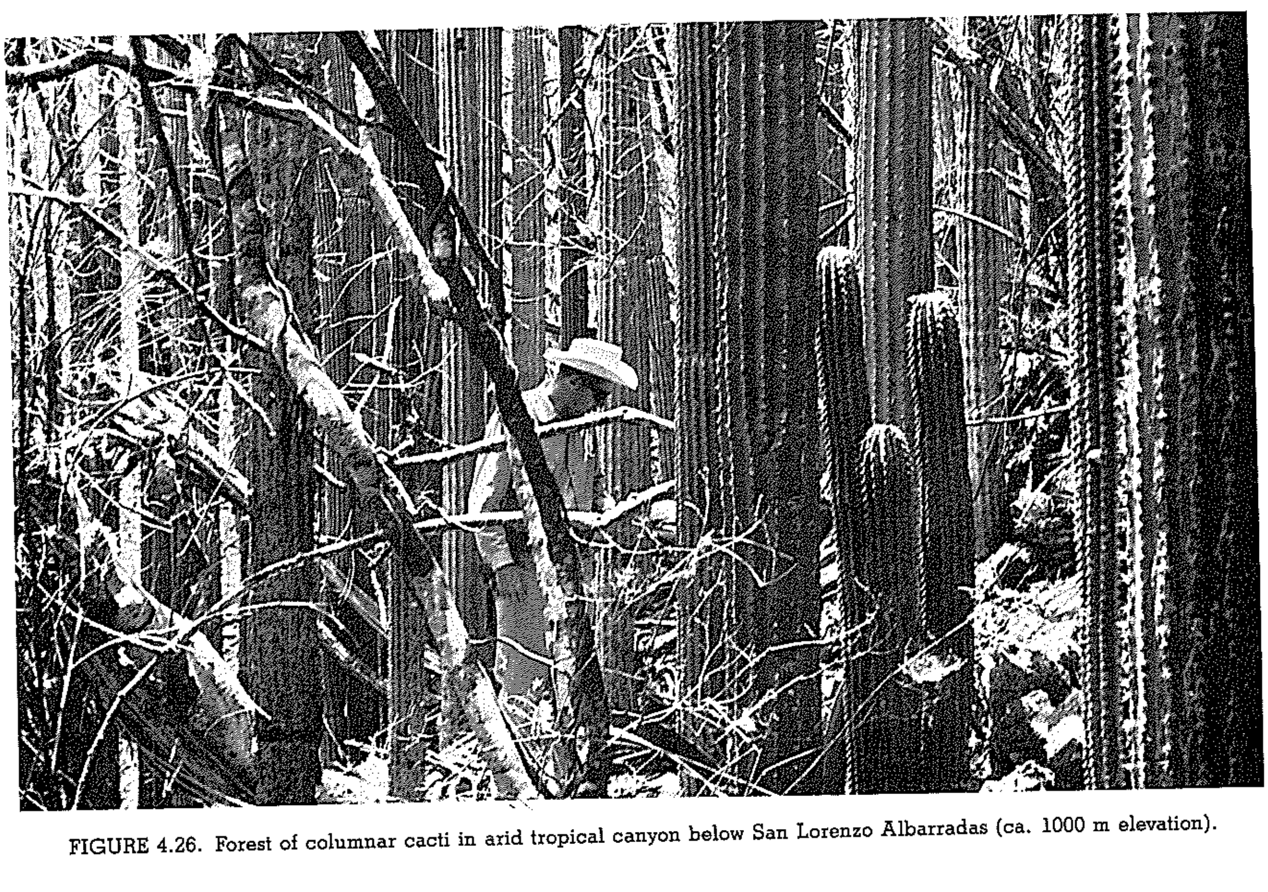

FIGURE 4.26. Forest of columnar cacti in arid tropical canyon below San Lorenzo Albarradas (ca. 1000 m elevation).

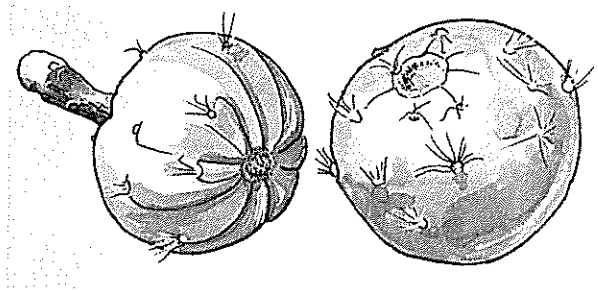

FIGURE 4.27. Fruits of the wild pitahayo (*Lemaireocereus* sp.).

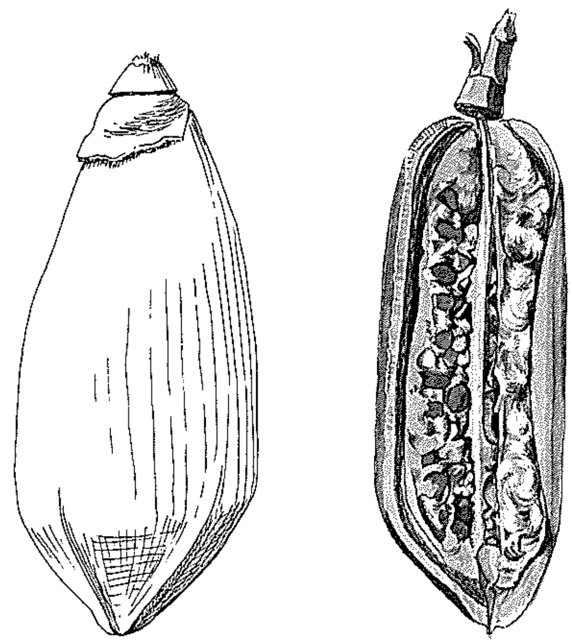

FIGURE 4.28. Pods and seeds of the pochote (*Ceiba parvifolia*).