

WAX, MEN, AND MONEY

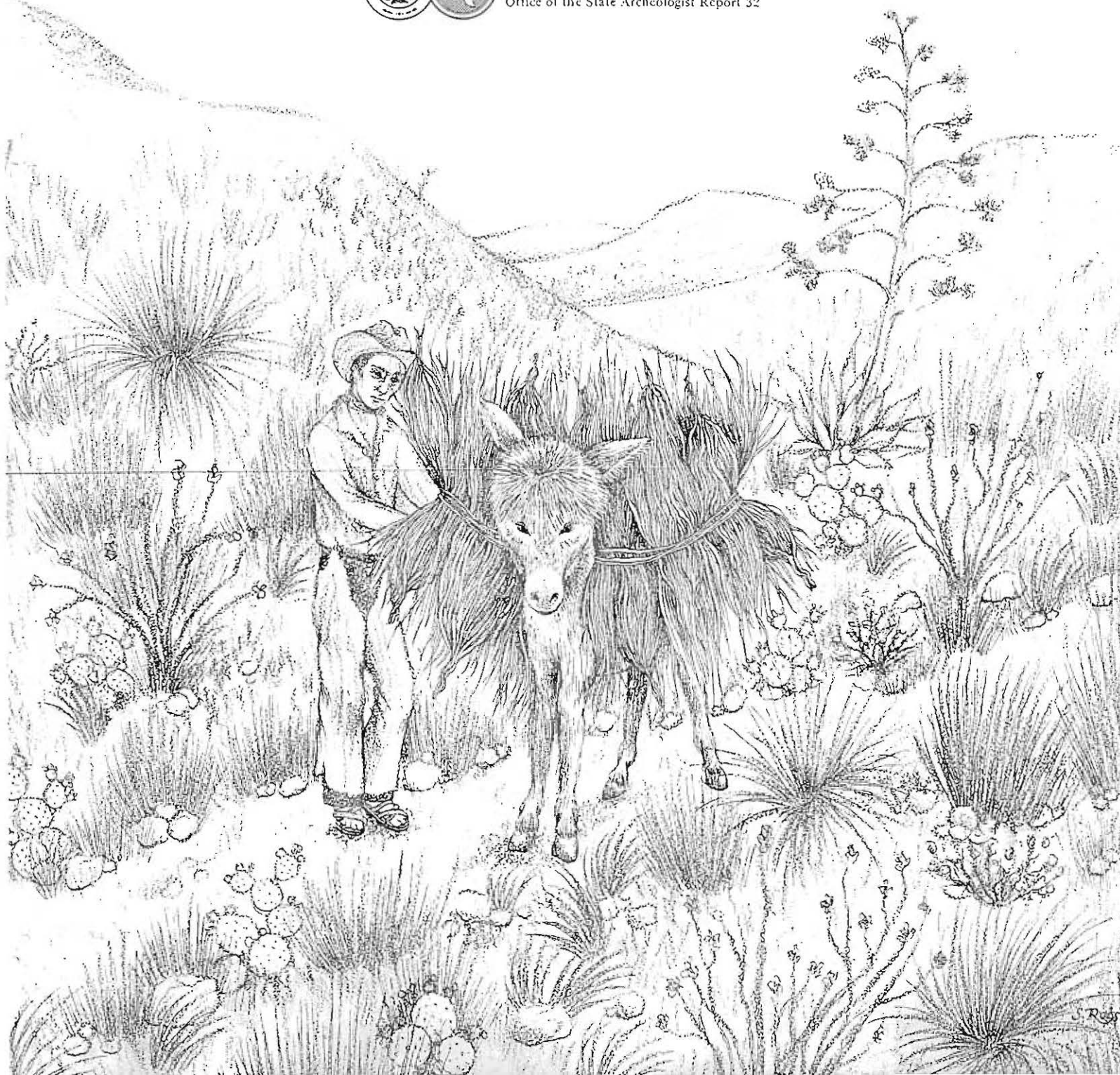
A Historical and Archeological Study of Candelilla Wax Camps
along the Rio Grande Border of Texas

by Curtis Tunnell



TEXAS HISTORICAL COMMISSION

Office of the State Archeologist Report 32



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graphics by Sharon Roos

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AUSTIN 1981

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Office of the State Archeologist Report 32
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Abstract

The candelilla plant (*Euphorbia antispyhilitica*), a source of valuable natural wax, occurs in locally abundant stands in Texas in El Paso, Hudspeth, Presidio, Jeff Davis, Brewster, Terrell, and western Val Verde counties. Transient camps for extracting the wax are located near water sources, primarily on the first terrace of the Rio Grande in isolated canyons. Archeological data from the camps and early 20th-century wax factories was recovered by survey crews from 1964 through 1980. Production areas, living areas, features, and other aspects of material culture in both active and abandoned camps were recorded by mapping, sketching, photographing, and observation. Historical sources relating to exploitation of the candelilla plant were examined, and local informants were interviewed. The wax camps represent a specialized, productive, and transient industry in the Chihuahuan Desert. The camps are occupied by men only, and these men are adept at "living off the land." They fabricate shelters, tools, bedding, and even clothing and make little use of commercially produced items.

It is proposed that the wax camps, in addition to being valuable sources of cultural data, may also serve as models for the generation and testing of hypotheses relating to prehistoric sites in the area. Attrition of the data base in wax camps is compared to that in prehistoric sites, and several hypotheses concerning seasonal movements and material culture are presented. It is suggested that future investigations of prehistoric sites in the region include testing of these hypotheses.

Introduction

The Chihuahuan Desert reaches its northern limit in southern New Mexico, includes all of trans-Pecos Texas except the Guadalupe Mountains, and extends southward through the states of Chihuahua and Coahuila in Mexico (Blair 1950:105). This vast area is not noted for its economic productivity. Of course, most areas serve very well for ranching, with sheep and goats being more widely accommodated than cattle and horses. Small amounts of silver, mercury, fluorspar, coal, sand, gravel, and petroleum have been laboriously extracted in some sections. Minor products include furs, honey, ornamental cactus, rope fiber, rubber from guayule, hunting leases for deer and antelope, tourism, and a modest amount of garden produce, corn, and cotton from irrigated plots along the rivers. Perhaps the most interesting and one of the most economically profitable activities has been the extraction of wax from the candelilla plant (Fig. 1). Since the first decade of this century, many millions of pounds of this high quality wax have been removed from wild plants and marketed in dozens of common products. Much of the wax production has been in Mexico, but, over the years, varying quantities have been refined and marketed along the international boundary in Texas. Many people have subsisted along the Rio Grande by making wax, and a few have grown rich through marketing.

The camps of the candelilla wax makers are one of the most common types of cultural sites along the Rio Grande. During an initial archaeological reconnaissance through the canyons, as part of a thousand mile survey of the river known as the "Cactus Cruise" in 1964 (Fig. 2), we began to find and record abandoned wax

camps. Mounds of waste candelilla cascading over the edge of a silt terrace often indicated site locations, and these were recorded by means of sketches, notes, and photographs. Along the river there were many stories about burro trains of wax smuggled across and sold to representatives of the big floor-wax companies. One day in the depths of a canyon (Fig. 3), a column of smoke led us to a wax camp in full operation, and the fascinating story of a fugitive industry

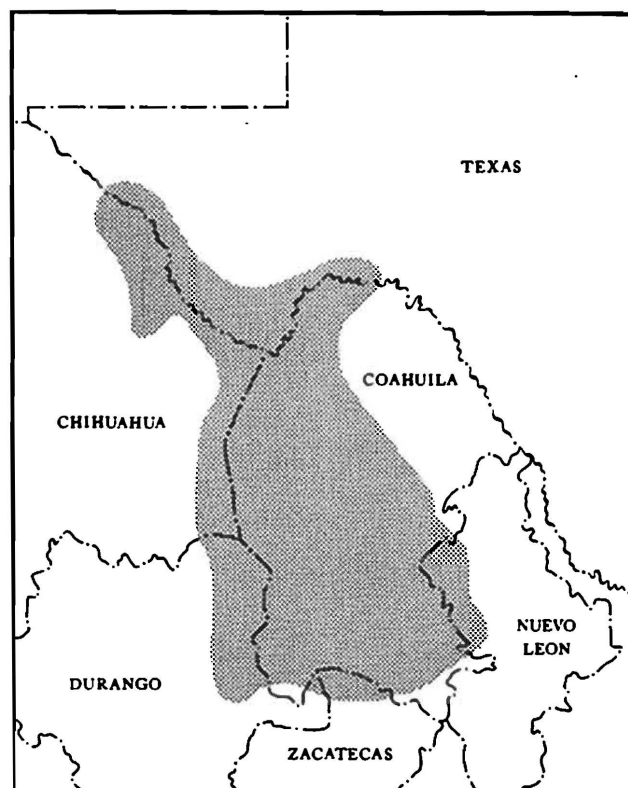


Fig. 1. Primary concentration of candelilla plants and wax production.

began to be revealed. In intervening years numerous camps from different decades have been recorded (Fig. 4), and many good people have consented to interviews. The stories of candelilla wax and evidence remaining in the camps have become a permanent part of the heritage of the Chihuahuan Desert.

The wax camps are an interesting cultural phenomenon for many reasons and one that might be studied from varying points of view. The economic botanist, for example, might view the wax camps as a specialized industry based on exploitation of a single desert plant species. Historians see the wax industry as a significant element in the opening of the last frontier. The anthropologist and sociologist would find material for study in the transient nature of the camps and the fact that they are occupied by males only, who live under primitive conditions. The folklorist who is fluent in both Spanish and English would no

doubt find the camps a goldmine of information, ranging from cures and costumes to tales of bandits and heroes along the river. For the archeologist, the wax camps are doubly interesting, being an excellent source of cultural data and insights in their own right and serving also as a veritable experimental laboratory for generating and testing hypotheses relating to prehistoric sites in the region, and the whole is enhanced by the fact that active camps can be compared to those that have been abandoned for various periods of time. For all those who are concerned with the documentation and preservation of cultural resources, all aspects of the wax camps and those who live and work in them are significant. The era of the candelilla camps may one day come to a close, and it is important that this fascinating facet of our culture be documented and studied in detail. This paper is planned as one step along that trail.



Fig. 2. A survey party on the river in Boquillas Canyon in 1964.

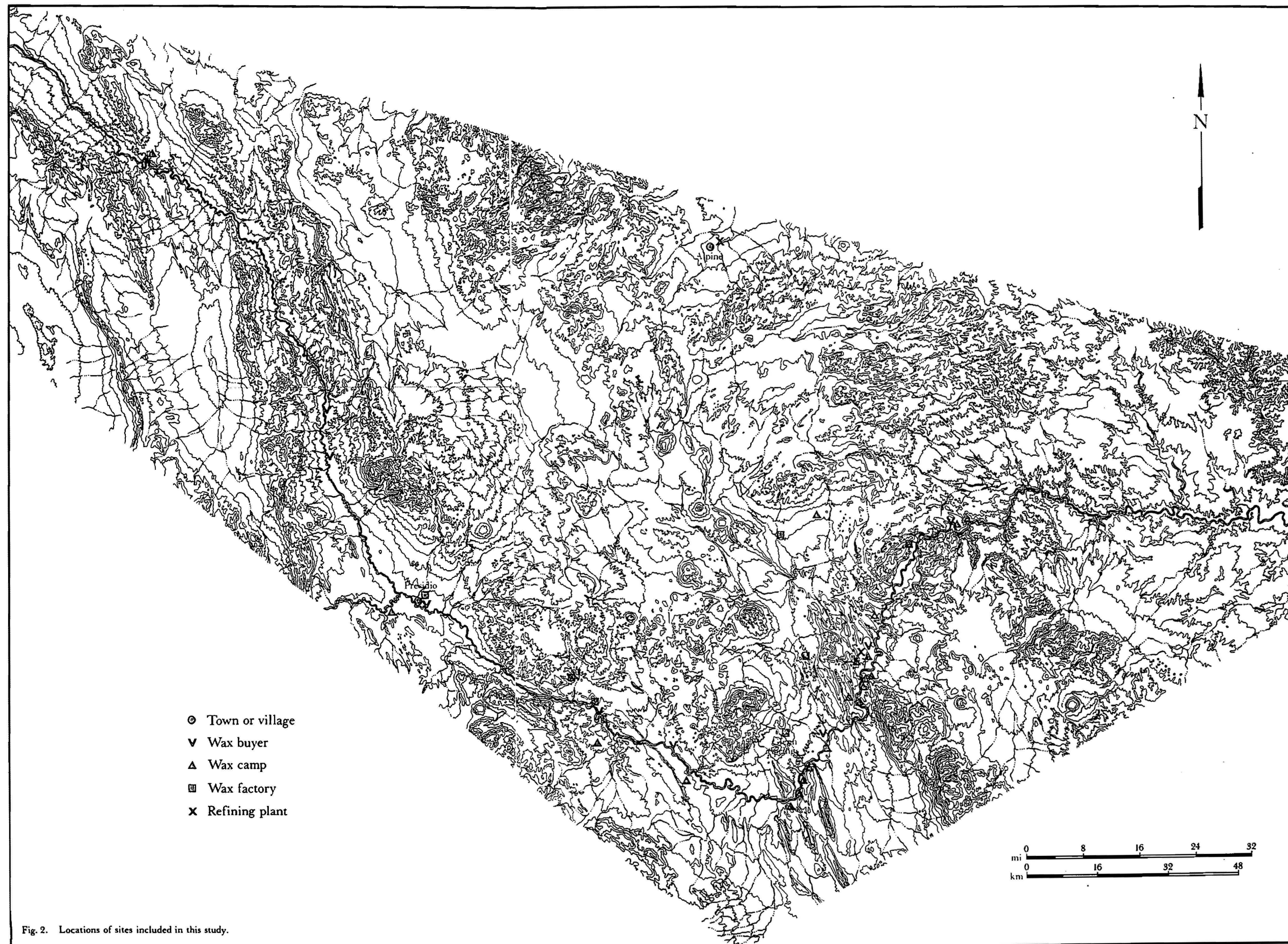
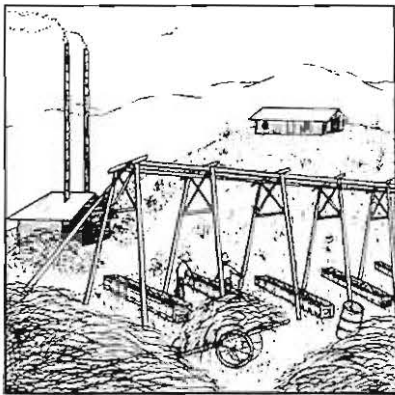


Fig. 2. Locations of sites included in this study.



Fig. 3. Sierra del Carmen at Boquillas Canyon on the Rio Grande, as photographed by W.D. Smithers from a small plane in about 1936. These rugged canyons contain many wax camps, including the first active wax camp examined by the survey crew in 1964.



1

History of Wax Making and Marketing

Historic Settlement

Early Spanish activity in that section of the Chihuahuan Desert under primary consideration in this report was centered around El Paso del Norte and La Junta de los Rios (junction of the Rio Conchos and Rio Grande), with enduring settlements established at both locations. Isolated outposts were established at San Carlos and San Vicente (Gerald 1968:37,39), and modern villages in those areas probably have been continuously occupied. Two hundred years of Spanish rule made many contributions to the modern culture of the Chihuahuan Desert.

Throughout much of the 19th century, this area served as a corridor for Plains Indian raids on settlements in Mexico, and the "Great Comanche War Trail" is firmly implanted in the folklore and physiography. A few remaining Jumano Indians in villages along the river probably were assimilated into the larger Mexican population.

Anglo-American settlement in this area lagged behind that in other areas of Texas, in part because of its isolation from the more

densely populated eastern half of the state with its easier access to supplies, in part because of the Indian raids in the area, and in part because of the aridity of the land itself. However, by the mid-19th century, interest was evident. After the Mexican War in 1845-1848, this region was examined by various topographical engineers (Tyler 1975:75). Perhaps the most important appraisal was that made by William H. Emory and associates during their survey of the United States and Mexican boundary in 1852 (Emory 1857), although the Emory party failed to traverse the rugged canyons.

Early Anglo settlement along this segment of the Rio Grande began in earnest after the Civil War, with men like Ben Leaton, John Spencer, Milton Faver, and John Burgess establishing ranches, and in some cases fortifications, at choice locations.

The last of the Apaches, under their great chief Victorio, were driven from this area by 1880, and soon thereafter most of the free and easy land had been incorporated into large ranches. Some successful ranches remain in the same families today. The State of Texas wisely retained ownership of many scattered and iso-

lated tracts of land for benefit of the public school system.

Around the turn of the century, entrepreneurs and small businessmen were moving into frontier towns like Marfa and Alpine, looking for opportunities in the undeveloped desert vastness (Casey 1972:38).

Commercial Beginnings

When or how candelilla wax first began to be utilized by historic inhabitants of the area is not recorded. Use of the wax for candles, religious statues, artificial flowers, and as waterproofing for leather, cloth, and matches may go back many generations in the Chihuahuan Desert (Goddard 1969:2; Casey 1972:178).

Mass production for commercial purposes seems to have begun in Mexico in the first decade of the twentieth century. One of the early wax entrepreneurs, Ralph Ogden, was a Texan who established a factory in Mexico because, as he said, "that's where the candelilla grows" (Goddard 1969:4). Ruth Ogden Goddard (1969:2), in recounting her husband's business activities, says he had a producing wax factory in Santa Elena, interior Mexico, when she met him in 1910, and he planned to install another closer to the border. Ogden said he had learned about the wax from a padre at a "Spanish Mission" who used it for making candles. While use of the wax for candle making in Mexico has been reported elsewhere (Hodge and Sineath 1956:145), a recent informant on the Texas border claimed he had never seen the wax used for candles, because it was too valuable to burn. It seems probable that use of the wax as an ingredient in commercial products, with its consequent increase in value of the wax, brought about a decline in local use of items, such as candles, that were made entirely of candelilla wax.

Oscar Pacius, a chemist in Monterrey, Mexico, is supposed to have developed the first economical process for commercial production of wax from candelilla (Literary Digest 1921:21). Pacius was associated with the Continental Wax Company of Little Rock, Arkansas, which reportedly had wax factories operating in Mexico

by about 1910 (Tyler 1975:147), and he later became involved in a wax company stock scheme in Alpine, Texas, which fizzled without ever producing wax (Casey 1972:180).

By 1919, several factories were reported to be making candelilla wax in the Monterrey consular district, with the largest of these producing a daily output of about 662 pounds, which would involve processing 30,000 pounds of plants (Dickinson 1919:809). The largest stands of candelilla plants in this area were in the Montemorelos, Galeana, Bustamante, and Villadama regions.

The beginnings of commercial exploitation of candelilla in Texas also date from the early 20th century. In 1907 the Thirtieth Texas Legislature passed S.B. No. 118 (General Laws of Texas, Chapter 135), which controlled the harvesting of guayule, lechuguilla, and other plants on the extensive state school lands in west Texas. Based on this statute, the General Land Office on July 20, 1907, adopted rules governing harvesting of the plants. The almost immediate issuance of leases for the gathering of candelilla indicates that commercial interest in the plant was already in existence along the border.

The Great Wax Rush

From 1908 until the end of World War I, the issuance of leases by the state reflects a continuous increase in wax-making operations in west Texas. And in addition to the profits to be made from gathering and processing candelilla, there was apparently money to be made in selling the rights for harvesting.

In May 1908 W.W. Willett petitioned the state (Appendix I, Item 1) for the rights to gather "Candalilla" in Terrell and Brewster counties, and the first contract for candelilla was issued to Willett and G.E. Brashear of Uvalde for a period of five years for a payment of \$1,000. Willett sold his share of the 1908 contract to M.B. Mayer of San Antonio for \$10, but there is a 1909 cash receipt in the General Land Office archives from the Willett Candelilla Wax Company, indicating that Willett was still involved in wax production during that year.

Willett also requested a lease extension in March 1911 (Appendix I, Item 2). G.B. Fenley of Uvalde purchased from Mayer the share that had earlier belonged to Willett, and then Fenley and Brashear renewed the lease for Brewster and Terrell counties in 1911 for a period of five years and a payment of \$1,000. They then sold the new lease to E.D. Lowe of Brewster County for \$7,000 in cash and \$13,000 in capital stock of the American Wax Company.

The second candelilla contract granted by the state was issued to J.H. Smith of El Paso in December 1908 (Appendix I, Item 3) for harvesting the plant in El Paso, Presidio, and Jeff Davis counties, for a period of five years for a payment of \$300 per year. (Since Hudspeth County was excluded from this contract, it may have been under contract to other parties.) In 1912 J.H. Taff tried to renew the original Smith contract on El Paso, Presidio, and Jeff Davis counties, but it was transferred in 1913 to G.W. Wooley and the Candelilla Wax Company of Marfa.

Edgar D. Lowe is reported to have secured a contract from the state in 1911 and installed the first wax factory in west Texas at Double Mills on Maravillas Creek in October of that year (Casey 1972:125). W.K. Ellis and C.D. Wood established successful wax factories at McKinney Springs in 1912 and at Glenn Springs in 1914. The complexity of the dealings among these early wax entrepreneurs is reflected in a letter to the land commissioner from Ellis in November 1915 (Appendix I, Item 4). Other early schemes for making fortunes from wax are summarized by Casey (1972:179-182), and newspapers from 1911 to 1915 contain many articles concerning the promise and disappointments of the candelilla business.

Feverish activity in the wax business was stimulated by the high price of wax immediately preceding and during World War I, when wax was used extensively for waterproofing tents and ammunition. The increase in business, of course, did nothing to lessen the complexity of the entrepreneurs' dealings. Edward M. Ellis of Memphis, Tennessee (American Wax Company), secured the candelilla lease for Brewster and Terrell counties in 1916 for five years for a cash payment of \$1,000. This is the lease that had originally been granted to Willett and Brashear

in 1908, then was owned by Mayer and Brashear, Fenley and Brashear, and E.D. Lowe in succession. E.M. Green of San Antonio secured a five-year candelilla lease on Hudspeth County in 1918 for \$250 and sold it the same year to Salvador Madero of San Antonio for \$1,000. The last lease to be issued by the state during the "great wax rush" was granted in 1922.

The Early Factories

The wax factory at Glenn Springs (Fig. 5) was one of the earliest and largest in the Big Bend region. Established in 1914 by W.K. Ellis and C.D. Wood, it soon boasted a water storage system, a boiler room with tall smoke stacks, six large extracting vats, a well-stocked general store, a large house for the Anglo foreman, and several dozen huts for families of the Mexican workers. In May 1916 the factory was thriving in spite of troubled times and a tense political situation along the border. General Pershing was with his troops in Mexico pursuing Pancho Villa, and the two governments were negotiating in El Paso to try and ease tensions (Tyler 1975:168). Several soldiers were stationed at Glenn Springs to help protect the wax factory and its little settlement. On the night of May 5, a group of about 75 Mexican raiders crossed the river and attacked Glenn Springs, killing several people, including troopers, and looting the store. Colonel George Langhorne and two troops of U.S. Cavalry crossed the border on May 11 and pursued the raiders over 100 kilometers into Mexico. The cavalry killed and captured several of the raiders and recovered some of the Glenn Springs loot, and the border dispute between the two countries became even more critical. By July 1916 the United States had over 100,000 troops along the Mexican border (Tyler 1975:174), and 250 men were assigned to protect the wax factory at Glenn Springs. Although there were sporadic attacks on ranches in 1918 and 1919, Glenn Springs had no further visits from Mexican raiders, and the troops were withdrawn by 1920.

In addition to the Ellis and Wood operation at Glenn Springs, their earlier location at McKin-

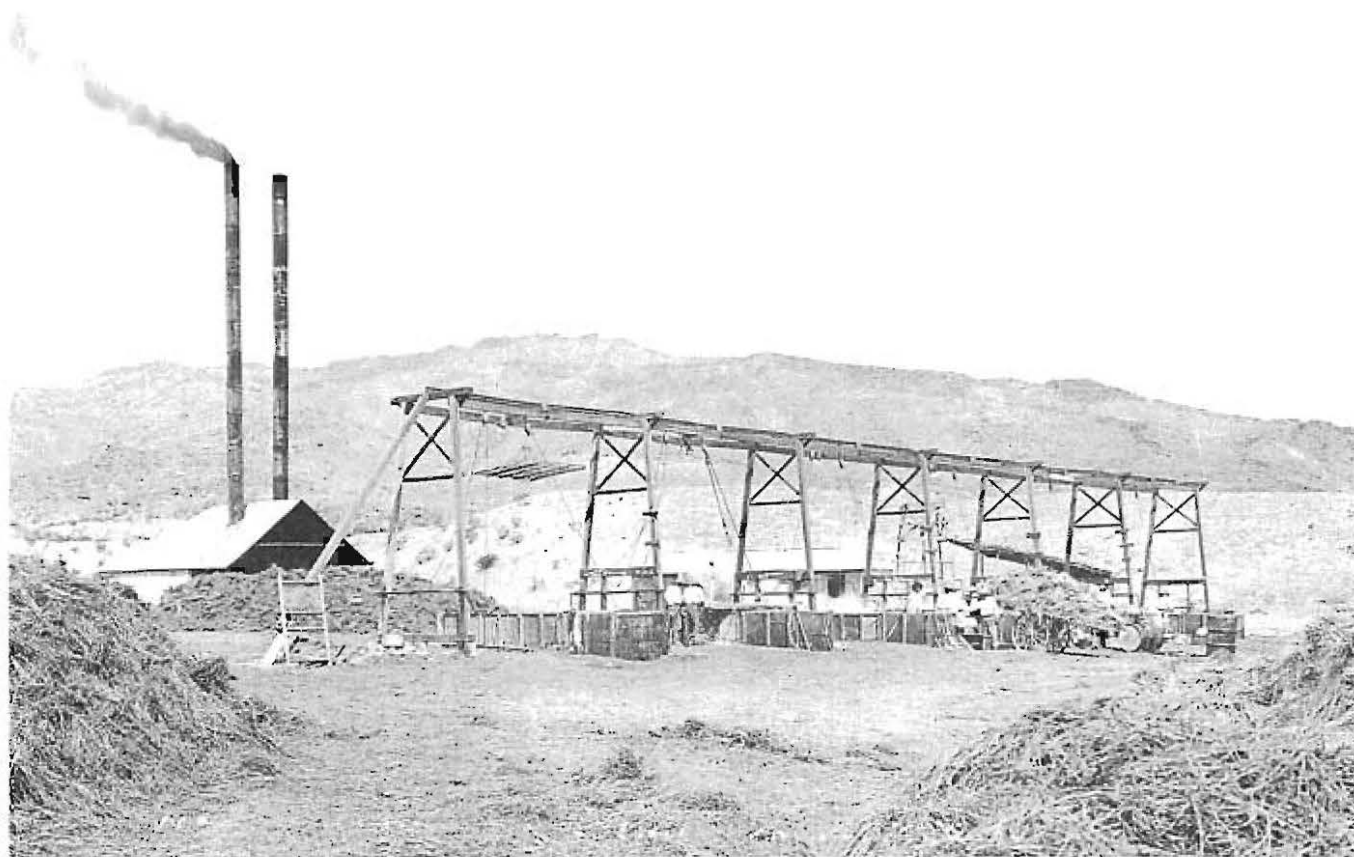


Fig. 5. Glenn Springs wax factory in operation about 1917. Note the boiler building in the background and sophisticated equipment including hoists and wheeled carts.

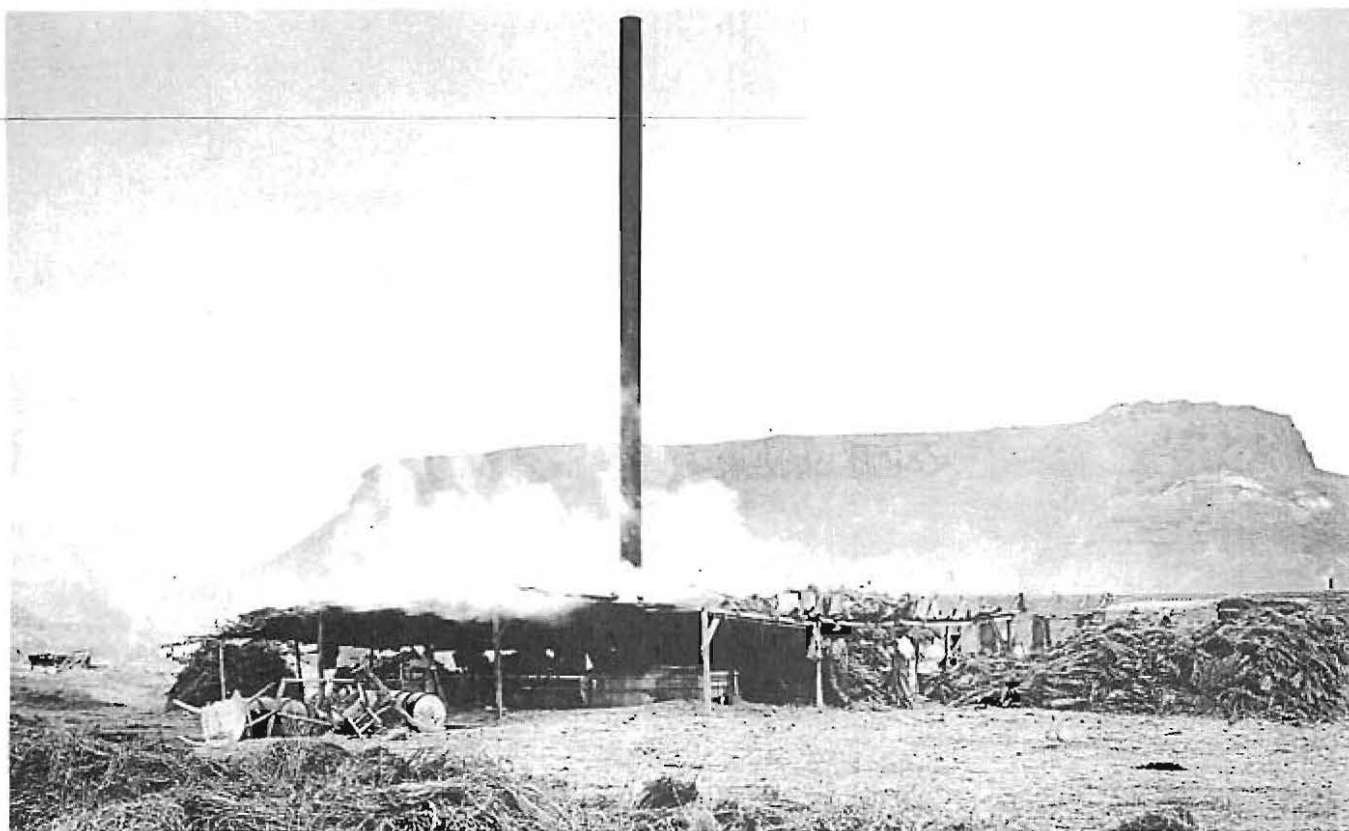


Fig. 6. The Fisher wax factory near Lajitas as photographed by W.D. Smithers in about 1916.



Fig. 7. The Fresno Canyon wax factory as photographed by W.D. Smithers in about 1917.

ney Springs, and the Lowe factory established in 1911 at Double Mills, several other attempts were made along the border to mass produce candelilla wax in factories. The Fisher factory was in operation near Lajitas in 1916 (Fig. 6) and during the boom years of World War I, H.H. Harris and J.L. Crawford operated a large candelilla factory in Fresno Canyon (Fig. 7). However, at the end of the war, wax prices dropped sharply, and all of the factories closed, including the Ellis and Wood plant at Glenn Springs (Casey 1972:181). Throughout the 1920s production waxed and waned along with market prices, but some of the factories reopened and prospered. W.D. Burcham purchased the Glenn Springs factory and produced wax there from about 1920 to 1929. Captain Wood continued to produce some wax at other locations after he sold the Glenn Springs operation (Hitchcock 1960:49). The Fresno Canyon plant also was back in production during the 20s and reportedly shipped \$100,000 worth of wax in 1923.

Although there are some good photographs of the early factories (Figs. 5, 6, 7) and some in-

formation on owners and volume of wax produced, little is known about the actual daily operation of the factories. Generally, a factory consisted of a building containing a large boiler fired with creosote brush and spent candelilla and vented by tall smoke stacks. Water was pumped from springs or windmill tanks, and pipes carried steam to a series of six or eight boiling vats that were charged with candelilla plants by means of carts and platforms suspended by ropes and pulleys (Fig. 5). As many as 50 men worked at one of these factories, stoking the firebox, charging the vats, skimming wax, drying spent weed, and gathering the tons of candelilla processed daily. Trucks, wagons, and burros transported the masses of weed in from the gathering fields. The largest and most accessible virgin stands of candelilla went into the early factories, and big profits went to Anglo investors. For example, it is estimated that \$500,000 worth of wax was marketed from Brewster County in 1928 (Casey 1972:182). The work was done by Mexican laborers like the one shown in Figure 8, who earned about \$1.50 per ton for harvesting the weed by hand.



Fig. 8. A wax maker and his family at the Glenn Springs factory in about 1917. Note the house thatched with candelilla and the relative abundance of material possessions.

None of the wax factories along the border lasted very long, and now only traces of them remain. The McKinney Springs and Glenn Springs sites were visited and recorded in 1980. Much of the metal from the sites was scavenged during World War II metal drives, and additional damage was done when the sites were "cleaned up" during the early years of Big Bend National Park. The Glenn Springs site revealed evidence of both the early operation and a later one dating from the late 1930s, including water transport and storage systems, structure foundations, ruins of wax vat pits, numerous artifacts, and ruins of the wax makers' houses. This site is a major cultural resource in the park.

Some small factories can still be found oper-

ating in interior Mexico, particularly around Quatro Ciénegas and Saltillo. A few factories were established in west Texas after the 1920s, but the only persistent production system along the Rio Grande is the one observed in transient camps.

The Transient Camps

Much wax has been produced along the river in temporary camps, where a few men with their burros go to good stands of candelilla and set up one or more small vats above fire pits dug in the ground. The men camp under primitive conditions for a few weeks or a few months

and then quickly pull up stakes and move the operation to a more productive location. By the late 1930s these small and transient camps along the river had begun to replace factory operations, and the days of the speculators and stock promoters and quick profit seekers were largely over. Wax making had simply become hard, hot, dirty, dreary work. Nevertheless, at least one flamboyant entrepreneur was to emerge during this period.

Alton Hutson became involved in the candelilla wax business in the years just before World War II. He helped finance widespread wax production in northern Mexico and paid top price for truckloads of wax delivered to the American side of the international bridge in Laredo. Mexican officials eventually closed down this operation and accused Hutson of

smuggling 400,000 pounds of wax across the border in Laredo, but he had declared it all with United States Customs and therefore had done nothing illegal in this country (Holden 1975: 141). Hutson also leased land in the Big Bend area and established a refining operation at the old Glenn Springs location, which was in production in 1939 utilizing Mexican laborers (Holden 1975:140). He claimed that during his absence Mexican officials arranged to have his building and candelilla stock burned and the equipment carried off to Mexico. If true, this constituted the "second" Glenn Springs raid.

Sharply increased demand for fine wax in World War II caused prices to rise, and a flurry of wax making persisted into the 1950s. A factory was started by J.E. Casner in Presidio in

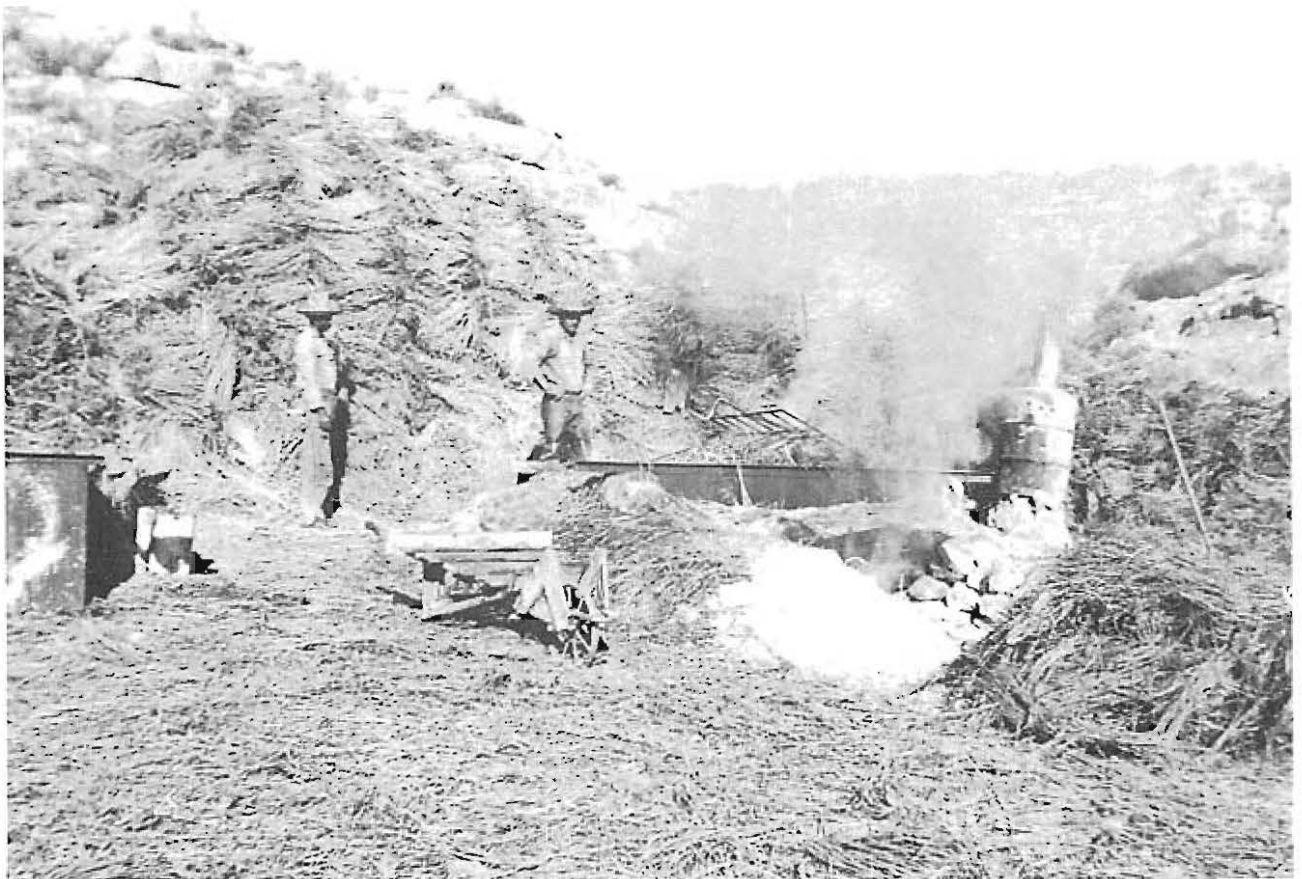


Fig. 9. One of Asa Jones' wax camps in the 1940s. An elaborate pumping system raised water over a thousand feet from the river to this camp on the bluffs.



Fig. 10. Cereros in front of their shelter thatched with candelilla in Asa Jones' wax camp. Two of the men wear leggings made of leather.

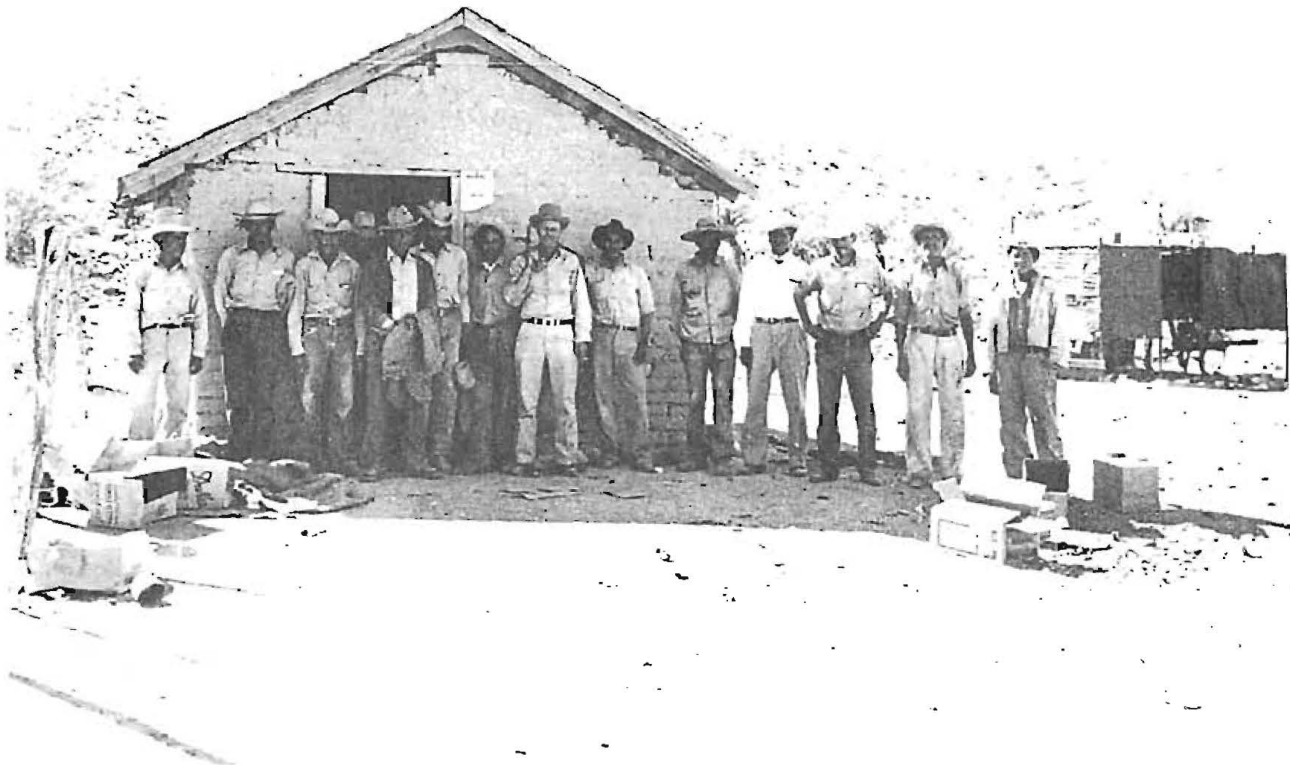


Fig. 11. Wax crew at the commissary on the Adams Ranch in the 1950s.

about 1942 and operated successfully during the war years, processing as many as 25 tons of candelilla per day (Madison 1968:225).

More typical of the period than the Hutson and Casner operations were the small but productive camps of Asa Jones (Figs. 9, 10). Located in the rugged Lower Canyons and Bullis Gap areas, these were in full operation during the 1940s.

Mr. Asa did good at that wax business for a long time. He put in one [wax camp] on the river down here below me. He got the candelilla in Mexico—wasn't much on this side. He got a bulldozer in there and scraped out an airstrip on top of the hill. Never did anybody think enough of it to land on it. (Harrison, 1977 interview)

Another informant reported that he went into the candelilla wax business in 1940 and was able to pay off about \$500,000 in debts in three years, using profits from his wax operations alone. He had as many as 400 people working with wax during the war years.

With the passing of the early factories, the formality of leasing state lands seems to have been ignored, and none had been issued since 1922. However, in the late 1940s increased demand for the wax evidently reactivated the state's interest. A summary of contracts issued during that decade is given in Appendix I, Item 5.

One informant said he found some good "weed" areas between Shafter and Presidio and secured a lease for gathering candelilla on the state lands. He set up a camp and began producing *cerote* (rough wax) but soon had to quit because of serious arguments with ranchers who had grazing leases on the same state lands and did not believe he had a legal right to harvest candelilla on "their" land.

One of the most successful stories of the later period of the candelilla wax industry is that of the Adams family. Eulice and Elba Adams began making wax on their west Texas ranch in the late 1930s, and Eulice continued intermittent production until his death in 1962. At times they had as many as 150 men making wax on the ranch (Fig. 11) and produced as much as 25,000 pounds of rough wax per month. Their *cerote* was sold to Casner until Eulice's son, David, took over the business in 1962 and expanded from wax production into

refining and marketing as well (Adams, 1977 and 1980 interviews).

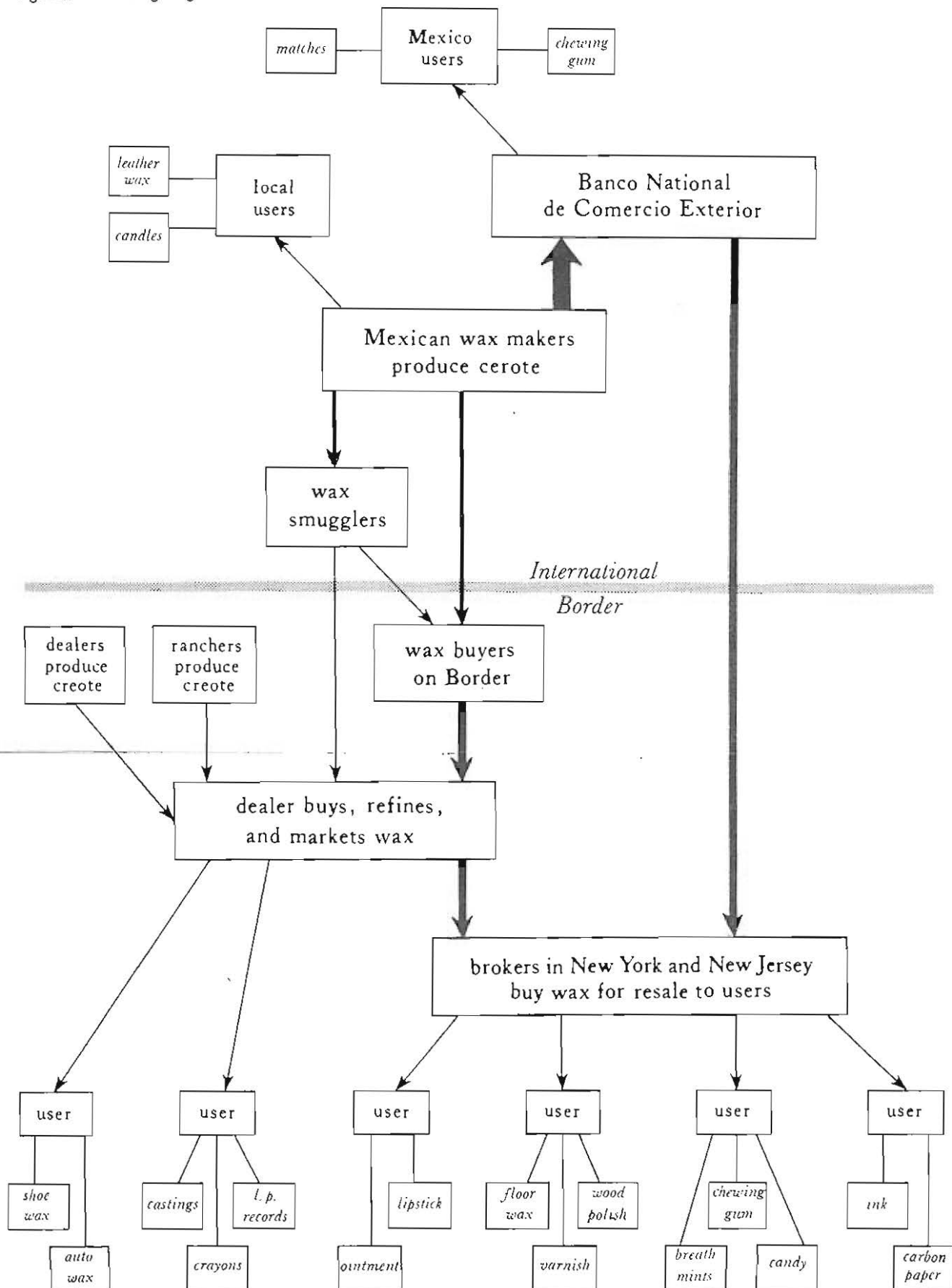
Wax making in small camps along the river has continued to the present time, but relatively small quantities have been marketed in Texas in recent years. Wax production in Texas and along the Rio Grande has always been a small part of the industry, with perhaps 80 to 90 percent of the total output coming from the interior Mexican states of Chihuahua, Coahuila, Nuevo Leon, Durango, and Zacatecas. Records are not available on candelilla wax importation prior to 1936, but during the years from 1936 to 1952 official importation of candelilla wax from Mexico ranged from about two million pounds annually in the late 1930s to as much as ten million pounds during the World War II years (Daugherty, Sineath, and Wastler 1953: 20). All of this production was from wild plants.

Fluctuating Prices

In the 1920s wax usually sold for between 12 and 20 cents per pound. Prices per pound during the 1930s and 1940s varied from 12 to 70 cents and usually averaged about one-half the price of carnauba wax. David Adams (1977 interview) said that the highest price his father received for rough wax until 1962 was 59 cents per pound and that the price of wax remained relatively stable between 1962 and 1976, fluctuating only between 48 and 52 cents per pound. In the mid-1970s Casner reported that he usually paid 40 cents for raw wax and had been forced to sell some refined wax for 63 cents, but he hoped to get 80 cents per pound in the future. In 1980 candelilla wax reached an all-time high price of \$1.50 per pound because of increased demand and decreasing competitiveness of petroleum-based waxes.

Most of it [wax] comes out of Mexico; however, there is some produced over here [Texas]. When the price is good on it, there'll be a lot of wax campers—you know, up and down the river cooking wax. And when the price goes down, why then you kinda abandon it and go do something else. Price gets good again, and they go back and fire up the boilers and go get some more wax. (Earwood, 1977 interview)

Fig. 12. Marketing diagram for candelilla wax.



An organization known as the Union de Credito de Productores de la Cera de Candelilla was formed in Mexico in 1936 to help improve conditions for the wax makers and to control prices and exports. In 1937 the Banco Nacional de Comercio Exterior imposed an export tax on wax and granted subsidies to producers. From that time to the present, the Banco and related organizations have controlled wax making in Mexico and sought to curtail illegal exportation along the Texas border. Having an alternative outlet in Mexico has improved the lot of the cereros. The marketing of candelilla wax produced along the border is complex and may involve many diverse individuals and organizations (Fig. 12).

Smuggling Wax

"For the Mexicans it's smuggling, but for us it's importing." Wax has always flowed across the Rio Grande either because buyers on this side would pay more than the Banco or because cash was more quickly accessible from Texas buyers. It is illegal under Mexican law to smuggle wax out of Mexico, but not illegal under United States statutes to bring it into this country for marketing if it is declared with customs. Heavily laden burros have brought wax into Texas at various places, including Stillwell's Crossing, Reagan Canyon, La Linda, Boquillas, San Vicente, Solís, Santa Elena, Lajitas, El Mulato, Presidio, and Candelaria. It is estimated that as many as 1700 tons of wax have been smuggled across the Texas border in some years (Daugherty, Sineath, and Wastler 1953: 23).

One informant described participating in a nocturnal wax-purchasing session near Big Bend National Park. He and the purchaser went to a prearranged place and camped. Long after dark a dry sotol plant flamed up on a hillside about a mile away, and he was told that the pack train would arrive soon. Some time later a single individual came warily into their camp. Upon determining that everything was in order, the "scout" went out and, accompanied by several other men, brought in the pack train of burros loaded with wax. The gunnysacks of wax were

unloaded from the burros and the bargaining began. Various sacks were opened and the quality of the wax (the amount of trash and sand content) was examined. The purchaser would occasionally find a rock in a bag and discard it, but occasionally a rock was added by the seller before a bag was retied. Eventually a price was agreed upon and the bags were weighed. The wax makers were paid in cash and got on their burros and left. The wax was loaded on a truck and hauled to a refining place some miles away, where it probably was mixed with wax produced on this side of the border. Some buyers, however, do declare clandestine wax shipments to U.S. Customs before refining.

One refiner described making a "big wax deal" in the park many years ago. The Mexican producer demanded cash in pesos for the load. The buyer was afraid to carry the cash with him to the rendezvous, so he had about \$20,000 in pesos sewn into a burlap bag and flown to the site in a light plane. After the large burro pack train was unloaded and the price agreed on, the plane was signaled to drop the cash bag. The plane circled twice and the bag was thrown out a window. Sailing on a brisk wind, the bag landed in a rugged rocky area, and the buyer spent several uneasy hours helping some very unhappy wax makers search for the bag of pesos.

Of course, the Banco has long sought to curtail wax smuggling across the river. It subsidizes cooperatives and provides acid (a necessary ingredient in wax making) to the wax makers on a quota system, expecting to get a specified quantity of wax in return. Wax makers who want to sell in the United States usually have to get acid from their American buyers. The Banco also tries to pay higher prices than U.S. buyers, but it may take one or two months for payment, and few wax makers want to wait that long for their money. During the mid-1960s (Douglas 1967:95), there was a quota of 100 to 150 kilograms per year for each family that made wax, and it was estimated that 20,000 Mexicans subsisted on wax production. More recently an *ejido*, or cooperative, near Ojinaga was reported as having a quota of 800 kilograms per month and as selling the wax for about a dollar per kilo to the Banco (Miller 1979:36). The cooperative got considerably less for any wax that was smuggled across the border. One buyer said at

times there have been from dozens to hundreds of Mexican federal officers (Forestal) along the border trying to curtail the flow of wax. This was especially true from July 1947 to August 1948 and again between December 1952 and September 1953 when the Mexican government banned all manufacture of wax from candelilla because the plant had become endangered from overexploitation (Daugherty, Sineath, and Wastler 1953:21). During these years wax shipments reportedly came from as far as 150 miles to be smuggled across the river.

One dealer, who prefers to remain anonymous, said he has traveled to Mexico many times to locate people who live by smuggling wax into Texas. He has often bought as much as 30,000 pounds of Mexican wax at one time, and the people who transport it make about 10 cents per pound profit for smuggling the wax across the river. He described the transactions as follows:

They always insist on coming in the middle of the night, and I've worked all night inspecting shipments many times. In the bags of cerote you often find what are called "highballs," which are balls of wet ashes covered in wax, and also rocks coated with wax.

In earlier days smugglers would bring as many as 100 burros across the river laden with \$10,000 to \$20,000 worth of wax. One crossing was on the "old Boquillas trail" below the park. In more recent years wax has been brought to the border in trucks and taken across the river at fords. The informant said most of his wax originates in a big production area around Cuatro Ciénegas, but some is made along the Rio Grande. It is not uncommon for buyers to keep \$10,000 to \$20,000 in cash handy to pay for wax arriving from Mexico, and, even though the buyers have guns, they don't feel the wax smugglers are dangerous because "they are not bad people." However, the informant had heard of shoot-outs between the smugglers and Mexican officers in which men on both sides were killed. More often, bribes are paid to appropriate officials in advance. One buyer is supposed to have made infamous wax deals in the 1950s which included payment of new gas refrigerators for Mexican officials.

Several times I sold her gas refrigerators which you couldn't get in Mexico. One time I delivered a box to her at a place called San Vicente, right on the river...

soon here came a team and a wagon and we unloaded the refrigerator on that wagon and I asked her "where does this go?" She says, "It goes to a Mexican army captain about 200 miles in the interior of Mexico." (Thomas, 1977 interview)

During a visit to the San Vicente area in 1980, we observed a pickup fording the river with two used refrigerators in the back. Apparently the system still works.

The Buyers

A bag of wax may be brought across the river at any time, so buyers have to be in convenient locations with a pocketful of cash. For years buyers have been situated at all the river towns and crossings between Candelaria and Stillwell's Crossing. One of the famous buyers was Maggie Smith, a Big Bend legend who ran a store near Langford's hot springs for many years:

Maggie Smith's main profit was in the wax that she bought from Mexicans and resold to American processors... she bought large quantities, selling them to refiners in Alpine and Marfa. Occasionally, the Mexican authorities obtained the help of our customs people in policing the border. There would be raids; and Maggie, hearing the sound of approaching officials from the sensitive acoustical position of her store, would hide any wax in the ladies' restroom—a place that the border officials, being gentlemen, never entered. (Douglas 1967:95-96)

Two wax buyers for the J.E. Casner operation were interviewed in 1976. Tom Ornelas had been buying wax for about 25 years in the Presidio area. He had just delivered a big load of cerote to the refinery a few weeks before the interview and had a little more wax on hand at the time. He said the Mexican wax makers "declare" their wax and deliver it to him in Presidio. They dump the wax out of the bags on a floor for the buyer to inspect its quality. He said, "You must pour it out of the bags and inspect it in order to not pay 40 cents per pound for rocks." The wax makers keep their own burlap bags and take them back to Mexico for reuse. Ornelas has on hand a good supply of sulphuric acid to dispense to the wax makers who need it for rough wax refining, and he pays

cash for the cerote and rebags it for shipment to the refinery in Alpine. When the wax business was doing better he was on the refinery payroll, but he now works on a commission.

Mrs. Walker, who runs the old General Store at Candelária, buys all the wax she can get and was paying 35 cents per pound in cash at the time of her interview in 1976. In better days she paid as much as 60 cents per pound. She usually pays for cerote in U.S. currency and tries to avoid using pesos, although almost all the wax she buys comes from Mexico. She used to get big loads—as much as 500 or 1,000 pounds per shipment—but now she usually gets 30, 40, or 50 pounds at a time. "I can always tell when there is going to be a wedding or a funeral across the river, because people start bringing in a half bag of wax to get some cash." A half bag of wax, about 50 pounds, would have been worth \$17.50 at the 1976 price of 35 cents per pound, and might bring twice that amount at 1980 prices.

Walker said most of the wax made in Mexico today goes to "the bank." The Banco pays more per kilo than she can pay per pound, but people have to wait 30 to 60 days to get their money, so they bring some to her for quick cash. Most of the wax makers that she knows work at other jobs like planting and harvesting crops and make wax between those other jobs. Wax making is considered to be good money, and men can make more at it than at "ranching or working for wages."

In the old days, Walker said, all her wax was delivered by burro, but now most comes over in pick-ups. She provides the wax makers with bottles of acid in return for the wax. She had delivered about 1,000 pounds of cerote to the refinery a few weeks before the interview, but at the time of our visit she had on hand only about 100 pounds.

An informant in Presidio said that Guillermo Galindo, the mayor of Ojinaga, was an active wax buyer in the San Carlos area for years and became rich in the wax business. Another well-known buyer was Gustavo Garcia, who lived near Ruidosa. The informant, who prefers to remain anonymous, also related a story about a Mr. Kalmore, who owned a store in downtown Presidio, which indicates that wax buying may at times be a hazardous occupation:

One night, real late, he bought a shipment of wax and paid cash, but apparently the smugglers wanted more money from his safe. They cut up his ears but he refused to open the safe, so they hit him on the head with a pipe and killed him.

Ironically, with the current high market price, some wax is beginning to be carried across the Rio Grande to Mexico for the first time. A rancher who is producing a considerable volume of wax reported that some of the men filch cerote and take it over to Mexico to sell. He said he would have to be in the wax camp every day to prevent this type of chicanery.

Wax Dealers

One of the principal figures of the modern wax industry in Texas is J.E. Casner (Fig. 13) of Alpine, Texas, who became involved with wax in about 1940 and was still refining and marketing it, at age 88, when he agreed to an extensive interview in May 1976. Through the years Casner has aggressively pursued the manufacturing, buying, refining, and marketing of wax and the attempted massive cultivation and



Fig. 13. J.E. Casner in Candelária, 1976.

harvesting of candelilla. His accomplishments gained him the popular title of "Candelilla Wax King" of west Texas. Casner purchased wax shipments in Big Bend National Park in the early days and maintained purchasing agents for years in Lajitas, Presidio, and Candelaria.

In 1976 Casner said he had recently shipped a large load of refined wax to a company in London. In earlier years he shipped wax to the northeast by rail, but it became too expensive, so he now uses trucks to haul the wax (40,000 pounds per load) to Houston. From there it goes by barge to New York and New Jersey. In recent years he has sold mostly to a New Jersey broker and understands that most of his wax is used by Wrigleys and American Chicle as a principal ingredient in chewing gum.

Casner talked freely about candelilla, graciously introduced me to some of his buyers, gave a tour of his refining plant in Alpine, and reluctantly sold ten pounds of raw and refined wax, at the current market price, for research purposes. He said he usually pays 40 cents per pound for cerote in 100-pound burlap bags. He then refines the wax by boiling it in dilute acid; during the refining process there is a loss of about 10 to 12 percent of volume because of moisture and sand removal. He has sold up to one million pounds of wax in good years, but now he can get only small quantities along the border. He blames this on the Banco in Mexico, a competitor in Marathon, food stamps, and the minimum wage law. In better times, his wax profits paid for a new refining plant, building and all, in only three months.

The only other big wax dealer in Texas during recent years has been David Adams of Marathon and Stillwell Crossing. After taking over the family wax business in 1962, he was doing fairly well just making wax on his ranch and selling it to Casner. Then the "markets got sticky" in the east, Casner stopped buying, and Adams went to New York and met the wax brokers himself. After returning to the ranch, he experimented until he learned how to refine cerote into pure wax.

Adams' profits on wax tripled when he started marketing it himself. In good years he refined as much as 60,000 pounds of wax per month, some of which was coming in from Mexico, and sold it directly to wax brokers in New York who handle all types of wax. He also sold wax directly to the "Beech-nut" chewing gum company for a while. At the time of his interview in 1977, the wax business was very slow, with little being produced or "imported" from Mexico. He blamed this situation on the Mexican government for controlling the price of wax by manipulating supplies and dumping expensive wax at cheap prices. He felt that this was done, at least in part, to crowd him and Casner out of the business and that it seemed to be working.

During a second interview in 1980, Adams was much more optimistic, and the wax industry was again booming with the price at \$1.50 per pound. He said he can now profitably ship the wax to the northeast by truck in reduced loads of about 20,000 (rather than 40,000) pounds per load because of the increased value. The shipping cost is about \$2,000 per load. He has produced and bought as much as 80,000 pounds of wax per month and has probably averaged 60,000 pounds per month for the past three years. Although much of this wax has come out of Mexico, he has recently been unable to buy as much imported wax because of the higher prices being paid there. He has about 22 men working on his ranch cooking candelilla at present. He said he and Casner have been the only refiners and marketers of candelilla wax along the Texas border in the past two decades. In recent years they have sold from 120,000 to 150,000 pounds per month, with most of it going to five companies on the east coast. When asked if a load of wax has ever been hijacked, he responded, "You can't get rid of a load of candelilla wax very easily." However, he added that everyone is careful to buy only from people they know, to be sure they don't purchase hijacked wax.



2

Techniques of Wax Making

The Candelilla Plant

Candelilla is known as the "weed" to those who work with wax in west Texas, while the Mexican laborers simply call it "yerba." The botanist J.G. Zuccarini (1832) first described the plant for the scientific world in 1829 and assigned it the name *Euphorbia antisyphilitica*. It is curious that he did not discuss the plant's wax but did mention juice from the plant being used by the indigenous peoples as a remedy against venereal disease. Mexican herb shops still carry candelilla (Fig. 14) as a medicinal tea.

In 1909 G. Alcocer (Alcocer and Sanders 1910) presented a new description of candelilla, named it *Euphorbia cerifera*, and discussed the fine wax produced by the plant. Alcocer's species is considered synonymous with *Euphorbia antisyphilitica* Zucc. (Hodge and Sineath 1956:136) and is the primary species of the plant utilized in wax production. Other minor species also occur in the Chihuahuan Desert. The common name candelilla probably was applied to the plant because of its small, erect, wax-coated stems, which resemble little candles.

Candelilla is a perennial and is found in lo-

cally abundant stands in Mexico in northern Zacatecas, western Nuevo León, eastern Durango, and scattered throughout Coahuila and Chihuahua, and in Texas in El Paso, Hudspeth, Presidio, Jeff Davis, Brewster, Terrell, and western Val Verde counties (Fig. 1). Small, isolated populations have been reported in southern Texas and the Mexican states of Guanajuato and Hidalgo.

The plant commonly grows on well-drained limestone slopes but is occasionally found associated with igneous rocks, and it does not seem to grow well in bottomlands and clayey soils. The root system is small but each plant supports numerous erect stems, which are mostly simple but occasionally are branched. A plant of moderate size may produce as many as 100 stems (Fig. 15) and be 0.3 to 0.5 m in diameter. The stems range from about 0.3 to 0.6 m in length and 4 to 8 mm in diameter and are a grayish green in color. In the wax camps we have occasionally observed an unusually large plant with stems at least 1 m in length. Where candelilla has a chance to grow normally, the plant clusters get larger and larger until they may be as much as 2 m in diameter. When they get that large they begin to die down in the center and leave a



Fig. 14. Candelilla is still sold as a medicinal tea in herb shops.

doughnut-shaped ring of candelilla. Near McKinney Springs in 1980 we found plant clusters of this shape that had rabbit nests in the center of the ring. A detailed botanical description of the plant can be found in Correll and Johnston (1970:965) and Vines (1950:619).

The candelilla plant has been observed flowering (Fig. 16) from April through August, apparently coinciding with spring and summer rains. Stands of the plant seem to be most abundant at elevations around 2,500 feet (Hodge and Sineath 1956:138) and are commonly associated with lechuguilla, sotol, chinogras, ocotillo, and various cacti. Severe freezes at higher elevations are said to kill the plants back to their roots (National Academy of Sciences 1975:142). Candelilla is generally a very hardy species and not particularly susceptible to diseases or pests. It does serve as occasional forage for goats and rabbits (ibid. 1975:141). Vaughn Bryant (personal communication, 1976) says candelilla produces small amounts of pollen, which is sticky and tends to fall directly to the ground. Candelilla pollen is unlikely to be wide-

spread or abundant and probably is rare in the archeological record.

The wax of the candelilla is an epidermal secretion on the stems that helps conserve internal moisture of the plants during severe hot and dry periods. The wax, which forms a scurfy coating on the stems, is much heavier in the dry season of the year and during periods of drought. Since average annual rainfall in the desert where candelilla flourishes ranges from about 100 to 500 mm (National Academy of Sciences 1975:141), drought is not an uncommon condition. The moisture-protecting mechanism of the plant is apparently effective, for it is said that "you seldom see a dead candelilla plant" (Madison 1968:224). The summer of 1980 was unusually hot and dry and many desert plant species such as lechuguilla and Spanish dagger suffered from desiccation, while candelilla seemed to suffer very little damage. Plants can be dug up and kept for long periods of time, and, even after the stems have become longitudinally wrinkled, the plant will recover when replanted in the soil. When cut or broken, the stems "bleed" a white, milky substance, and, if the plants are harvested by cutting, the root systems will die.

Candelilla is the second most important vegetable wax after carnauba (Hodge and Sineath 1956:134), which is extracted from a Brazilian palm. About ten tons of the plant can be harvested per acre where it grows abundantly, far less in most harvest areas. Since primitive wax-extraction methods produce a yield of only about 2 percent of plant weight, the refiner who marketed one million pounds of wax in a good year was representing exploitation of about 50 million pounds of wild plants from 2,500 to 5,000 acres of desert. Five or ten times that much wax may be imported annually from Mexico, representing denuding of perhaps as much as 50,000 acres of desert of candelilla growth. Can any desert species survive this magnitude of exploitation? Apparently candelilla has done fairly well, because wax production continues after seventy years.

The plants need from two to five years of growth before they produce significant wax. When we asked many informants familiar with wax making and marketing how long it took for candelilla growth to return in an area that



Fig. 15. Typical candelilla growth.

has been intensively harvested, the estimates ranged from five years to fifty years. All of these estimates may be accurate for different areas and conditions. David Adams was more specific and said that after a first harvesting the candelilla will return in some abundance in two years; after a second harvesting it takes about five years for candelilla to come back; and after a third harvesting it might take ten years for there to be enough plants for economical harvesting. He said in some areas of northern Mexico they have depleted the candelilla through overexploitation and are now using pickaxes to pull out lechuguilla and greasewood

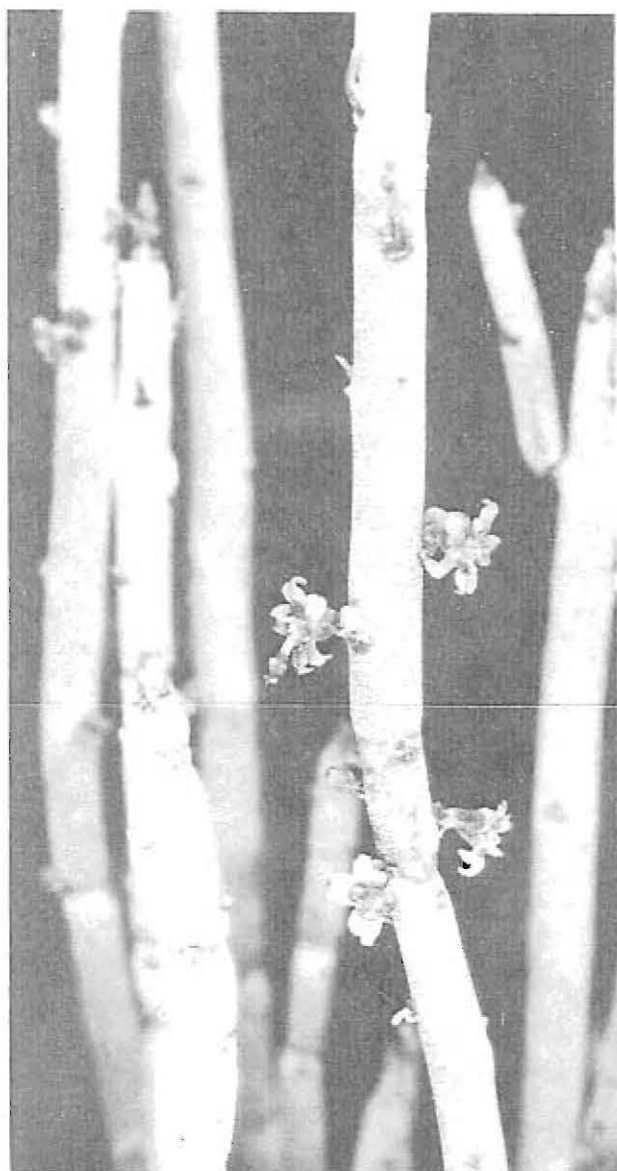


Fig. 16. Candelilla stems showing blooms and branching.

in order to get the small amount of candelilla growing around those plants. In normal harvesting they would pull out the candelilla that is easy to recover and leave plants in and around lechuguilla to help the stand grow back.

In recent years the hearty plant has been transported widely as an ornamental, and it is reported to grow more robustly than in the native habitat but to produce little or no wax under protected conditions. Cultivation of candelilla for wax production has been attempted in Haiti, Cuba, and the Dominican Republic (National Academy of Sciences 1975:142), but these efforts have failed. A local informant

said he was involved in an expensive experiment to grow candelilla near Laredo, Texas. The land was prepared and the candelilla was planted and "grew like weeds," but when the enthusiastic entrepreneurs began harvesting, they found the plants produced almost no wax. Other attempts at cultivation and mechanical harvesting of candelilla in the Presidio area were equally unsuccessful. Harvesting native stands of the plant and processing the wax under primitive conditions remains the best and perhaps only method of extracting candelilla wax.

Despite the failure of cultivation efforts and continued exploitation of the wild plant, candelilla probably will not be threatened with extinction. Some plants will grow back from remnant root fragments, and others grow in inaccessible niches where gathering is impractical. However, some scientists fear that, after harvesting, candelilla may never return to its original abundance and balance in the vegetation community. The impact of the weed harvesting

on the desert environment in general and on associated sensitive plant communities in particular is a matter of concern to biologists in the Chihuahuan Desert.

Harvesting the Plant

Various attempts to harvest candelilla with mowing machines and bulldozers have failed. It seems that two strong hands, a bent back, and a burro are still the best way to gather the plant economically. The gatherers (*arrieros*) arise in the wax camps at dawn, and, after a breakfast of coffee and tortillas, each man rounds up his hobbled burros (Fig. 17) and prepares from four to six animals for the day's work. Each burro gets a small wooden pack-saddle (called a *fuste*, or occasionally *aparejo*; Fig. 18), and, if the man is careful with his animals, a saddle blanket (*corona*) of burlap. One informant said he had seen burros with



Fig. 17. A prize burro and her colt in a wax camp on the Adams Ranch. Note rope hobbles on front feet of adult.

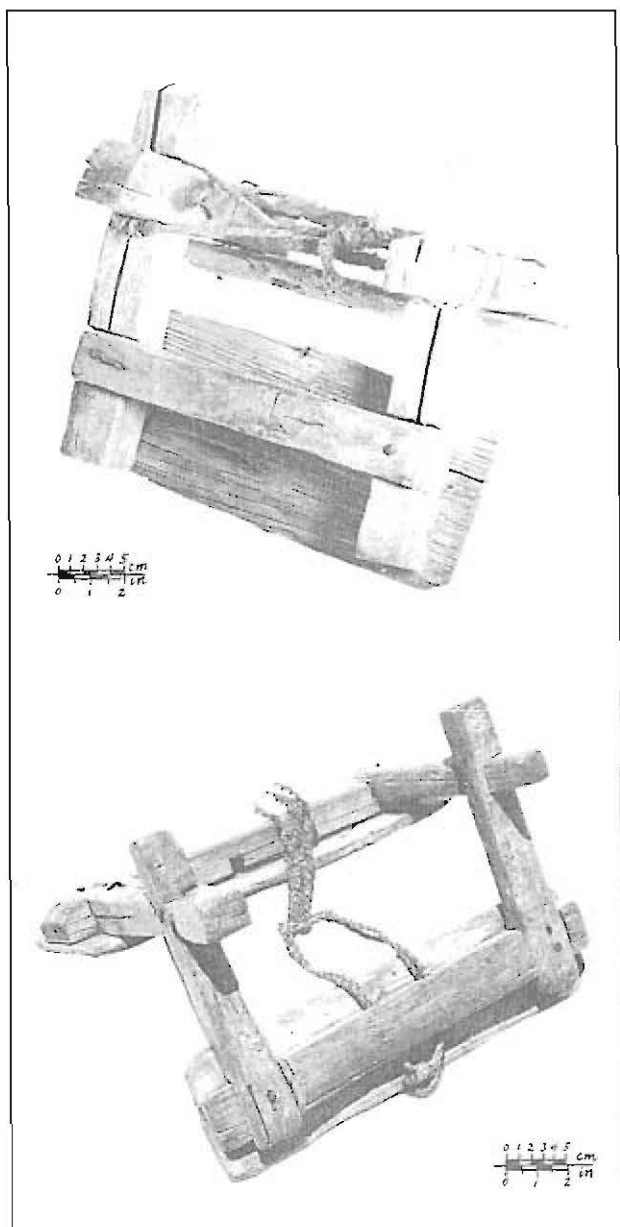


Fig. 18. Packsaddles like these, on a burro, will support four bundles of weed or two bags of wax.

large galled spots on their backs from carrying burdens without proper padding under the saddles. The man will ride on a favorite burro, behind the packsaddle, and carry a bag of tortillas with frijoles and chiles, and a plastic bleach bottle of river water. He may travel from a few hundred yards to as much as five miles, depending on how long the camp has been active, in order to find good candelilla growth. When a slope with good growth is located, he hobbles the burros and begins the hard, solitary work of "pulling weed."

The plants are usually pulled up by hand, but a sharpened stick may be used as a primitive spading fork. After dirt and rocks are shaken from the roots, the plants are thrown into wind-rows until a large quantity has been gathered. Then a rope 10 to 12 feet long (called a *mecate*; Fig. 19) made in a local *fabrica* from lechuguilla fiber is laid out on the ground, and the plants are carefully stacked on it with root ends alternating with tips. About 50 to 80 pounds of plants are tied in a bundle with each rope, using a *honda* (Fig. 20) to facilitate cinching and quick release of the load. Graham (1975:44-45) gives a more detailed description of the gathering process. Later in the day the burros are rounded up, and four bundles of weed are tied on the packsaddle of each animal. When asked how much candelilla can be carried by each burro, one candelillero responded:

That depends entirely on the conscience of the man—one man may put 250 or even 300 pounds on a burro, while another man will never put over 150 pounds on his animals. (Arenivas, 1976 interview)

So six burros and one man may bring in 1,200 pounds of weed which, when processed, will yield about 24 pounds of wax. The weed is stacked in orderly piles in the camp and may be stockpiled for days or weeks until it is time for it to be boiled for removal of the wax.

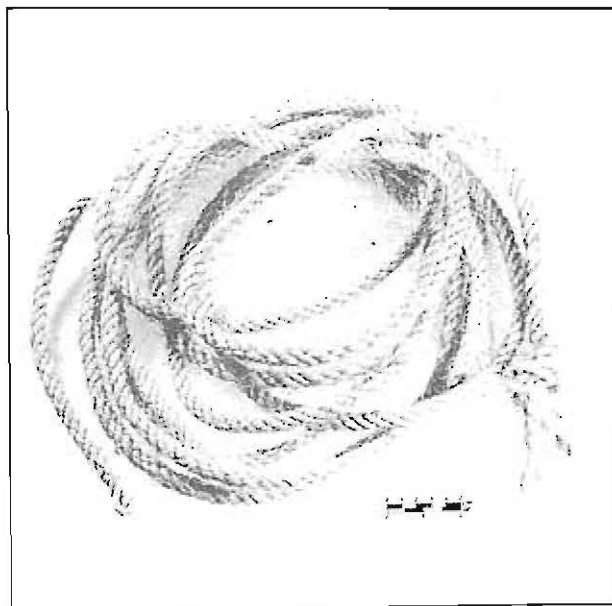


Fig. 19. Rope made of lechuguilla fiber, from the San Carlos area.

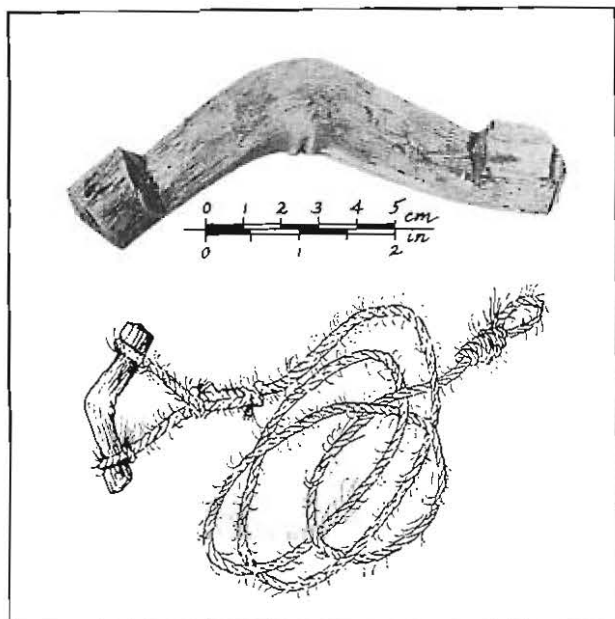


Fig. 20. Honda, carved from wood, used in tying a bundle of candelilla. Inset drawing shows rope attached to honda.

The wax gatherers pull all of the accessible plants they can find in an area before they move on to another stand of plants, so a broad band around each wax camp is denuded of plants before the camp is moved to another location along the river. The gatherers commonly ford the river and gather weed indiscriminately in Texas and Mexico and take no particular note of ranch or park boundaries unless forced to do so.

The National Park Service has recently increased efforts to control illegal harvesting of candelilla in Big Bend National Park. In May 1980 a park official said they had caught a large burro train loaded with candelilla on Mesa de Anguila a few months before. The cereros were carrying candelilla down a treacherous trail and across the river to a wax camp about two miles up a tributary toward San Carlos. The burros were confiscated and the men turned over to Mexican authorities. These cereros were double smugglers—carrying weed out of the park and across the river to their camp and then bringing the extracted wax back across the river to a buyer. The Park Service was planning another raid on a wax operation the following week. A camp on the Mexican side of the river in Boquillas Canyon was sending burro trains up a tributary canyon on the U.S. side to gather

weed in the park. The Park Service planned to have enforcement personnel go down the river, seal off the trail, and trap the gatherers in the park with heavy loads of candelilla. Increased poaching of candelilla in the park is another indication that the weed is being overexploited in Mexico.

Boiling the Wax

When sufficient candelilla has been stock-piled at camp, the vats are made ready for extracting the wax. (Cross section of a typical vat is shown in Figure 21.) Ashes are scooped or scraped from the firebox and thrown aside. The vat is cleaned of dirt and debris from previous firings and filled to within six or eight inches of the top with river water (Fig. 22). An average vat will hold from 200 to 300 gallons of water, which is carried from the river in five-gallon cans. The same water, with some added at each firing, may be used for eight or nine days before the vat is emptied and cleaned.

Several large pitchfork loads of spent weed (*yerba seca*) are shoved under the vat, and a fire is started with matches and paper or dried creos-

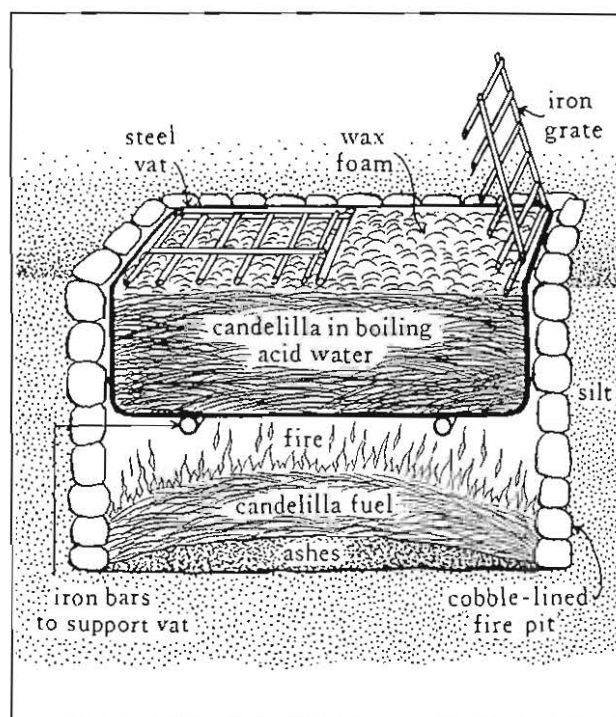


Fig. 21. Cross section of fire pit and wax vat.



Fig. 22. Empty wax vat ready to be charged with weed. San Vicente area.

sote bush. Soon a roaring fire is burning beneath the vat, and gray smoke billows out of a chimney made from a steel drum (Appendix II, Fig. 4). Additional forkloads of dry weed must be added to the fire every five or ten minutes during the firing, and occasionally a long-handled shovel (*paila grande*; Fig. 23a) is used to remove some of the growing mound of gray ash from the firebox.

A high mound of candelilla is forked onto the water in the vat. Two men climb on top of the load and, while holding onto the open grates (*parillas*), they stomp and tromp the weed down to water level (Fig. 24). Their shoes occasionally encounter the acid water, thus partly accounting for the large number of discarded shoes around wax camps. Then an additional six-inch layer of candelilla plants is placed carefully, lying horizontally, over the top of the vat (Fig. 25). When these plants are tromped down, no loose ends will protrude above the water and interfere with scooping the wax. A smooth stick about four feet in length (Fig. 23b) is used to push all loose plant ends down in the corners and along the edges of the vat. The vat is now charged with as much as 500 pounds of weed. The grates then are pushed down on the neatly tucked load of weed (Fig. 26), and a clamp is placed across the center of the vat. A gallon jug is opened and two cans of acid (*ácido obscuro* or *sulfúrico*) are poured on the packed weed. A pipe handle is placed on the clamp, and two men push it down, completely submerging the weed. A large rock is then used to hold the pipe in place. Soon the contents of the vat begin to boil and bubble and a brown foam of wax appears on the acid water (Fig. 27). A candelillero squats beside the vat with a perforated skimmer, or *espumador* (Figs. 28, 29). The hot foam may be skimmed into a cut-off steel drum, a bucket, a conical hole in the ground, or on the ground surface inside a dampened earthen dike (Fig. 30). The hot foam separates as it is scooped into the mold, and the brownish water sinks to the bottom. Above the water is a layer of smooth, yellow cerote about the consistency of heavy cream, and on top is a crust of ashes, bubbles, and debris.

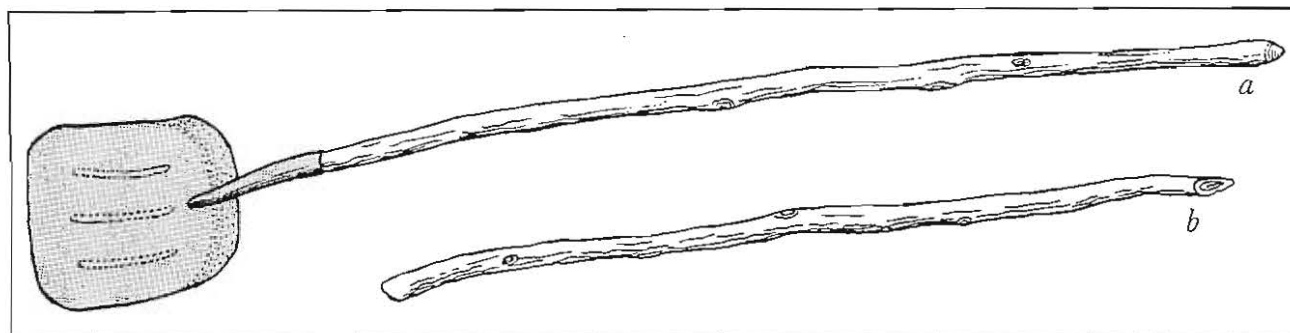


Fig. 23. Tools: (a) *paila grande* for shoveling ashes from a fire box; (b) a stick for poking loose weed into a vat.



Fig. 24. Stomping weed into the vat before firing. Adams Ranch.



Fig. 25. Final charging of the vat with candelilla. Adams Ranch.



Fig. 26. Final closing of the grates on a vatload of candelilla. Adams Ranch.



Fig. 27. Waxey foam on top of a boiling vat with steel drum mold to the left. The manufactured pitchfork is rare. Mariscal Canyon.



Fig. 28. Waxy foam being scooped from the top of a boiling vat into a steel-drum mold. Mariscal Canyon.



Fig. 29. Two well-used skimmers handmade from tin cans.

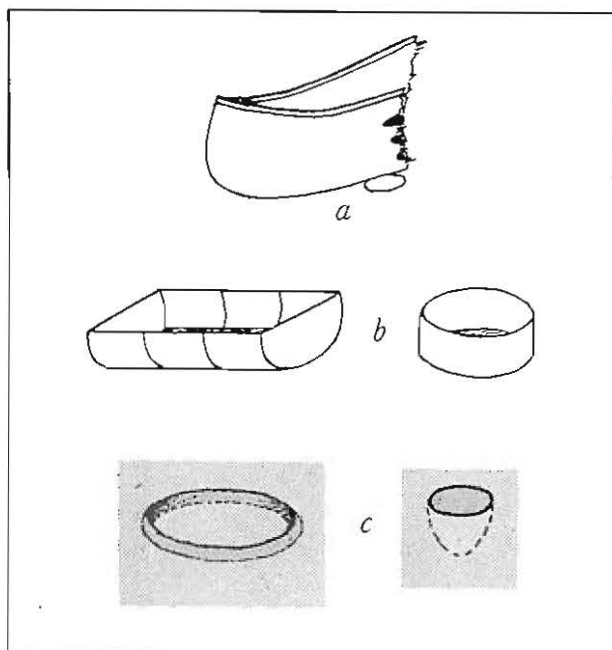


Fig. 30. Molds for rough wax: (a) improvised mold made from end of fiberglass canoe; (b) steel drums cut lengthwise and crosswise; (c) ground-surface and conical-hole earth molds.

The cerote is left to harden overnight. If a barrel or bucket is used to form the wax, several inches of water must be left beneath the wax so that when it forms into a three- or four-inch-thick layer, it can be broken out easily. At one camp, molds made from steel drums cut lengthwise (see Fig. 36) were used because the wax cake was easier to dislodge from these half-cylinders. One cerero said he always molded wax in the ground because it hardened quicker, was easy to dislodge from the hole, and weighed slightly more because of adhering sand.

The skimmer continues to skim wax from the vat every few minutes for a period of about 20 minutes. Then an extra can of acid is poured into the boiling water to increase the wax yield. A cerero said a gallon of acid will serve five or six vats of weed and is expected to yield about sixty to eighty pounds of raw wax.

After about half an hour the candelilla has yielded most of its wax. A handful of ashes is dropped into the corners of the vat opposite the skimming. This causes a violent reaction that drives the last traces of wax to the end of the vat, where they are scooped out. Wax makers never waste even small amounts of the valuable wax.



Fig. 31. Refilling the vat with water at the end of the cooking cycle. Adams Ranch.

When the man in charge is convinced that no more wax will come from the load, cold water is added to bring the liquid level to within an inch of the top of the vat (Fig. 31). The grates are then released from the clamp and thrown back, and a soggy mass of spent weed rises from the vat. If the men have no wheelbarrow, they lay two long, smooth poles parallel on the ground beside the vat and a mound of wet weed is forked onto the poles. The men then carry the load (Fig. 32) a few yards and dump it on a mound of drying spent weed, which will eventually be used as fuel.

More dry weed is stoked under the vat while fresh candelilla is being forked onto the water in the vat—and the process begins again. Since the water level in the vat was just right before the spent weed was removed, it will again be right when the vat is recharged. It never overflows. This process is repeated over and over until the stacks of candelilla and the men are exhausted.

Ramón Riojas said he expected to get twelve pounds of wax from each vatload of weed. Since thirty minutes are spent on each vat load,

he might produce 240 pounds of wax in a ten-hour day. At \$1.50 per pound (market price 1980), this wax could be worth about \$360 when refined. Ramón probably gets about ten cents per pound, or \$24 per day.

When the cakes of cerote are hardened, they are removed from the molds and broken into angular chunks with a hammerstone (Fig. 33). The wax chunks are placed in burlap bags, which are then crudely sewn shut with cordage. The valuable bags of cerote may then be hidden in a safe place nearby; we have never seen them

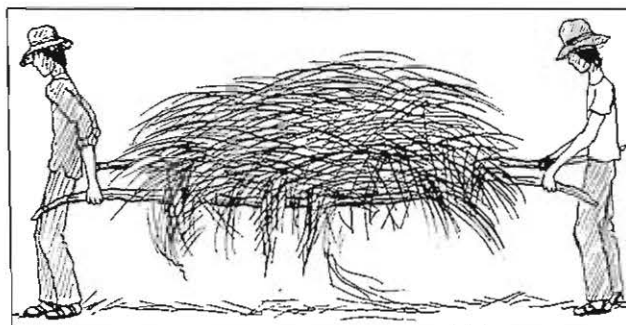


Fig. 32. Cereros use two unattached poles to carry a pile of cooked weed, which will be dumped, dried, and used as fuel.

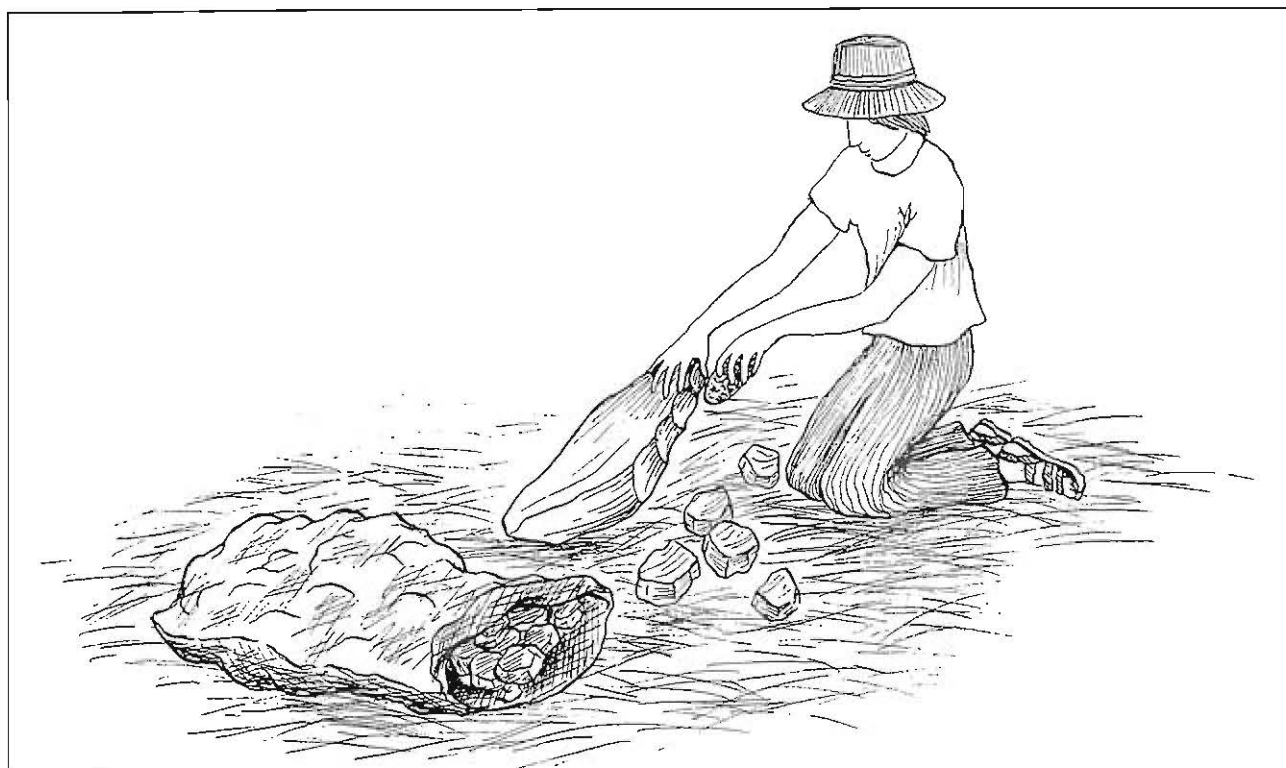


Fig. 33. Breaking cerote into angular chunks with a hammerstone.

stacked in camp. Perhaps in some secluded rock niche they are safer from brushfires, government agents, and bandits.

Refining the Wax

Cerote as it comes in from the camps along the river is unsuitable for marketing and must be refined. In recent decades all wax refining and marketing in west Texas has been done by J.E. Casner and David Adams.

Casner described the following process as practiced in his Alpine refinery (Fig. 34) in 1976. The two large, circular steel vats have flat bottoms and are about 3 meters in diameter and 2 meters in depth. These vats rest in a large firebox made of fire-bricks. Butane heating elements apply flames to the bases of the vats, and the wax melts at about 160 degrees F. The heat must be carefully monitored and controlled to prevent boil overs. About 5,500 pounds (wax is weighed in pounds, 1 lb. = .4536 kg) of cerote is placed in each vat with about 3 cm of water in the bottom to keep it from

scorching. The vats are heated for five to six hours to drive off all moisture from the wax and let sand settle to the bottom. The floor of the building immediately in front of the vats is smooth, well-waxed concrete and is divided into shallow, square septa by steel bulkheads that are about 20 cm high. The hot wax is drained through pipes into these shallow floor "cells" to cool in about 8-cm-thick layers.

About 5 cm of residue in the bottom of each big vat is dipped into a smaller rectangular vat, where it is boiled in about 60 cm of water. The wax is left to harden on top of the water and is then broken out and placed in the next batch in the big vats. Dregs from the bottom of the rectangular tank are discarded. The refined wax on the floor cools overnight and forms four solid cakes of wax about 3 meters by 5 meters in size and 7 cm in thickness. These wax cakes are pried up the following day and broken into fist-size chunks with ball-peen hammers. The angular chunks of refined wax are then placed in new burlap bags (ca. 100 pounds each), and the bags are sewn shut for shipping.

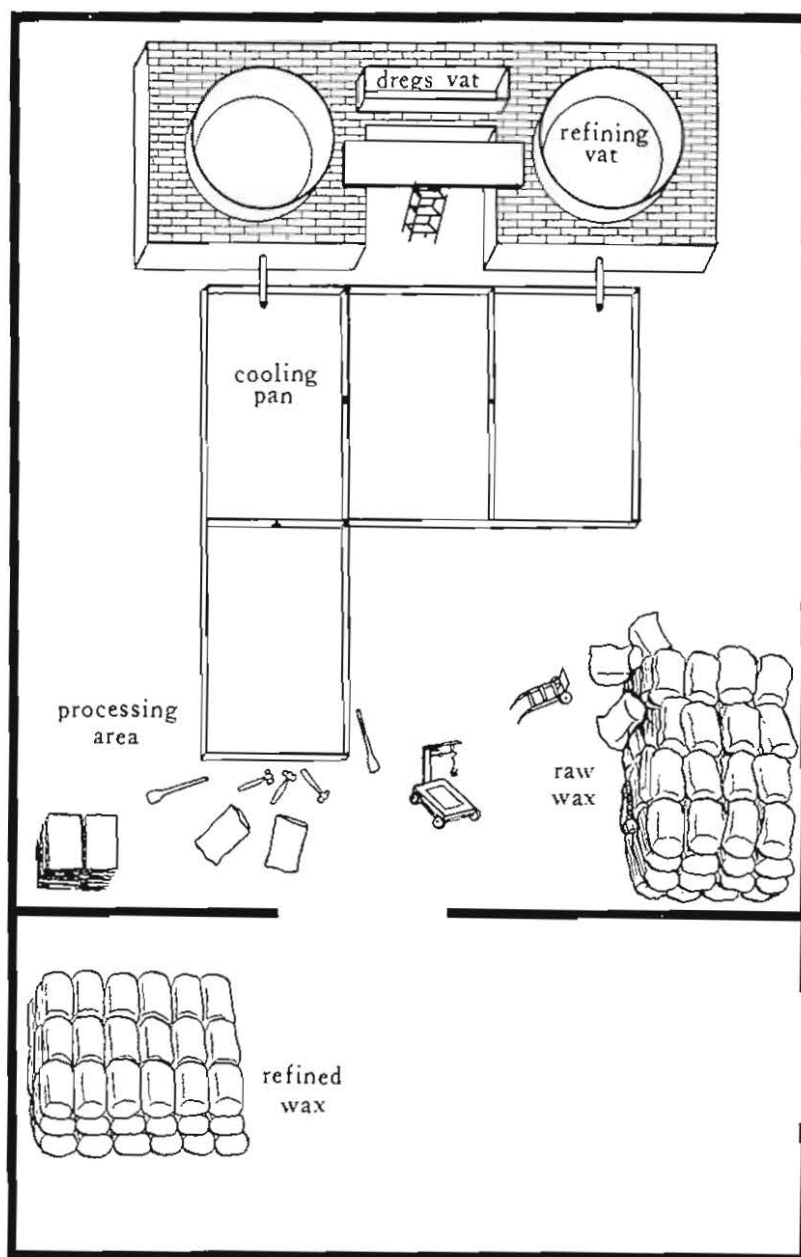


Fig. 34. Casner wax-refining plant in Alpine, Texas, as it appeared in 1976 (not drawn to scale).

Adams has a similar refining plant at his ranch on the Rio Grande (Fig. 35).

We take the crude wax and boil it with a little bit of sulphuric acid, and boil the water out of it, and then just let it set until the dirt and stuff like that settles to the bottom. And then we pour it out of the vat into cooling platforms and let it cool. And we change the color from a whitish color to a kind of tan or brown which is the difference in the moisture content. We sell a refined wax. It's just nearly pure wax. When we buy it, it has about 10 percent dirt and water mixed up. (Adams, 1980 interview)

Adams said he bought his big refining vat from Asa Jones. Asa told Adams he paid 50 dollars for the vat and had used it for years, so Adams thought he might buy it "used" for about 20 dollars. Instead, Asa said because of inflation it had increased in value to 150 dollars, and that was what it cost.

Ramón Riojas, foreman on the Adams Ranch, said they put about 3,500 pounds of cerote in the big vat and use butane burners to heat it. When the wax is sufficiently cooked, it is drained onto the cooling floors in the barn

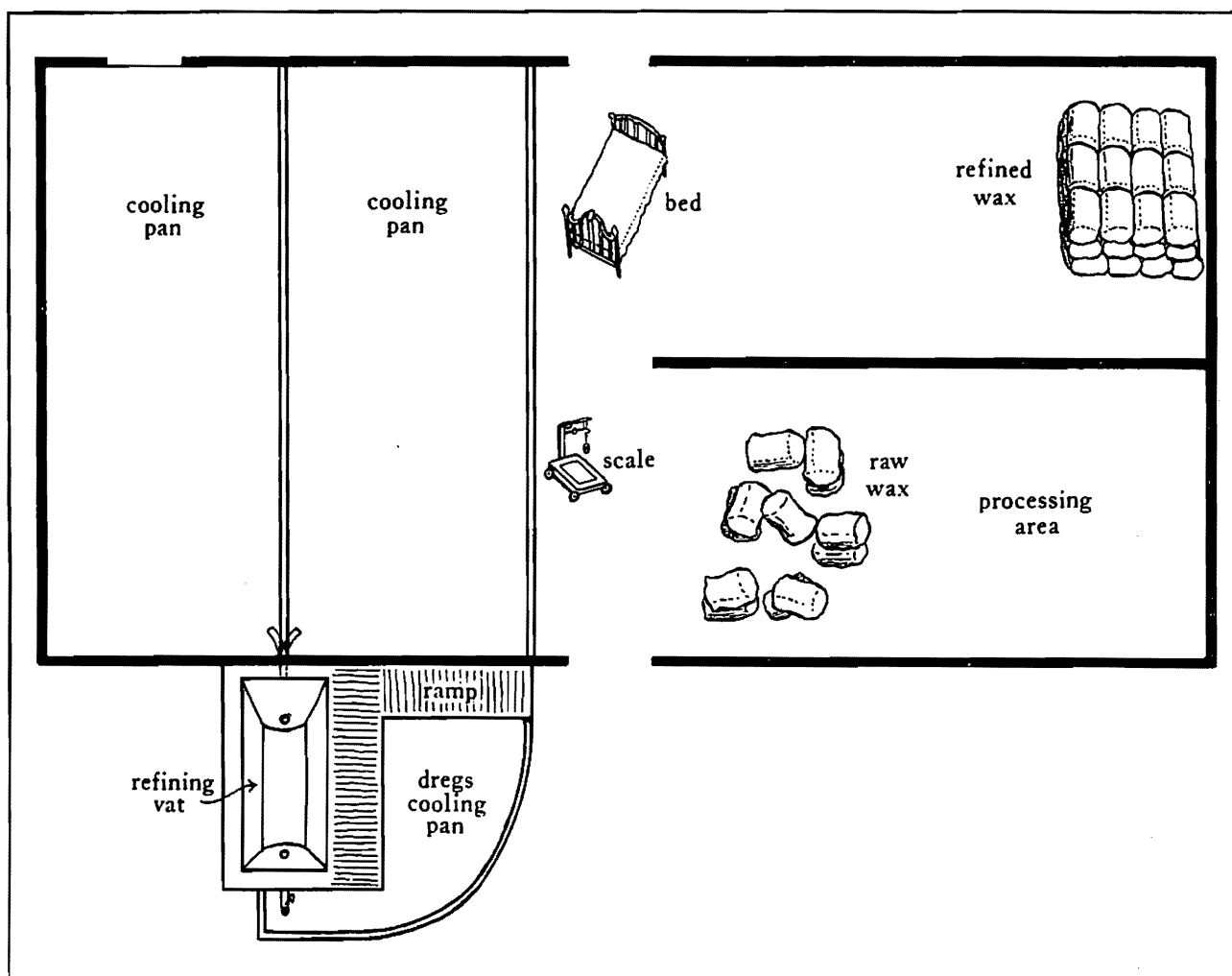


Fig. 35. Wax-refining plant on the Adams Ranch (not drawn to scale).

out of the sun and rain. He said the floors retain heat, so it is necessary to alternate between them so one of them can cool and thereby cool the wax more quickly. Once the refined wax cools, it is broken up with bars and hammers and bagged in new burlap bags (*costal*). The wax is carefully weighed and exactly 138 pounds of refined wax is put in each two-pound sack, for a total weight of 140 pounds per bag. At the time of our visit there was about 15,000 pounds of wax at the refinery, and Riojas was very proud that it was "wax produced by Ramón." He provided us with fragments of cerote and refined wax and assured us that we would find them to be of the highest quality.

The Wax

Wax forms on candelilla stems in a flaky coating that is heavier during the dry season (November through March) and in colder months. Rain, when it does fall, removes some of the wax from the stems and makes the plants less likely to produce wax until the area has again dried out. It is said that an expert wax maker can twist a plant and pull it through his hands and accurately predict the yield of a stand of candelilla. Even a novice can twist stems of the plant and find his hands covered with tiny white flakes of wax.

The wax yield is about 1.5 to 2.5 percent of



Fig. 36. Block of cerote from a half-barrel mold. Lower Canyons.

plant weight. Cerote is the common name of raw wax as it is brought in from camps along the river (Figs. 36, 37). The raw wax is in large angular chunks, from the size of your fist to almost as large as your head, weighing about 200 to 1,000 grams each. The cerote chunks are broken from large molded blocks by percussion and exhibit curved (conchoidal) fractures on many facets (Figs. 33, 38). Raw wax is a dirty buff color and contains obvious bubbles, sand grains, and fragments of plant stems and carbon. The refined wax, as marketed, is in percussion-fractured, angular chunks of a more uniform shape, averaging about 8 by 10 cm in size and weighing about 150 grams (Fig. 38). These fragments contain no obvious contaminants, are somewhat heavier by volume and more dense than cerote, and are a dark caramel brown in color. After the wax has been refined, it has a hardness of between one and two on the mineral scale (Hare and Bjerregaard, 1910:204) and can be scratched easily with your thumbnail. It is harder and more brittle than beeswax and less so than carnauba. When candelilla wax is warmed, the odor resembles that of beeswax. In the sample analyzed by Hare and Bjerregaard (1910:203-205), the melting point was found to be 67 to 68 degrees C and the solidifying point, 64.5 degrees C. They give the refractive index as 1.4555 at 71.5

degrees C and compare these and other characteristics to carnauba, beeswax, and Chinese insect wax. After combustion the wax yielded 80.3% carbon and 12.69% hydrogen. Wax from plants harvested in the winter has a higher melting point and is somewhat harder than that obtained from plants harvested in other seasons (Daugherty, Sineath, and Wastler 1953:8). Plants of different ages are also said to yield wax with slightly different properties. Candelilla wax is soluble in organic solvents such as acetone, benzine, carbon tetrachloride, chloroform, ether, and gasoline—particularly when the solvents are heated. Alcohol can be used to remove resins from the wax for purification. Daugherty, Sineath, and Wastler (1953) present five tables of detailed data on wax from several species of candelilla, including *Euphorbia antisiphilitica*.



Fig. 37. Chunks and cakes of rough wax. Note the wax molded in a hole dug in silt in the background. Mariscal Canyon.

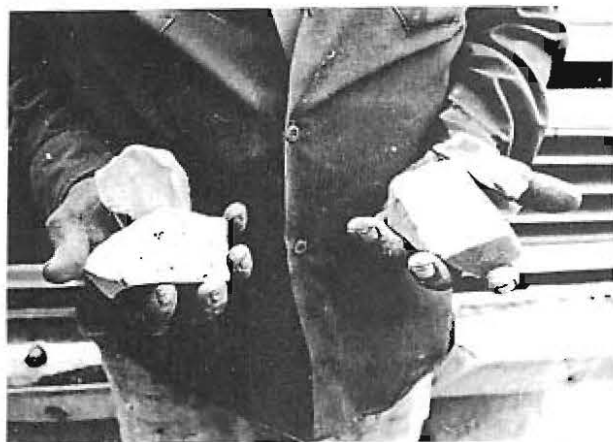


Fig. 38. Cerote, on the left, and refined wax, on the right, in the hands of a master wax maker. Adams Ranch.

Uses for the Wax

Few people in this country have ever heard of candelilla wax and only a handful have seen it being produced, yet nearly everyone has had personal contact with it. If you have chewed gum, used cosmetics, worn shoes, ridden horseback, polished an auto or an antique, played a phonograph record, or walked across a dance floor, you have probably encountered wax from candelilla plants.

Traditional or folk uses for the wax include candles, religious statues, artificial flowers, cloth waterproofing, leather dressing, chewing gum, dance-floor wax, and coating for the small wax matches from Mexico. Candles made from the wax are said to "burn with a bright light and an agreeable odor" (Hodge and Sineath 1956: 146).

Since before World War I, when the wax became readily available, it has been used extensively in chewing gum and, more recently, in breath mints (Fig. 39). Various big name companies have used the wax in automobile polish, floor waxes, furniture polish, and saddle soap. Leather shoes are treated with the wax to facilitate polishing and prevent squeaking, and leather-stitching thread is waxed for strength, ease in sewing, and waterproofing. The wax is used in carbon paper, parchment, stencil and tracing papers, and as an ingredient in inks for printing, stamping, and writing. Mixed with

gum elastic and guttapercha, it has been used extensively in electrical insulation. Fine, high-luster varnishes and lacquers contain candelilla wax, and various products such as adhesives, cements, cosmetics, crayons, and lead pencils also contain small amounts.

During the world wars when other waxes were scarce, candelilla wax was indispensable to the military for waterproofing and insect-proofing tents, tarpaulins, thread, and fabric. Airplane parts were coated to prevent deterioration and lessen friction. Some explosives contained small amounts of wax, and the bags of powder charges for naval guns were impregnated with it.

Candelilla wax has been used as a hardener for soft waxes and as a dilutant for beeswax and carnauba. It serves well as an acid-proofing agent in metal etching. Even unexpected products like linoleum, celluloid, plastics, rubber, ointments, and paint removers contain small amounts of candelilla wax. Phonograph records, precision castings, dental castings, anatomical models, and molded figurines utilize the wax. The textile industry has used the wax as sizing in fabrics, to coat thread, and to lessen friction on shuttles in looms.

Certainly a product that has been found useful for such diverse applications probably has been used in dozens of other industrial products as well. Whitaker (1941:498) says candelilla wax probably has more uses than any other product originating from an uncultivated plant on this continent. And yet, primary production is still by means of back-breaking labor and burro power.

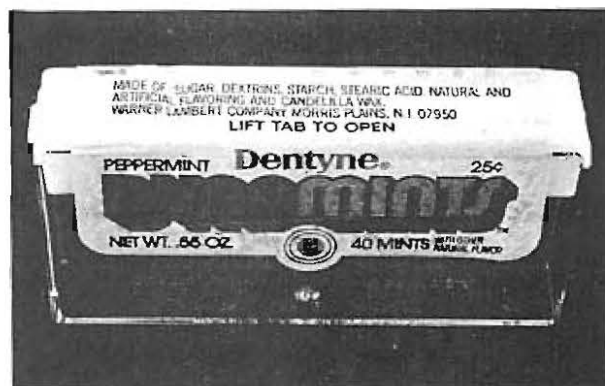


Fig. 39. A popular breath mint containing candelilla wax.



3

The Candelilleros and Their Camps

Wax Makers

Work Conditions and Wages

Wax makers are called *cereros* or *candelilleros* or occasionally *paileros* and are always men (Figs. 40, 41). There is a conspicuous absence of women in the camps. The occupation of wax maker is one that many men along the border have practiced at one time or another, and a few men work at the wax vats for years.

All wax makers come from Mexico. You couldn't get people in this country to make wax if it was worth five dollars per pound. You can't just hire anyone to make wax, they need to have had experience. It is very hard work and relatively few men can do it well. The men have to have tough hands and a strong back to pull *candelilla*. They never use gloves and you can tell by looking at their hands if a man has worked with wax a long time. Experienced men can get more wax from each ton of weed and get more wax with less acid. (Adams, 1980 interview)

Some of the *cereros* are family men who travel back to their villages—Las Norias, Boquillas, Santa Elena, El Mulato—periodically to visit their families, attend mass, and get supplies.

Others are young men who are wanting to learn a trade, earn sufficient money to go to a city like Ojinaga or Juarez, or, more likely, head north as illegal aliens. A few are drifters or men outside the law and are hostile toward strangers with cameras or hide in the rocks to avoid such contacts.

Generally *cereros* work eight to ten hours per day and six days per week. Sometimes the men will work for 20 or 30 days straight and then quit and go to nearby towns "to see the girls and get alcohol." They also like to observe all manner of religious and political holidays. Some men may go well down into Mexico to visit family or attend weddings. Their usual mode of travel is by burro or "they just walk."

A good wax maker can gather the plants for and extract about 1,000 pounds of wax per month if he works at it. One man can make wax by himself, doing everything from gathering the plants to the final boiling and bagging, but usually at least two men work together. Men of the same family (for example, a man and his sons or several brothers) often work together on a crew. When the price is right the men produce wax the year round; however, slightly more wax is produced in winter than in summer.



Fig. 40. A cerero and his favorite burro relax for a moment. His good boots are rare in the canyons.



Fig. 41. Candelilleros watching a cameraman. The vat has received a heavy charge of weed, but the grates are still open. Lower Canyons.

The men are paid a little more if they provide their own burros, but a foreman or rancher always has extra burros on hand. When asked the price of a burro, one informant said: "If you are wanting to buy a burro it is always worth 100 dollars, and if you are wanting to sell one it is always worth 25 dollars." He estimated a good average price in 1980 to be about 50 dollars.

Adams said wax makers on his ranch will work hard until they have made 200 or 300 dollars in a month, then they begin to slack off. If they worked hard all month they could make as much as 600 dollars, but they don't seem interested in making as much money as possible each month. He believes that, generally, the standard of living of the wax makers is much better than it used to be, and that "some day if Mexico becomes sufficiently affluent, no one will want to produce candelilla wax."

Adams said "you gotta have a commissary if you're going to produce wax." He said he always sells groceries to the men because they have no other place to get them. "You can't

just provide them with food because if you do they will use a pound of coffee per day, but when they have to buy it themselves a pound of coffee will last them for a week." The most common items which he sells to the men include coffee, beans, potatoes, flour, black pepper, salt, canned tomatoes, vermicelli, lard, roll-your-own tobacco, onions, and chile peppers. He said it is rare for the men to have meat, but occasionally they may have a chicken or a goat if those can be acquired cheaply from a nearby homestead. They also kill javelina hogs on the ranch but are not permitted to kill deer. Traps are used by the men, since they are not permitted to have guns on the ranch. Adams said that, since he also forbids the wax makers to have liquor, things are fairly quiet on the ranch.

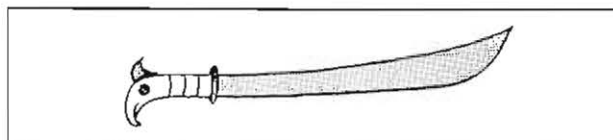


Fig. 42. Machete, the all-purpose tool of the wax camps.



Fig. 43. Candelilla bed and spare boots in a small limestone rockshelter. Boquillas Canyon.



Fig. 44. Small thatch shelters such as this one offer minimal protection from the weather. Note the discarded shoes. Lower Canyons.

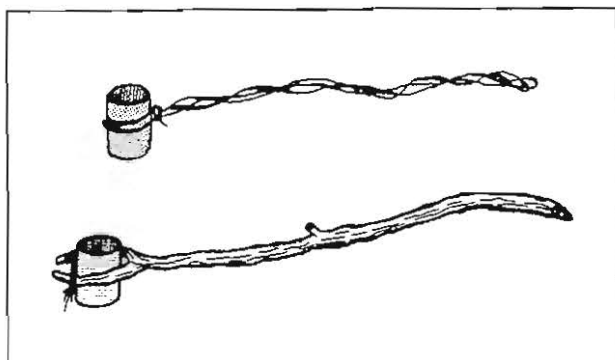


Fig. 45. Above, acid dipper with twisted wire handle; below, acid dipper tied to a stick.

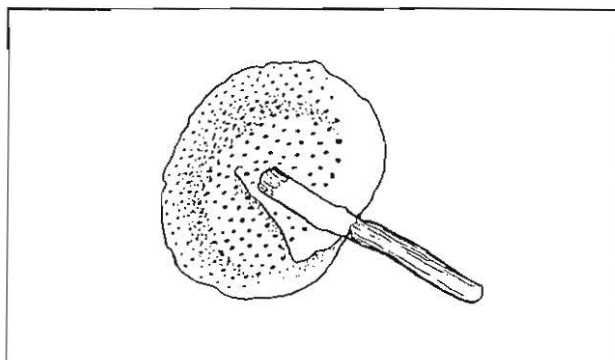


Fig. 46. Espumador, or wax skimmer.

Adaptation and Improvisation

Cereros take little in the way of material possessions with them to the camp. An iron wax vat with grate, burros and packsaddles, machetes (Fig. 42), burlap bags, rope, jars of acid, a few cooking pots, staple food, and a change of clothes make up the usual inventory. The men are masters at improvisation, adaptation, and "living off the land." This is perhaps best illustrated by the shelters that they find or fabricate. The cereros' use of the candelilla is especially noteworthy, for not only does the plant produce the wax and provide fuel for the vats, the wax makers also use it for their beds (Fig. 43) and as thatching for various types of shelters (Figs. 44, 57, 59). The types of shelters and their methods of construction are discussed in the section on camps below.

Candelilleros fabricate many of the tools they use for work, the implements they use in cooking, and even the clothing they wear. Pack-

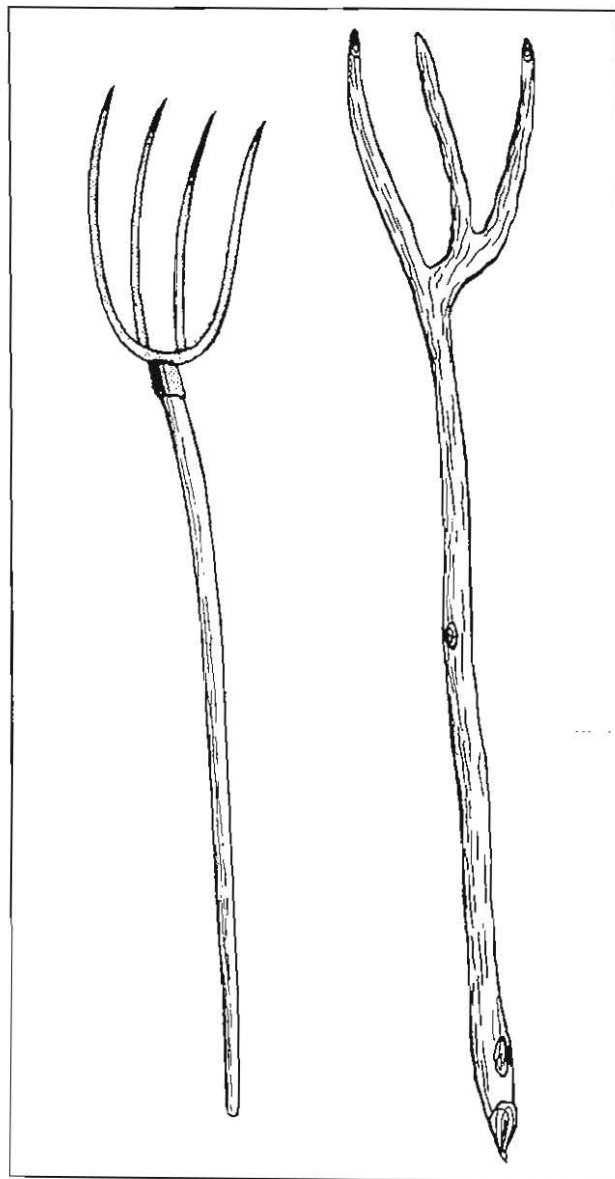


Fig. 47. A manufactured pitchfork (left) is rare in the wax camps; pitchfork made of mesquite limb (right) is more common.

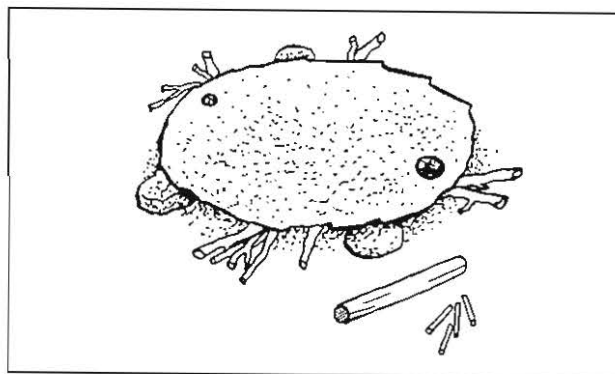


Fig. 48. Tortilla griddle made from the end of a steel drum; wooden roller and cut cane cigarettes in foreground.

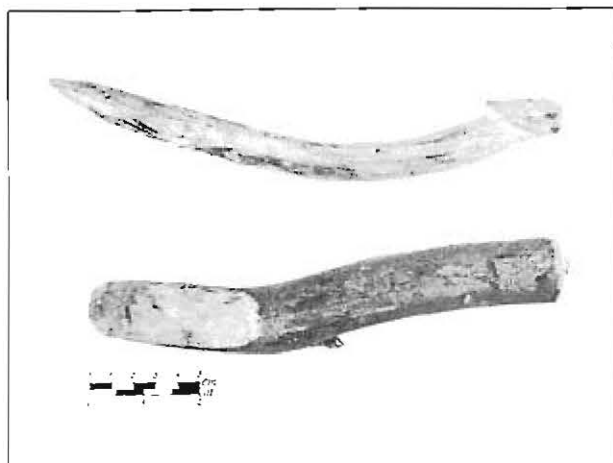


Fig. 49. Pegs like these are driven into shelter walls for hanging clothes and food.

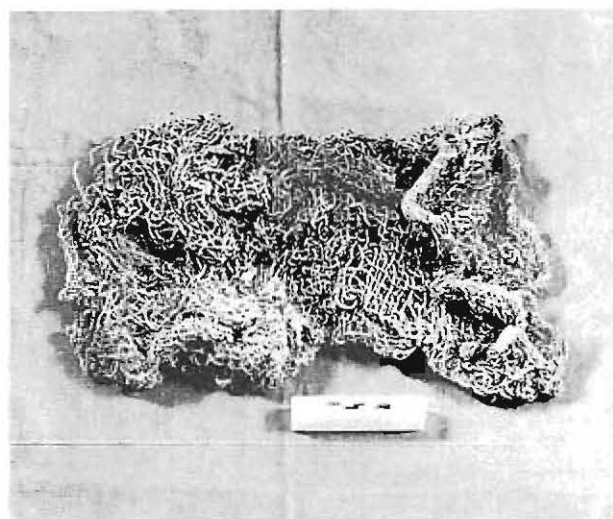


Fig. 51. A bag handmade from cordage twisted from lechuguilla fibers.

saddles often are made from pieces of driftwood held together with rope, pegs, and salvaged nails (see Fig. 18). An acid dipper consists of a small can or jar tied in the fork of a stick (Fig. 45). A wax skimmer is made from a flattened tin can perforated with a nail and attached to a handle with wire and nails (Fig. 46; see also Fig. 29). Pitchforks for stoking candelilla into the fire are carved from forked mesquite branches (Fig. 47). If no wheelbarrow is available, candelilla is stacked on two parallel poles and carried between two men (see Fig. 32). A gridle for tortillas is made by cutting the flat end

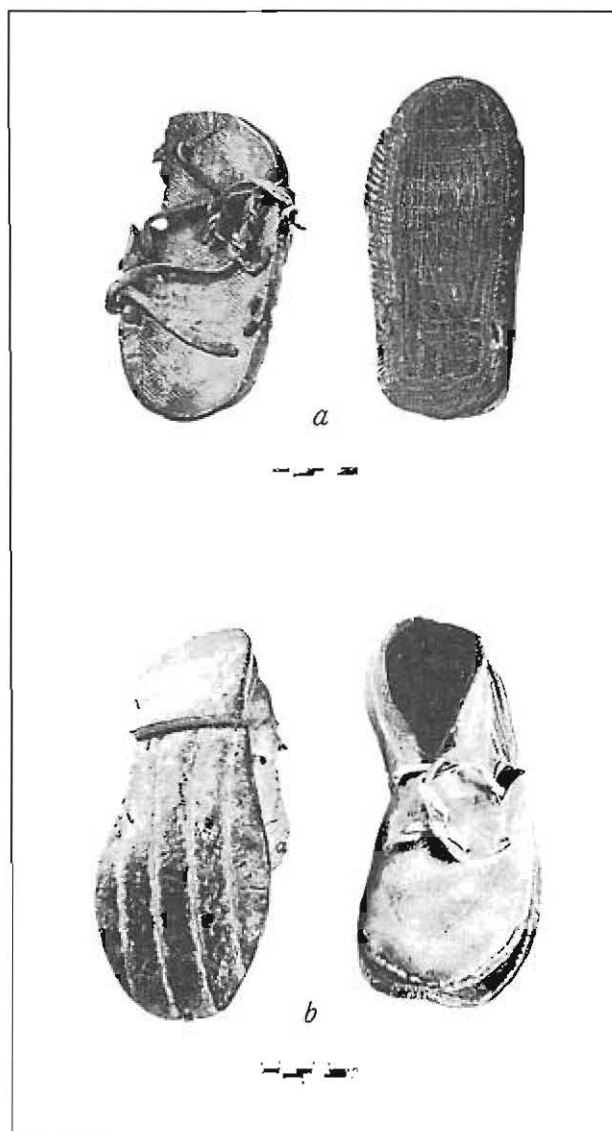


Fig. 50. Footwear: (a) handmade sandals with tire-tread soles; (b) often-repaired shoes from a wax camp in the Lower Canyons.

from a steel drum (Fig. 48). Wooden pegs are cut and driven into shelter walls for hanging clothing and food (Fig. 49). A hanging wire serves to keep food out of the reach of rats. Sandals are fabricated from the tread of old tires (Fig. 50a), and shoes may be repaired and reused as long as bent nails will sustain them (Fig. 50b). Leggings of raw goat skins are sometimes used to reduce the painful wounds inflicted by lechuguilla and Spanish daggers on the gathering slopes. Plastic bleach bottles lost by fishermen are the usual water canteens seen around camps and carried on burros.

One informant described an example of spontaneous inventiveness:

I was walking with a wax collector one time when the candelilla load began to shift on the burro. The man stepped over to a *torre yucca* and stripped off some fibers with his fingernail and twisted them into a crude cord and tied the candelilla load to the packsaddle more securely. (Burleson, 1976 interview)

Sotol and lechuguilla are readily available sources of good fibers for twisting into twine and rope, which are used in the harvesting of the weed, fabrication of bags (Fig. 51) and shelters, repair of tools and clothing, and for many other purposes. We have seen piles of leaves and quids from both species where hungry *cereros* have baked the plants in hot ashes at the front of fire pits and feasted on the nourishing hearts (Appendix II, Fig. 4). Our field party baked hearts of both plants in an earth oven for 20 hours and found them to be soft, quite palatable, and almost tasty.

For the most part the wax makers have been friendly and cooperative with our field crews, permitting us freely to take photographs, ask numerous questions in broken Spanish, wander around camp, draw maps, and pet burros. An occasional small *mordida* of cold beer or money improved communications (see Fig. 64) and helped compensate the workers for time lost in conversation.

The Camps

Location and Features

Rarely, a wax operation may be set up sufficiently near a settlement that the men can commute from their homes to the production area, but most such locations were exhausted long ago. By far the most common pattern is for several men, three or four to eight or ten, to take their vats and donkeys into a remote canyon area where candelilla is abundant and establish a camp, which they may use continuously for months and intermittently for years.

A few camps may be found near springs, tinajas (potholes), or windmills, but the majority, even those in out-of-the-way places in the canyons, are located near the river (Fig. 52). The camps occur on both sides of the Rio Grande and seem to be situated according to convenience with no consideration of the international boundary. The vats usually are placed immediately beside the river on the first terrace, a couple of meters above normal river flow and three or four meters back from the terrace edge (Fig. 53). Living areas may be from ten to thirty meters farther back on the same level but are more often on the edge of the second silt terrace. The area of the camps varies from about a quarter acre to as much as two acres, with most of the area devoted to stockpiles of candelilla awaiting processing and spent weed drying for fuel. Variations in the layouts of the camps are shown in Appendix II.

The most prominent features in the camps include vats and firepits, deeply worn trails, piles of ashes, sleeping shelters, candelilla stockpiles, yerba seca (cooked candelilla) piles, sunshades of various types, brush fences, and burned areas in brush and cane along the river. The most obvious activity area in a camp is the area where the weed is processed. The living area where the men sleep and cook is also clearly delimited in most camps (Figs. 54, 55). Occasionally there may be an area where the burros are maintained. Trash seems to be scattered randomly about rather than deposited in a systematic way.

Work Organization

There are various types of organization in the wax camps. Some camps are composed of several individuals who gather weed for themselves and take a "turn" at the wax pit when they have stockpiled sufficient candelilla. Other camps, especially those on *ejidos*, consist of a group of men working in common and sharing in the profits of the operation. A few camps belong to one man, a rancher or *jefe*, who pays wages or a commission on the wax to the workers. Adams said there were from five to seven camps producing wax on his ranch in 1980,



Fig. 52. A plume of smoke heralds a wax camp beside the Rio Grande.



Fig. 53. A wax camp in full production in the Lower Canyons, with mounds of spent weed and ashes.

and these are operated according to a modified commission plan. He has a foreman who buys wax from the camps and then sells it to Adams, and the man makes about 10 cents per pound for the transaction. Adams finds it necessary to buy the wax by the sack even though it is produced on his land, because if he paid the candelilleros to produce it, he would not get as much for his money. Buying wax produced from his own weed costs the same per pound as wax brought from Mexico.

Job assignments in the camps vary. In some, men seem to have particular jobs—stoking the fire, carrying water, skimming the vat, breaking wax blocks, bagging cerote—and the jobs have different status within the group. In other camps chaos seems to reign, with different men doing different jobs at different times and some obviously doing more than their fair share. There often is one older man, the master wax maker, who is nominally in charge.

Shelters

In pleasant weather the wax makers usually prepare meals on open hearths and sleep on top of candelilla piles under star-filled skies (Appendix II, Fig. 1). However, shelters are always provided in the camps for those nights when rain storms rumble through the canyons or cold north winds bring chill and frost.

Rockshelters are the quickest, easiest, and most durable type of shelter available in the desert, and the cereros never miss an opportunity to use them. In some areas, small cavities and crevices in limestone (Figs. 43, 56) serve as individual living units, which may be furnished with candelilla and burlap-bag beds, pegs, and a rat wire for protection of food. These shelters serve well in the most inclement weather. More commonly, overhanging cliffs provide partial shelter for camps and storage of possessions (Appendix II, Figs. 1, 10).

Simple to fabricate and reasonably effective shelters are prepared under convenient mesquite trees (Appendix II, Figs. 5, 6). Branches are chopped from the underside of two or three large overhanging branches, and the shelters are thoroughly thatched with candelilla and cardboard when available. A candelilla bed and

cobble-lined hearth complete the living unit, which is effective in a rain but gives little shelter from cold wind.

At sites where high silt terraces face the wax-producing ground, substantial dugout shelters may be prepared (Figs. 57, 58). These have well-smoothed walls with niches and pegs for storage and unlimited potential for graffiti. The roofs are made with wooden support poles and vigas thatched with thick layers of candelilla interspersed with cardboard and rags. Candelilla beds and cobble-lined hearths are on the floor. These dugouts provide adequate shelter for most weather and may survive for years in a desert environment.

Another type of fabricated shelter is about the size and shape of a pup tent (Figs. 10, 44, 59). This type is made from a framework of wooden and ocotillo poles tied together with lechuguilla fibers and thatched with candelilla. A candelilla bed and plastic water bottle constitute the furnishings. Hearths are not compatible with these shelters, which provide only moderate protection from rain and cold.

Wax Vats

Like the shelters improvised by the workers, the equipment used in making wax varies from camp to camp and according to circumstance. A large wax vat (called a *paila* or occasionally *caldera* by the cereros) may be made from half a steel boiler cut lengthwise (Fig. 60) or fabricated from sheet steel in a welding shop in one of the larger cities. Graham (1975:45) says that in some camps the vats are provided by the wax refiner and do not belong to the cereros who use them. The vats vary in size and shape but may be about 6 feet long, 3 feet wide, and 3 feet in depth. A heavy steel grate is attached at either end by loop hinges and, after much stomping to submerge the weed, a lever clamps the grate at the center to hold the load in place until the wax is boiled off. The vats and grates can be used for years, although they frequently need patching or small repairs.

A small wax vat made from half an oil drum cut lengthwise was seen tied between two wooden poles and carried by two burros. It was designed for easy transport into a remote niche



Fig. 54. Living area in a wax camp in the Lower Canyons. Note the packsaddles and burlap bags.



Fig. 55. A camp beneath the trees with a makeshift platform. Plastic carrying bags like the one hanging on the tree at left are now common in wax camps. Lower Canyons.

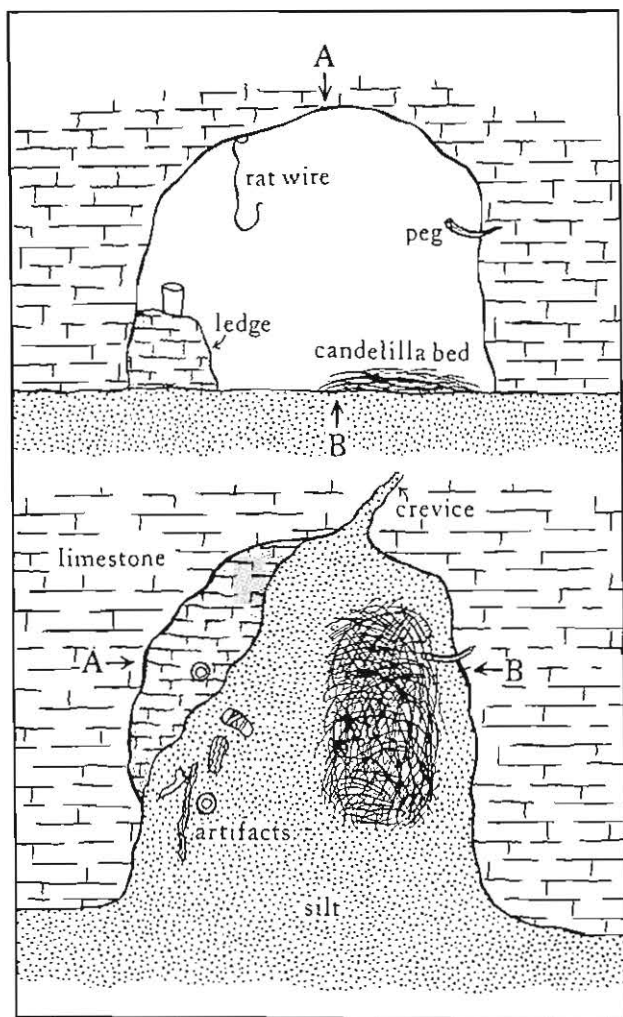


Fig. 56. Cross sections of small cavity in a limestone cliff used by wax makers for shelter. Front view and overhead view.

where a tinaja of rainwater would support a brief rendering operation. A grate of hardwood sticks was used to submerge the weed in this small vat.

Modern Conveniences

Certain categories of things, which we who are accustomed to a more affluent existence might expect to find in wax camps, have never been observed there. Trucks, although used to haul weed to some of the early factories, are not in evidence. We have never seen a motor vehicle, or remains of one, in camps along the river. Devices for marking the passage of time such as radios, calendars, clocks, and watches have not been recorded there. Basic tools such

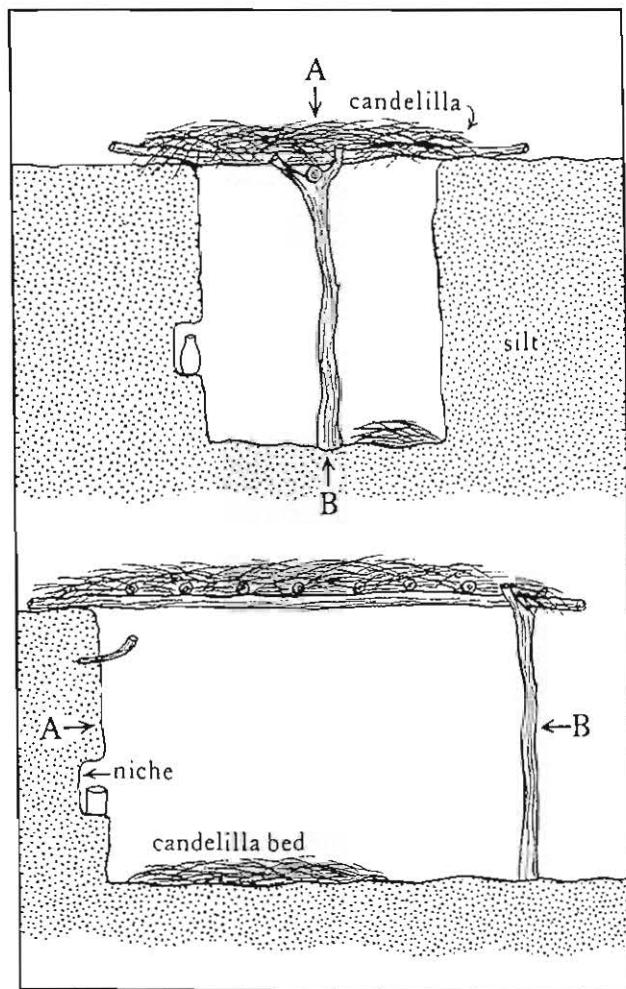


Fig. 57. Cross sections of wax maker's shelter excavated in a silt bank with roof composed of wooden poles thatched with candelilla. Front view and side view.

as axes, hammers, and saws are apparently replaced by machetes and hammerstones. Lighting devices such as flashlights, candles, lanterns, and lamps have never been seen in the camps; moonlight and a campfire suffice at night. The convenience of boats, mattresses, and even gloves cannot be afforded by the cereros; nor can eye glasses, finger rings, dishes, and flatware. For those who live standing up and working or sleeping on the ground, there is no need for chairs and tables. Common domestic animals such as dogs, cats, and chickens have not been observed. The sharp eye of a master wax maker judges the weight of bags of wax in lieu of scales. Even such inexpensive conveniences as books, paper, pencils, and soap are apparently beyond the means of or simply not desired by cereros.



Fig. 58. Shelter dug in a silt terrace with a roof of candelilla thatch. Mariscal Canyon.



Fig. 60. Wax vat made from half a steel boiler cut lengthwise.

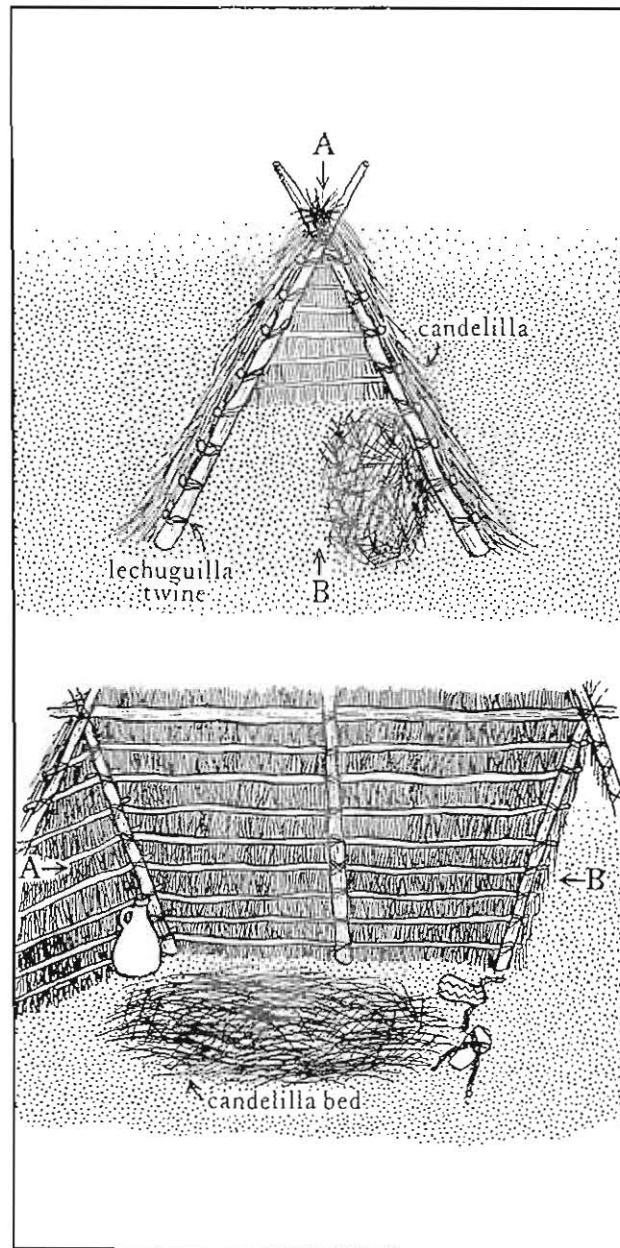


Fig. 59. Cross sections of a typical wax maker's shelter made of ocotillo poles tied with lechuguilla fibers and thatched with candelilla. Front view and side view.



4

Archeological Models from the Wax Camps

The Prehistoric Background

During wetter periods in the past, most recently about 10,000 years ago, the Chihuahuan Desert was extensively covered with pine forests. However, for at least six millennia it has looked very much like it does at present, with essentially the same vegetation communities. Throughout this vast time period, Indian groups have lived in the desert, moving between springs and river, mountains and canyons, gathering the meager but adequate food resources.

A common type of prehistoric site in the desert is the burned rock midden (also called ring midden or sotol pit). Sites of this type are accumulations of burned rocks, covering an area from 3 m to as many as 10 m across and ranging from 15 cm to 1 m in thickness. They are often circular, doughnut shaped, or crescentic in outline.

Archeologists who have studied such sites have generally agreed that they accumulated as a result of prehistoric people baking sotol, le-

chuguilla, and perhaps other desert plants in stone-lined pits (Greer 1965). Favorite locations were reused over long periods of time, resulting in larger and larger accumulations of fire-cracked rocks around the baking pits. An ethnographic account of this type of food preparation is given by Buckelew and Banta (1911: 70-73).

There may be interesting similarities between the lifeways of the prehistoric people of the desert and those of the *candehilleros*. The candelilla wax camps represent a specialized, productive, and transient industry in the desert. The early people lived in transient camps, moving seasonally in response to changing food resources and climatic fluctuations. Much of their effort went into exploitation of particular plant species by means of gathering and baking the plants in large numbers. One difference between this prehistoric plant exploitation and candelilla processing is that great amounts of water were not required for the Indians' food preparation. Nevertheless, some of the cultural patterns observed in the wax camps can generate hypotheses concerning prehistoric adaptations in this region.

Seasonal Movements

Rainfall records have been kept in the Big Bend region since about 1900, but the most complete data covers the 40-year period since 1940. An analysis of monthly precipitation records from 28 recording stations in Presidio, Brewster, and Terrell counties clearly shows that about 70 percent of the annual moisture falls in the five summer months, May through September. By contrast, the five winter months, November through March, bring only 16 percent of the annual moisture. Recording stations at lower elevations along the river show an average annual precipitation of about ten inches, with wet years bringing twelve to fourteen inches and dry years only five to seven inches. Recording stations at higher elevations in the mountains show an annual precipitation of about sixteen inches, although the wet and dry months coincide with those at lower elevations.

For the wax makers these statistics mean that the best wax is found on candelilla in the cool and dry winter months. It is also somewhat more pleasant working around the boiling vats in winter than in the blistering hot summer months. Wax camps commonly are situated on the lowest silt terrace, immediately beside the river, so that the considerable volume of water used in the rendering process need not be transported more than a few yards. Although dams on the Rio Grande and Rio Conchos have controlled the worst flooding in recent years, there was a distinct advantage to working on the river only in the dry season a few decades ago. The high silt terrace systems along the Rio Grande bespeak a long pattern of devastating floods in the wet season. In the wetter summer months, when tinajas and springs of water are to be found in the mountains, wax makers sometimes take a small portable vat and exploit good stands of candelilla that are situated too far from the river and can be utilized only while the tinajas hold water.

Considering the wax camp data and looking back into the prehistoric period, the following hypothesis is proposed concerning Indian cultures in this region: During the rainy season (May through September) Indian groups moved away from the river to avoid catastrophic floods

and to utilize tinajas of water and wet weather springs in exploiting plant and animal communities remote from the river (e.g., stands of sotol and prickly pear). This also enabled them to utilize higher elevations during the warm summer months.

In the dry season (November through March) these same groups moved back down to the silt terraces along the river where the water was low and clear, and fish and frogs could be caught in the shallows. There was little or no danger from floods and plenty of food plants and fuel (trees, brush, and driftwood) for fires during the cold months. In winter it is often 20 or 30 degrees F. warmer along the river than on the high plateaus and mountain slopes.

These prehistoric "dry season" sites, situated on the low silt terraces, are probably rare in the archeological record because of attrition from violent erosion during floods in intervening centuries. Thus a study of better-preserved sites, situated back from the river, may give an incomplete picture of cultural patterns.

Material Culture

Attrition of Data Base

About 100 data categories have been identified in the wax camps (Fig. 61). Decrease in the data base at wax camps is dramatic at time of abandonment and during the first few years thereafter. Figure 62 reveals that there will be about a 40 percent decrease in data in the first five years, and only about 25 percent of the original data may be archeologically recoverable after 25 years. A projection of the data preservation curve to a time 500 years after abandonment predicts that about 15 percent of the original data categories could still be present in the sites.

Factors that contribute to the decrease in the data base at wax camps include the following:

1. Many items are simply hauled away when a camp is abandoned (see discussion below).
2. Flooding of the river can sweep away tons of cooked candelilla and many perishable

artifacts. Where a silt terrace is being actively cut away, even fire pits can be destroyed.

3. Wind erosion often contributes to the collapse of temporary shelters and rolls unattached objects into the river.

4. Plant remains, cloth, cardboard, and paper labels are quickly faded and desiccated by the desert sun.

5. Insects eat away food remains, leather, and all sorts of perishable items. It is not uncommon to pick up an artifact in an abandoned camp and find the back part completely eaten away.

6. Rats, coyotes, and other small animals gnaw at foodbones, leather, and other perishables in the camps.

7. Since many of the metal artifacts are exposed to acid vapors and periodic moisture, they eventually succumb to oxidation and exfoliation.

8. Human scavengers occasionally visit the camps and carry off bottles or fragments of oil drums for reuse.

9. River-floating collectors come through the camps and remove packsaddles and tire-tread sandals to be used as decoration on office walls.

Although prehistoric cultural inventories in this region may have been somewhat impoverished, they were probably similar in many respects to that found in the candelilla camps. Prehistoric sites at one time must have contained a surprising array of baskets, mats, sandals, cordage, wooden and fiber tools, food remains, feces, fabricated shelters and so forth. It is proposed that exposed prehistoric sites in the Chihuahuan Desert experienced a decrease in the data base similar to the curve shown in Figure 62.

A projection of the number of data categories remaining in a wax camp after 500 or more years is surprisingly similar to the inven-

tory that may be found in prehistoric sites in this region:

<u>500+ Year Wax Camp</u>	<u>Prehistoric Site</u>
rockshelters	rockshelters
firepits	sotol pits
ash piles	ash & charcoal
hammerstones	hammerstones
hearths	hearths
rock graffiti	rock art
buttons (glass, shell, metal)	----
cartridge cases	arrowpoints
bottles & glass sherds	potsherds
mussel shells	mussel shells
----	scrapers
----	debitage

Major Sources of Bias in Data Base

Several factors that contribute to the attrition of the data base in wax camps are discussed in conjunction with Figure 61. Two major sources of bias in the archeological data base, primary removal and differential preservation, are considered in greater detail here because they are essential to the formulation and interpretation of the hypotheses that follow.

Primary Removal

People never leave a camp empty handed. Things that are carried off when a camp is abandoned may forever bias the data for archeological purposes—and in interesting ways. Some of the most important tools in the wax-making process are nearly always taken along when a camp is moved. These include the boiling vats and grates, which are of great value, are difficult to replace, and are left behind only when they become totally unserviceable and irreparable. Burros and important personal possessions such as boots, guns, and machetes are never left in camp. It is interesting that, because of cerote's considerable cash value, even tiny scraps of the raw wax cannot be found in old camps.

Fig. 61. Data base in wax camps.

DATA BASE		ATTRITION				
Item/Remains	Occurrence	Active Camp	+5 Years Recent Camp	+25 Years Moderately Old Camp	+50 Years Old Camp	Projected 500+ Years
Intangibles						
smoke	common	████████				
fire	common	████████				
smells	common	████████				
sounds	common	████████				
Men and Domestic Animals						
men	common	████████				
burros	common	████████				
horses	rare	████████				
goats	rare	████████				
human feces	common	████████████████				
animal feces	common	████████████████				
Activity Area Features						
water source	common	██				
firepits, unlined	common	██				
firepits lined with adobes	rare	██				
firepits lined with cobbles	common	██				
firepits lined with rocks	common	██				
sun shelters	rare	████████████████████				
ash piles	common	██				
brush fences	rare	████████████████████				
uncooked candelilla piles	common	████████████████				
cooked candelilla (fuel) piles	common	████████████████████████████				
oil drum mold for wax	common	██				
earth hole mold for wax	rare	████████████████████████████				
fiberglass canoe mold for wax	rare	████████████████████████████████				
trails toward gathering areas	common	████████████████████████████				
Activity Area Related Items						
wax, chunks of	common	████████████████				
wax, sacks of	rare	████████████████				
boiling vats	common	████████████████				
grates	common	████████████████				
carrying sticks	common	████████████████████████████				
wheelbarrow	rare	████████████████				
pitchfork, handmade	common	████████████████████████████				
pitchfork, iron	rare	████████████████				
hammerstone	common	██				
buckets	common	██				
skimmers, perforated	common	██				

Fig. 61. Continued

DATA BASE		ATTRITION				
Item/Remains	Occurrence	Active Camp	+5 Years Recent Camp	+25 Years Moderately Old Camp	+50 Years Old Camp	Projected 500+ Years
Activity Area (continued)						
acid jars	common	██████████	██████████			
acid dippers	common	██████████	██████████			
ropes	common	██████████	██████████			
oil drums	common	██████████	██████████	██████████	██████████	
burlap sacks	common	██████████	██████████			
packsaddles	common	██████████	██████████			
burlap saddle blankets	common	██████████	██████████			
hobbles, rope	common	██████████	██████████			
hobbles, leather	rare	██████████				
sack needle with cord	rare	██████████				
shovel/scoop	rare	██████████				
machetes	common	██████████				
Living Area						
Features						
thatch shelters	common	██████████	██████████			
rockshelters	common	██████████	██████████	██████████	██████████	
silt shelters	rare	██████████	██████████			
mesquite shelters	common	██████████	██████████			
hearths with stones	common	██████████	██████████	██████████	██████████	
candelilla beds	common	██████████	██████████			
rock niches	common	██████████	██████████			
silt niches	common	██████████	██████████			
cut vegetation (trees, cane, etc.)	common	██████████	██████████			
rock graffiti	rare	██████████	██████████	██████████	██████████	
silt graffiti	rare	██████████	██████████			
Living Area						
Related Items						
cardboard in beds	rare	██████████				
cardboard in shelter roofs	common	██████████	██████████			
rat wires	common	██████████	██████████	██████████	██████████	
wooden pegs	common	██████████	██████████			
Food						
Preparation						
tortilla griddle (barrel end)	common	██████████	██████████	██████████	██████████	
tortilla roller, wood	rare	██████████	██████████			
enamel bean pots	common	██████████	██████████			
olla	rare	██████████	██████████	██████████	██████████	
Food and/or						
Containers						
plastic bleach bottle canteens	common	██████████	██████████			
bottles with labels (tequila, mescal, beer)	rare	██████████	██████████			
bottles without labels	common	██████████	██████████	██████████	██████████	
cans with labels (sardines, tomato paste, milk)	rare	██████████	██████████			

Fig. 61. Continued

DATA BASE		ATTRITION				
Item/Remains	Occurrence	Active Camp	+5 Years Recent Camp	+25 Years Moderately Old Camp	+50 Years Old Camp	Projected 500+ Years
Food and/or Containers (continued)						
cans without labels	common	██				
bones (fish, deer, goat)	rare	████████████████████████████████████				
masa sacks	rare	██████████				
mussel shells	rare	██				
sotol leaves	rare	████████████████████████████████				
lechuguilla leaves	rare	████████████████████████████████				
prickly pear fruit and pads	rare	████████████████████████████████				
citrus fruit rinds	rare	████████████████████████████████				
tortillas	common	██████████				
frijoles	common	██████████				
chiles	common	██████████				
vermicelli	common	██████████				
coffee	common	██████████				
Personal Possessions						
shoes, boots & sandals	common	████████████████████████████████████				
clothing	common	████████████████████████████████				
buttons	common	██				
hats	common	██████████				
belts	rare	██████████				
blankets	rare	██████████				
leggings, leather	rare	██████████				
cane cigarette holders	rare	████████████████████████████████				
cigarettes	common	██████████				
tobacco	common	██████████				
matches	common	██████████				
pin-up pictures	rare	██████████				
money	rare	██████████				
guns	rare	██████████				
cartridge cases	rare	██				
leather saddles	rare	██████████				
fiber bags, handmade	rare	████████████████████████████████				
plastic mesh bags	common	██████████				
religious crosses	rare	██████████				
religious pictures	rare	██████████				

It is assumed that this same selective process was in operation when prehistoric camps were abandoned and that artifacts which may be crucial to comprehensive interpretation of those sites often are not present or may be found only rarely and in worn-out or broken condition. Important tools, weapons, ornaments, containers, and sacred objects may have been usually transported.

Differential Preservation

Differential preservation is another factor that may bias archeological data. Many items that are discarded or abandoned in a camp (i.e., items that may already have been selectively deposited because of the primary removal factor) may then deteriorate partially or totally at very different rates or be subsequently removed or obliterated by natural or artificial impact. Primary possessions, such as items of clothing, food containers and food remains, cigarettes, and so on, provide excellent examples of the differential preservation bias. However, all aspects of material culture may be affected. Differential preservation as a factor in formulating hypotheses about prehistoric adaptation based on the candelilla camp as a model is illustrated in the specific discussions of material culture below.

Proposed Hypotheses Concerning Material Culture

Personal Possessions

As shown in the comparison of prehistoric camps and the projected 500+ year wax camp, few personal items, such as clothing, remain in the data base. Nevertheless, footgear in recently abandoned camps does lend itself to comparison.

Worn-out sandals and shoes are probably the most common artifacts in wax camps. The best gathering slopes are littered with detritus and cactus that make foot coverings essential. Rugged surfaces take a heavy toll on shoes and sandals, and when footwear can no longer be repaired with nails, wire, and string, it is discarded.

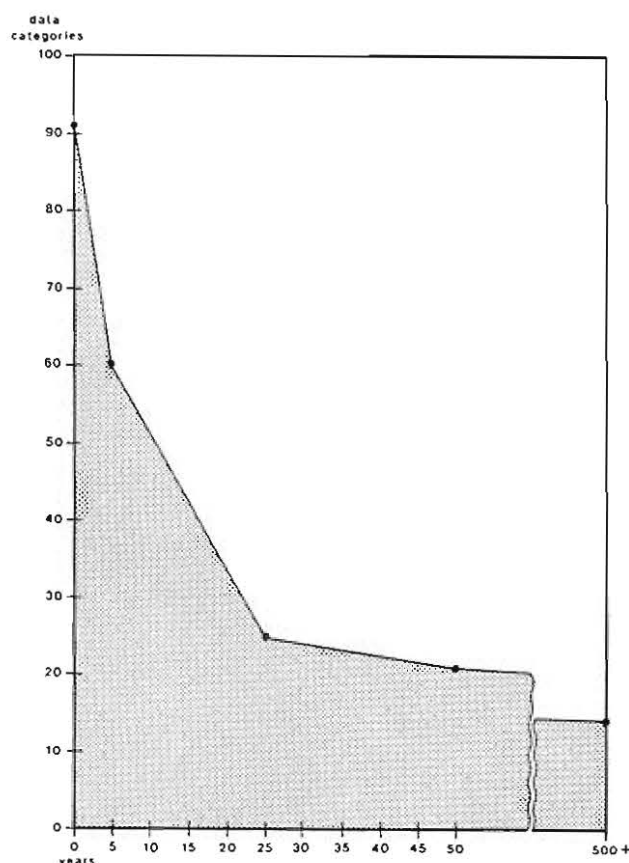


Fig. 62. Decrease of data base in wax camps.

Prehistoric desert dwellers also probably found footgear to be a necessity on the gathering slopes, and it is likely that worn sandals of fiber and perhaps leather were common artifacts in the early camps, although they would not be preserved except under very exceptional conditions.

Diet

Certain special treats like canned sardines, canned milk, and bottles of tequila are rare in the lives of the candelilleros and may be enjoyed only on those infrequent occasions when the men have sold a hoard of wax and have traveled to a town for supplies. Yet, cans and bottles from these products are relatively common in the archeological inventory, even many years after a camp is abandoned. On the other hand, staple foods—beans, chiles, and tortillas (Fig. 63)—which are consumed daily and constitute

perhaps 95 percent of the diet, are virtually never found preserved in abandoned sites. These items simply are not discarded, are not readily preserved, and do not come in durable containers. It is easy to see that a gross misinterpretation concerning the cerero's diet might be made from data preserved in the camps.

In interpreting faunal and plant remains from the prehistoric period, differential preservation may be an important factor as well. For example, mussel shells and animal bones found in sites in the Chihuahuan Desert may have represented a rare form of protein in the Indian's diet, while plant foods such as sotol and opuntia, which left little or no trace in the archaeological record, were primary elements of subsistence.

Shelters

The wax makers prefer naturally sheltered locations for their camps, but when these are not readily available near water in a good gathering area, they fabricate their own shelter. Simple and effective shelters (Appendix 2, Fig. 6) composed entirely of locally abundant materials are made with moderate effort, using minimal tools.

It is proposed that some of the perishable shelter types developed by the cereros were also used by prehistoric inhabitants as they occupied the silt terraces adjacent to the Rio Grande. This would have enabled them to utilize much more of the valley with relative safety and comfort than would have been possible if they were dependent on rockshelters alone. Thus, when a hearth is excavated from a silt terrace in the canyons, one should realize that it originally may have been associated with a mesquite shelter and fiber bed.

Activity Areas

The vats and firepits are obviously the focus of activity in the wax camps. Adjacent areas are clearly devoted to stockpiles of plants for processing and fuel. Living areas are situated away from the wax-making area and often at a slightly higher elevation. The living areas are much less obvious than the processing areas in older

camps.

Prehistoric sites in this region which contain "sotol ovens" or "mescal pits" may have similar activity areas. The pit with its surrounding mound of burned rock and ash was obviously the focus of activity at such sites. Adjacent to the stone-encircled pit there may have been areas for trimming and stockpiling plants that were to be baked in the oven and dried fuel for fire. Subtle living areas, indicated by a few artifacts and a hearth, may lie a few yards away from the baking oven on a more desirable living surface.

Desert Fuel

Wax making by the traditional method is probably one of the only industries that produces a by-product sufficient to provide all the fuel required in the extraction process. The weed, even with most of the wax removed, combusts readily and makes a hot and enduring fire. A large mound of this fuel usually remains when a camp is abandoned. Candelilla is a common associate of sotol, lechuguilla, and other plants that are assumed to have served as basic food (when baked) in the prehistoric period. It is proposed that stacks of dry, waxey candelilla provided a quick, easy, and excellent fuel source for sotol-baking ovens in some sections of the Chihuahuan Desert. As a group was preparing to leave a favorite sotol pit, they could simply pull up and stack a bunch of candelilla plants, and a plentiful fuel supply would be waiting when they returned next season. Baking ovens so fired should contain ashes but no wood charcoal.

Creosote bush grows in abundant stands on some flats and was used along with spent candelilla as a fuel in the early wax factories. Where creosote is found in proximity to prehistoric baking ovens, it may have been used as fuel, and ovens fired with these plants should contain some charred segments of stems and roots.

It is also likely that leaves trimmed from sotol and lechuguilla plants, prepared for the baking ovens, would have dried and been used as supplemental fuel the following season. Ovens so fired should contain some charred thorns from those plants.



Fig. 63. A wax maker's meal consisting of black coffee, beans, and tortillas. San Vicente area.



Fig. 64. A hard-working cerero enjoying a small mordida of cold beer.

Influence and Change

Remote Influences

Remote influences may be crucial to interpretation of cultural sites. If there was no demand for candelilla wax in the chewing gum, cosmetics, and floor-polish industries of New York, there would be no wax camps on the Rio Grande. However, by meticulous examination of the camps alone, one would never discover their *raison d'être*. Undoubtedly some types of prehistoric sites resulted from remote influences as well. Lithic quarrying operations and peyote-gathering sites are two that come to mind.

Access and Change

Most of the wax camps are situated in remote canyon areas where the only access is by precipitous burro paths and by boat on the treacherous river. For decades only a handful of people knew about the camps and fewer yet had visited them. This situation has changed dramatically since the advent of recreational boating on the river in the past few years, and the effects on the camps are obvious.

A typical candelillero of thirty or forty years ago wore khaki clothing, tire-tread sandals, and a hand-made hat from interior Mexico (Fig. 10). Today he wears blue jeans, imitation leather shoes, and a western hat or baseball cap of synthetic fiber (Fig. 31). As recently as twenty years ago, the common burden bag in the camps was one made of local fibers (Fig. 51) or an ixtle bag from interior Mexico. To-

day woven plastic shopping bags (Fig. 55) seem to have completely replaced the older style.

Although some of these changes reflect a general increased access to manufactured goods in northern Mexico, the biggest impact on the camps has derived from the "river-runners." When field crews first visited some of the camps by boat in the mid 1960s, we were viewed as a curiosity by the cereros, some of whom had not previously seen people going down the river in boats. In the past decade canoe caravans on the river have increased in frequency, and now several groups a day may pass by a camp on a good weekend. An obvious effect of this river traffic is found in the artifact inventory of the camps. Items specifically linked to the boaters include beer cans, soft-drink bottles, tennis shoes, t-shirts and baseball caps with mottos, pin-up pictures, plastic water cubes, and photographic film cartons. One cerero was seen using the broken end of a fiberglass canoe as a mold for wax (Fig. 30). A less obvious effect is seen in the demeanor of the wax makers. In earlier days they were friendly and eager to visit and answer questions about the wax process (Fig. 64), but they have become increasingly reticent and reluctant to tolerate photographs in recent years. When a survey party approached one of the camps in April 1980, the cereros apparently hid in the rocks until the crew went on downriver.

In the prehistoric period, groups utilizing the excellent niches in the canyons may have been particularly isolated from contact with other groups, since traffic along the river would have been difficult or impossible. It will be interesting to see if archeological evidence of such isolation can be found by studying the canyon sites.

Conclusion

In a small way, candelilla wax has touched all our lives through a variety of products. If people involved in wax making will avoid disastrous overexploitation of the plant communities, this industry can become a permanent source of high quality wax and a consistently productive economic activity in the Chihuahuan Desert. Unwise management will undoubtedly lead to depletion of another valuable resource in a region which has painfully few.

Regardless of the future of wax production,

the stories and the people and the camps are a fascinating facet of our cultural heritage. An increasing body of oral history of wax making is being recorded. We can learn valuable cultural and environmental lessons by studying the camps. Perhaps most important of all, from the cereros we can learn about hard work, productivity, adaptation, ingenuity, persistence, pride, endurance, determination, and survival against great odds.

Appendix I

Documents Relating to Candelilla Harvesting
from State Lands

ITEM 1

to

No 5.



3

Petition of W.W. Willet,
to
Honorable J.J. Ferrell, General Land
Commissioner of the State of Texas.

Submitted this the 27th. day of May,
1903.

Filed 8/26/1905
John J. Ferrell
Comr. G.L.O.

7112
To Honorable J.J. Ferrell,

General Land Commissioner of the State of Texas:- Now comes your petitioner, ^{W.W. Willett} W.W. Willett, a resident of Bexar County, and represents that he is now interested in obtaining and converting into an article of commercial value, a certain plant known as Candalilla, and growing in the counties of Brewster and Terrell, ^{in the State of Texas,} in the State of Texas, and that the said lands upon which the product grows is at present the property of the State, ^{as to be sold for public school lands,} and further, your petitioner represents, that by virtue of a law enacted by the Thirtieth Legislature of the State of Texas, captioned "Providing For the Sale of Guayule on the Public Free School Lands", the Commissioner of the General Land Office, with the consent and approval of the Governor and Attorney General, may sell any valuable material found on such lands, to the interest of the School fund and the State; and the law further provides that the State may enter into ~~into~~ executory contracts of sale for the purpose of determining the commercial properties and value of any and all such material.

Wherefore, your petitioner prays, that by virtue of the above stated law, the State enter into a contract with him, whereby, if such be possible, he will be enabled to convert the product known as Candalilla, and now growing in the counties of Brewster and Terrell, ^{into an article of commercial value.} into an article of commercial value. And your petitioner further believes, that a compliance with his request herein made, ought to be granted for the following reasons:-

undecided
1st. That the conversion of the Candalilla plant into a marketable product will attract capital to that portion of the State where the plant grows, and will materially aid its development by opening up a new field of commercial activity.

undecided
2nd. That the value of the land upon which the product Candalilla grows will be enhanced by its conversion into a marketable product.

3rd. That such an industry would open up a new field for employment, and would be an additional inducement for settlers, and enable them to establish permanent homes in that portion of the State.

4th. That should your petitioner prove the commercial value of the plant known as *Candalilla*, the State would be able to estimate the value of lands producing such plant, and fix prices accordingly.

5th. Further, your petitioner believes that the State ought to comply with his request because the lands in West Texas growing the plant *Candalilla* are in alternate sections, and it would be impossible to enlist capital for the promotion of this enterprise unless permission to remove the product be had from the State.

20
Respectfully submitted, this the 27th. day of May, 1908.

(Signed)

W. W. Willett

Petitioner.



ITEM 2



(TRANSCRIPTION)

Walter Willett Candelilla Contract
3873

My address
1424 Mt. Vernon Pl.
Philadelphia, Pa.

March 31, 1911

Mr. Robinson

Dear Sir:

I have been here in the east since November last striving to enlist capital to take up the leases that I secured from the State of Texas--the right to remove the Candelilla weed.

Mr. Max B. Mayer...gave it up and sold out to G.B. Fenley at Uvalde. Mr. Fenley has given me an option to sell it so he can recover the money he paid for the lease besides over two thousand dollars in experiments.

There is a world of hot air about this. The trouble is to find a mode of extraction that will be economical. Also to find a market. The market for this wax has to be created and this is going to take a great deal of time. I interested people at Marfa. Mr. Breseling he has spent a great deal of money. This letter is to show you I have worked at this for over three years.

I know of every institution in Old Mexico--there is nothing definite that has begun to pay. Could you, believing in my sincerity, be willing to give me an extension for three years longer, that is to say. I will pay into the state one thousand dollars cash--\$1000.00--for this extension paid up to June 1916 AD. You well know if the Candelilla turns to be a profitable investment to capital it will benefit Texas and the arid lands where it grows, if there is anything in it, which only money will tell. You know as it stands it is only an experiment. If I do nothing Texas has lost nothing. I have it up now before reliable people with money. They will not look at the proposition. They say the lease is too short.

I will forward you a thousand dollars for a three year extension of the lease. If you turn me down, I will assure you that those now striving will all quit it. I deserve this request. I have given it my labors for three years.

I know the cutting and gathering of the weed alone if taken up will distribute on say 50,000 tons at \$20.00 dollars a ton One Million dollars. This will benefit men who live in that country and help the poor man pay for his home. Help me. I do not wish to see my friends lose their money. Capital will not touch the experiment on my short lease.

Awaiting your reply
I remain Respt.
Walter Willett

(FACSIMILE OF FIRST PAGE OF WILLETT LETTER)

1424 Mt. VernonSt Philadelphia
 RECEIVED
 Mr. Robinson APR 3 1911
 March 31-1911

Dear Sir. Referred to School

I have been here in the east since November last striving to enlist Capital. to take up the Leases that I secured from the State of Texas. The right to remove the Candalaria weed.

Mr Max B Mayer. although a Jew. gave it up - and sold out to George Fenley at Uvalde Mr Fenley has given me an option to sell it. so he can recover the money he paid for the lease besides over two thousand dollars in experiments.

There is a word of hot air about this. The trouble is to find a mode of extraction that will be economical also to find a market. The market for this wax has to be created and this is going to take a great deal of money and time.

ITEM 3

N^o 11 1
The State of Texas

To

J. H. Smith

Contract for
Caudrilla, Pa.

Filed Dec 9th 1908

John J. Turrell
County Clerk

Attorney General's Department,
State of Texas.

THE STATE OF TEXAS §

COUNTY OF TRAVIS §

This contract made and entered into in duplicate
this the 15th day of December, ¹⁹⁰⁸ by and between John J. Ferrell,
Commissioner of the General Land Office, T. M. Campbell, Governor
of the State of Texas, and J. V. Davidson, Attorney General of
the State of Texas, acting herein by authority of the act of
the Thirtieth Legislature of the State of Texas, approved
April 18, 1907, hereinafter styled parties of the first part,
and J. H. Smith, of the County of El Paso, State of Texas, herein
styled party of the second part, WITNESSETH:

FIRST: That the said parties of the first part for
and in consideration of the sum of Fifteen Hundred (\$1500.00)
Dollars to be paid in five (5) equal annual installments
of Three Hundred (\$300.00) Dollars each, payments to be made
yearly in advance to the State Treasurer at his office in Austin,
Texas, the first installment of Three Hundred (\$300.00) Dollars
being now paid, the receipt whereof is hereby acknowledged;

and for the further consideration hereinafter stated, do sell
unto the said party of the second part all of the plant known
as the Candalilla Plant now growing or to be grown upon the un-
sold public free school lands of the State of Texas situated

in the counties of El Paso, Presidio, and Jeff Davis, Texas, during the term of this contract, and which the party of the second part shall cut and remove from said lands during the term of this contract, upon the following conditions:

(a) That for the purpose of cutting and removing the said Gandalilla Plant from said lands the said party of the second part shall have the free right of ingress and egress thereto; provided, however, that this right shall not extend to lands under lease from the State during the term of the lease unless his ingress and egress is obtained by permission of the lessee.

(b) In gathering or removing the said Gandalilla Plant from any of said lands, said party of the second part, or his assignee, or any one for him or them, shall so cut and remove said plant so as to not destroy the roots that the plant may thereby annually reproduce itself, or that the roots of said plant shall be left in such condition that the same will produce annual growth of the plant.

(c) In any and all cases where said Gandalilla Plant is found on any of the lands of said State, in said counties, which lands are now or may be under lease and the lessee or lessees thereof refuse to permit the said party of the second part or his assignees to enter upon said lands for the purpose of removing the said Gandalilla Plant therefrom, then, in all such cases, the said party of the second part or his assignees shall have the same length of time as is herein given

for cutting and removing the said Candalilla Plant from other State lands not leased after the expiration of such leases.

(D) That in case of a failure on the part of the party of the second part or his assignees, to make any of the said annual payments of Three Hundred (\$300.00) Dollars each, for thirty (30) days after the same is due, or a failure to comply with any provision of this contract, shall operate as a forfeiture of all rights under this contract and the same shall become absolutely null and void without the necessity of

going into court or without judicial ascertainment, but the said forfeiture shall become complete and perfect by the endorsement thereof made by the Commissioner of the General Land Office on the duplicate copy of this contract deposited in that department; that thereafter all payments shall cease on this contract and the said party of the second part or his assignee, shall have the right within six (6) months thereafter to remove any improvements erected upon said land, if he shall erect any thereon, under the terms of this contract.

SECOND: Subject to the foregoing conditions, this sale of the said Candalilla Plant for said term of five (5) years is made to the said J. W. Smith, his heirs and assigns,--and

TO HAVE AND TO HOLD to him, his heirs and assigns during said period of five years hereinbefore mentioned.

In witness whereof the said parties of the first

part and the said party of the second part do hereunto subscribe their names, the day and date above written.

John J. Terrell
Commissioner of the General Land
Office of Texas,

T. M. Campbell
Governor of the State of Texas,

R. V. Davidson
Attorney General of the State of Texas

J. M. Smith

THE STATE OF TEXAS §

COUNTY OF TRAVIS §

Before me, a Notary Public in and for Travis County, Texas, on this day personally appeared John J. Terrell, Commissioner of the General Land Office, T. M. Campbell, Governor of the State of Texas, and R. V. Davidson, Attorney General of the State of Texas, each known to me to be the person whose name is subscribed to the foregoing instrument, and they severally acknowledged to me that they executed the same for the purposes and consideration therein expressed, and the capacities therein stated.

Given under my hand and seal of office, this
the 15th day of December, 1908.


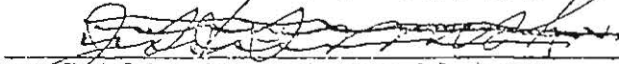
Milton Harris
Notary Public in and for Travis County
Texas.

STATE OF TEXAS §

COUNTY OF EL PASO §

Before me a Notary Public in and for El Paso County, Texas, on this day personally appeared J. H. Smith, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the ____
day of 19th Dec, 1908.



Notary Public in and for El Paso,
County, Texas.



ITEM 4



Driskill Hotel Company

AMERICAN PLAN
RATES \$3.00 TO \$5.00 PER DAY
W. L. STARK, MANAGER

LARGE, COOL ROOMS WITH OR WITHOUT
BATH, SINGLE OR EN SUITE

AUSTIN, TEXAS. Nov. 24, 1915.

Hon. H. T. Robison,
Land Commissioner,
Austin, Texas.

My dear Sir:-

It has come to my knowledge that Edgar B. Lowe has applied to your department for a lease covering the Candelilla weed in Brewster and Terrell Counties. I have also learned that this man has made certain statements and representations to you as to being the owner of certain leases made heretofore by the State to George E. Brashear, which expires July 3rd, 1916; and said lease now stands in the name of said Lowe from the records of your office.

I wish, therefore, to enter my protest most strongly over the renewal or extension of this lease to Lowe or over-granting to him of any contract covering Candellila rights and privileges in the counties mentioned before, for the following good and sufficient reasons:

In the first place, I am the absolute owner in fee simple estate of an undivided one-half interest in the lease

before mentioned, having paid therefor good and valuable consideration to the American Wax Company, a corporation domiciled in Memphis, Tennessee, and hold their receipt therefor. I have owned this interest since date purchase was made from Brashear and G. B. Fenley, which is and has been well known to this man, Lowe. Operating under my said interest I have expended more than \$20,000, developing this industry in Brewster County, and now have two plants there. This expenditure was entirely of my own funds as I have not incorporated any company or sold any stock, and have been and am now exerting my deepest and most earnest effort as well as finances to carry on and develop thoroughly this wax business.

Edgar D. Lowe at the time he made his so-called purchase of this lease (and which, from the inspection of the records of your office show to be in his name,) was in reality and in fact acting as an agent of the American Wax Company of Memphis, Tennessee, and in truth and in fact purchased said lease for and on behalf of the American Wax Company, and with funds furnished by the American Wax Company and myself. All of these matters were known and are known to me personally, and I vouch as to the veracity of these statements. He did not at that time, nor has he now any financial ability or means.

Under contract I purchased my one-half interest in lease from the American Wax Company (it having obtained, as before mentioned, said lease through Lowe), and Lowe does not now, nor has he at any time owned any interest whatever of any character in such lease. He may have owned at one time a small

amount of stock in the American Wax Co. These are facts within my personal knowledge.

This man Lowe, as I have stated, does not own any interest whatsoever in this lease, but has retained the same in his name in your office by and through his wrongful and fraudulent acts. The American Wax Company owns the other one-half interest aside from mine in present leases. This concern, however is no longer a going or active one, and is not and has not operated in Brewster or Terrell Counties on its interest.

As a matter of right and justice in the premises, I am entitled to and should have an opportunity to submit you a bid in connection with further lease covering this Candelilla weed, and I respectfully ask that in view of the faults and fraudulent representations made you by this man Lowe, you extend me an opportunity of submitting to you a bid covering this weed on State lands.

I have only recently learned that this lease was retained in the name of Lowe, and as to the misrepresentations made to you department by him; otherwise would have called these facts to your attention at a prior date. I sincerely trust that this letter and request may have due consideration at your hands.

Yours very truly,

E. M. Ellis
Memphis, Tenn.

November 24, 1915.

Hon. James E. Ferguson,
Governor,
Austin, Texas.
Dear Sir:-

I am in receipt of information from Mr. E. H. Ellis, a business man of Memphis, Tenn. to the effect that Edgar B. Lowe, with whom you, the Attorney General and myself were on a deal whereby he was to obtain a lease on the candelilla plant in West Texas in lieu of the lease now on that substance, that he, Mr. Lowe, had no interest in the present lease though there is a transfer on file here to him. Mr. Ellis informs me that the American Wax Company purchased that lease employing Mr. Lowe for that purpose, and Mr. Lowe took the transfer in his own name and that the wax company transferred a half interest in the lease to Mr. Ellis. Assuming that to be true, Mr. Ellis is well recommended to me and I would suggest that I hope you will not approve the document you have now in your possession because it calls for a cancellation of the lease we now have and application of all unearned part of that fund to the new lease.

I suggested to Mr. Ellis that he simply go ahead and operate under the present contract until it expires, and then the Board would entertain the proposition for a new lease. You may either hold the document you have which was signed by the Attorney General and myself or return to me as may best suit your pleasure. On account of this development in the matter I will express my gratification that you have not heretofore approved it.

Yours very truly,

Commissioner.

Robison/P



ITEM 5



Candelilla Leases in General Land Office, Austin

Dates	Persons & Places	County	Term	Amount	Acres
1908	W. Willett, Bexar County G. Brashear, Uvalde	Terrell Brewster	5 years	\$1000	
1908	J.H. Smith, El Paso	El Paso Presidio Jeff Davis	5 years	\$1500	
1910	Z.W. Cannon	Brewster Presidio	5 years	\$1000	
1912	J.H. Taff, El Paso	El Paso Presidio Jeff Davis		\$ 300+	
1913	Smith lease to Texas Candelilla Wax Company, Sam W. Wooley, Marfa	El Paso Presidio Jeff Davis	5 years		
1916	E.M. Ellis	Brewster Presidio	5 years		
1916-17	Edward M. Ellis, Memphis, Tennessee, American Wax Company	Brewster Presidio	5 years	\$1000	
1918	E.M. Green, San Antonio	Hudspeth	5 years	\$ 250	
1918	Green contract to Salvador Madero, San Antonio	Hudspeth	5 years	\$1000	
1918	W.H. Sartain, San Antonio	Hudspeth			
1942-43	Casner, Alpine	Presidio	18 mos.	\$ 340	21,000+
1942-43	Collins, Marathon	Brewster	1 year	\$ 20	1,280
1943-44	Compton, Marfa	Presidio	1½ years	\$ 32	640
1944-45	Collins, Marathon	Brewster	1 year	\$ 20	1,280
1946-51	Benavides, Marfa	Presidio	5 years	\$ 160	3,200
1946-51	Casner, Alpine	Presidio	5 years	\$ 105	4,480
1946-51	Dodd, Houston	Presidio	5 years	\$ 32	640
1946-51	Dodd, Houston	Presidio	5 years	\$ 32	640
1946-51	Dodd, Houston	Presidio	5 years	\$ 32	640
1946-51	J & H Wax Company, Marathon	Brewster	5 years	\$ 60.11	1,202

Appendix II

Plans of Transient Wax Camps along the River

(Sketch maps, not to scale.)

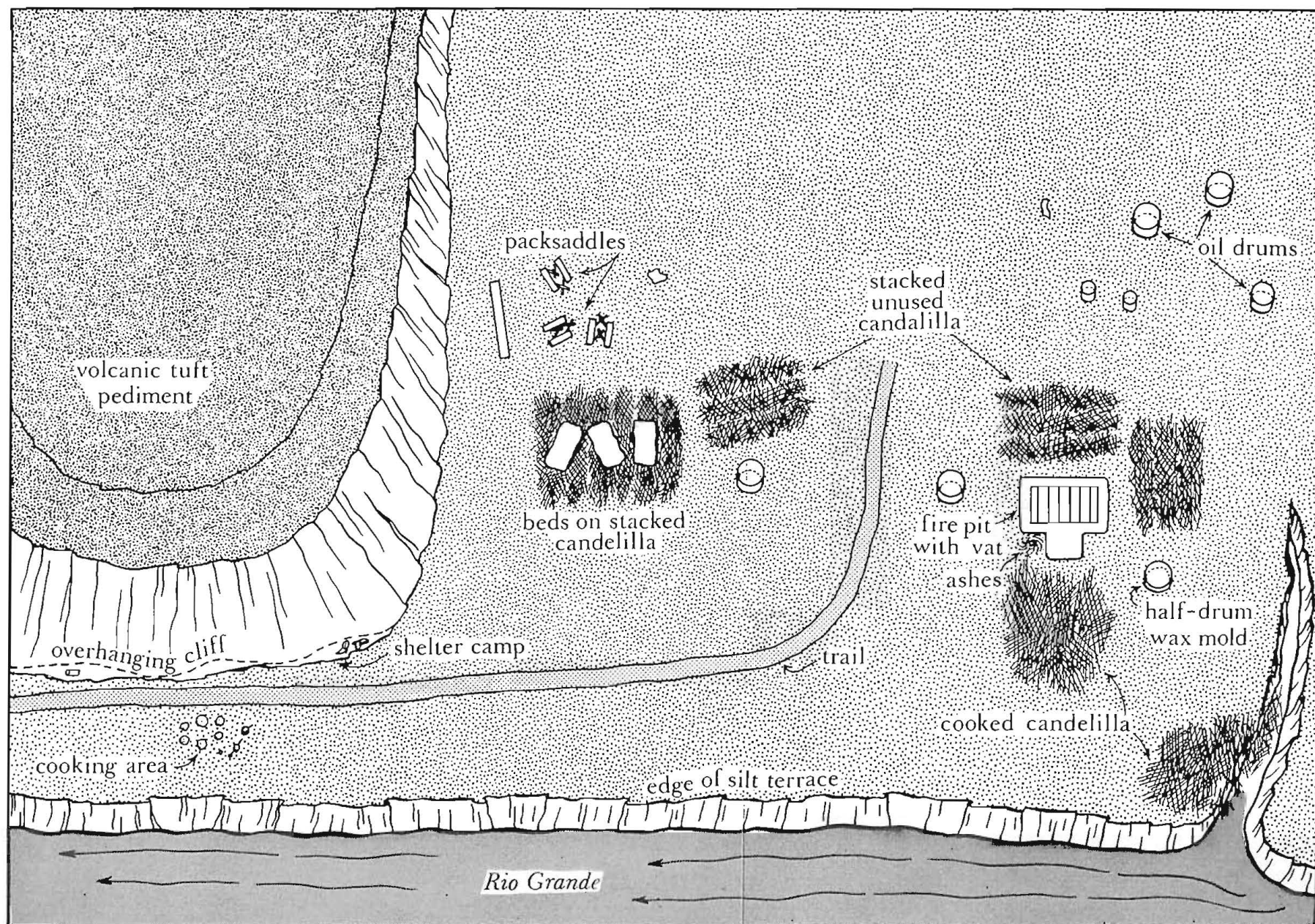


Fig. 1. Wax camp above Mariscal Canyon. Note cereros' beds on candelilla stack at center and cliff shelters at left.

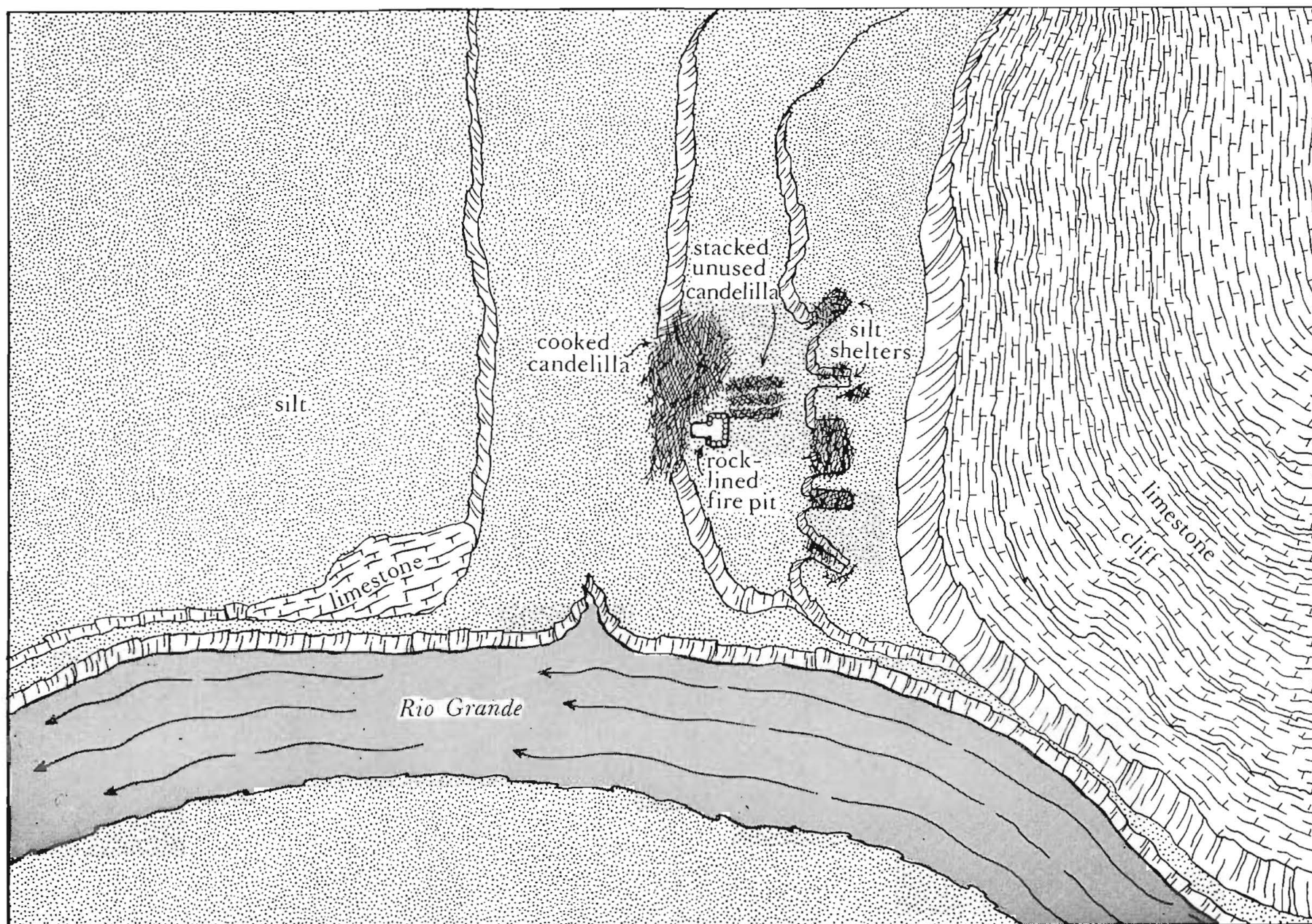


Fig. 2. Active wax camp in Mariscal Canyon. Note silt shelters at center right.

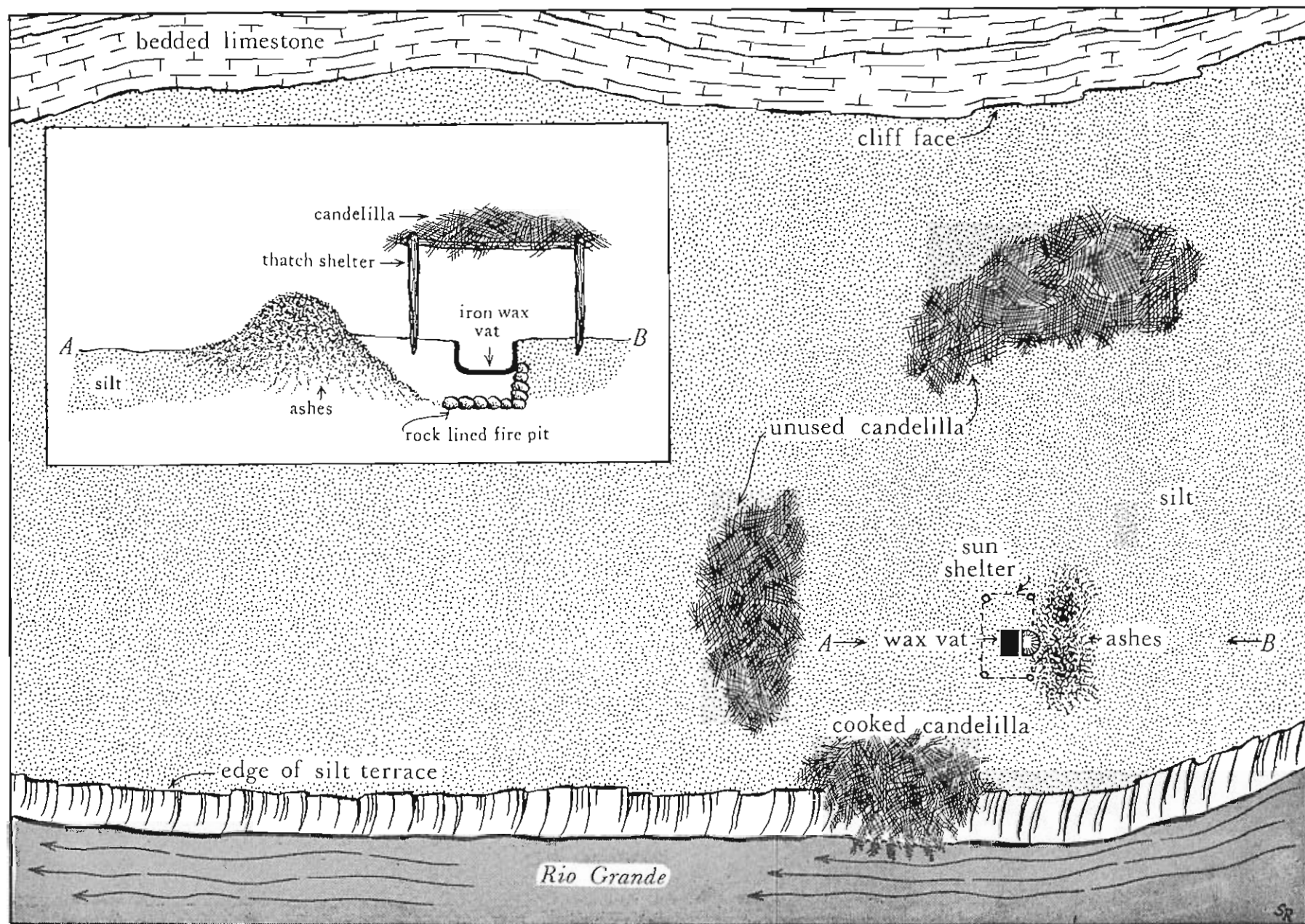


Fig. 3. Recent wax camp in Boquillas Canyon. Cross section detail of thatched sunshade.

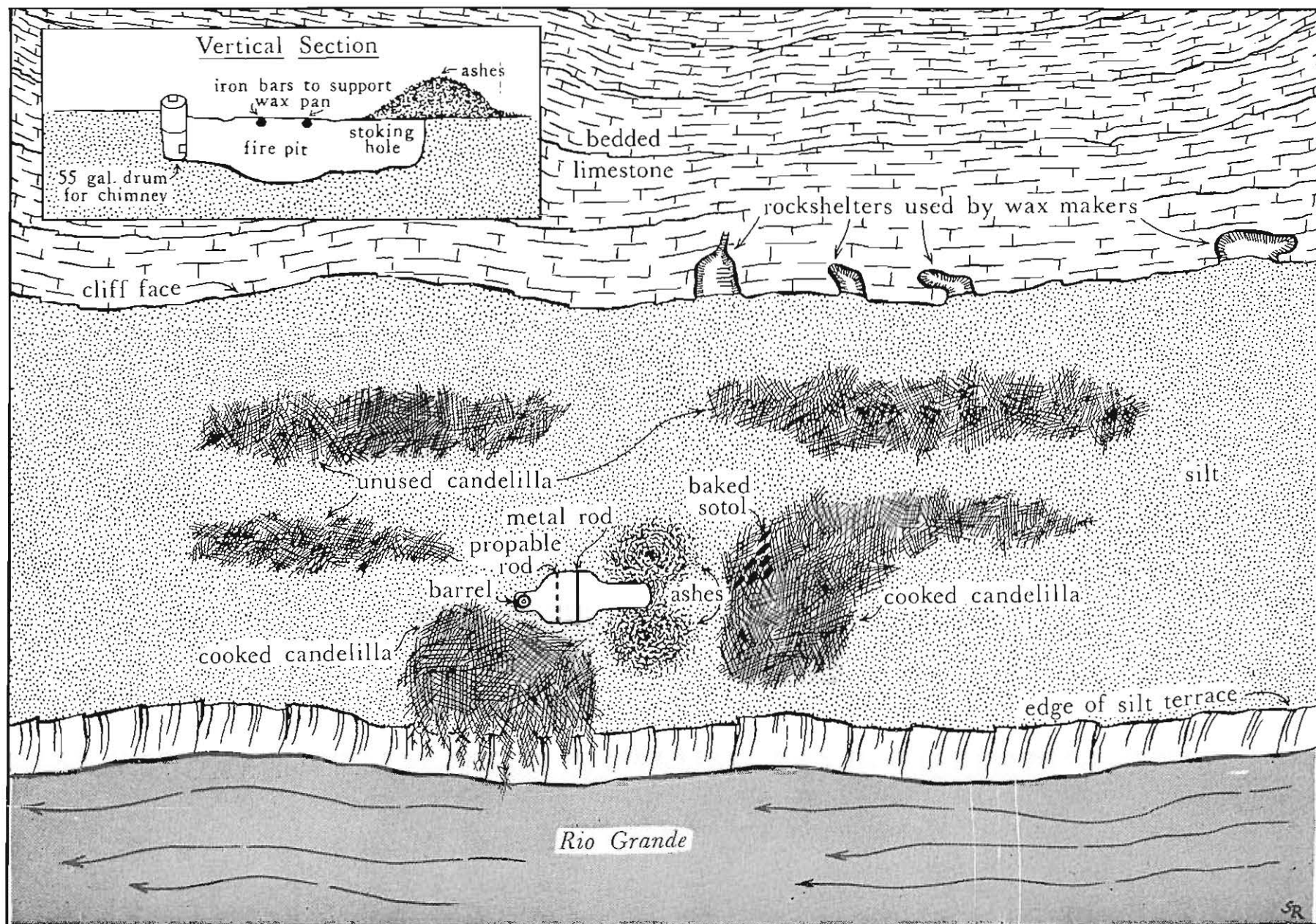


Fig. 4 Very recent wax camp in Boquillas Canyon. Cross section detail of fire pit showing steel-drum chimney. Note presence of baked sotol on candelilla stack and limestone rockshelters used for sleeping.

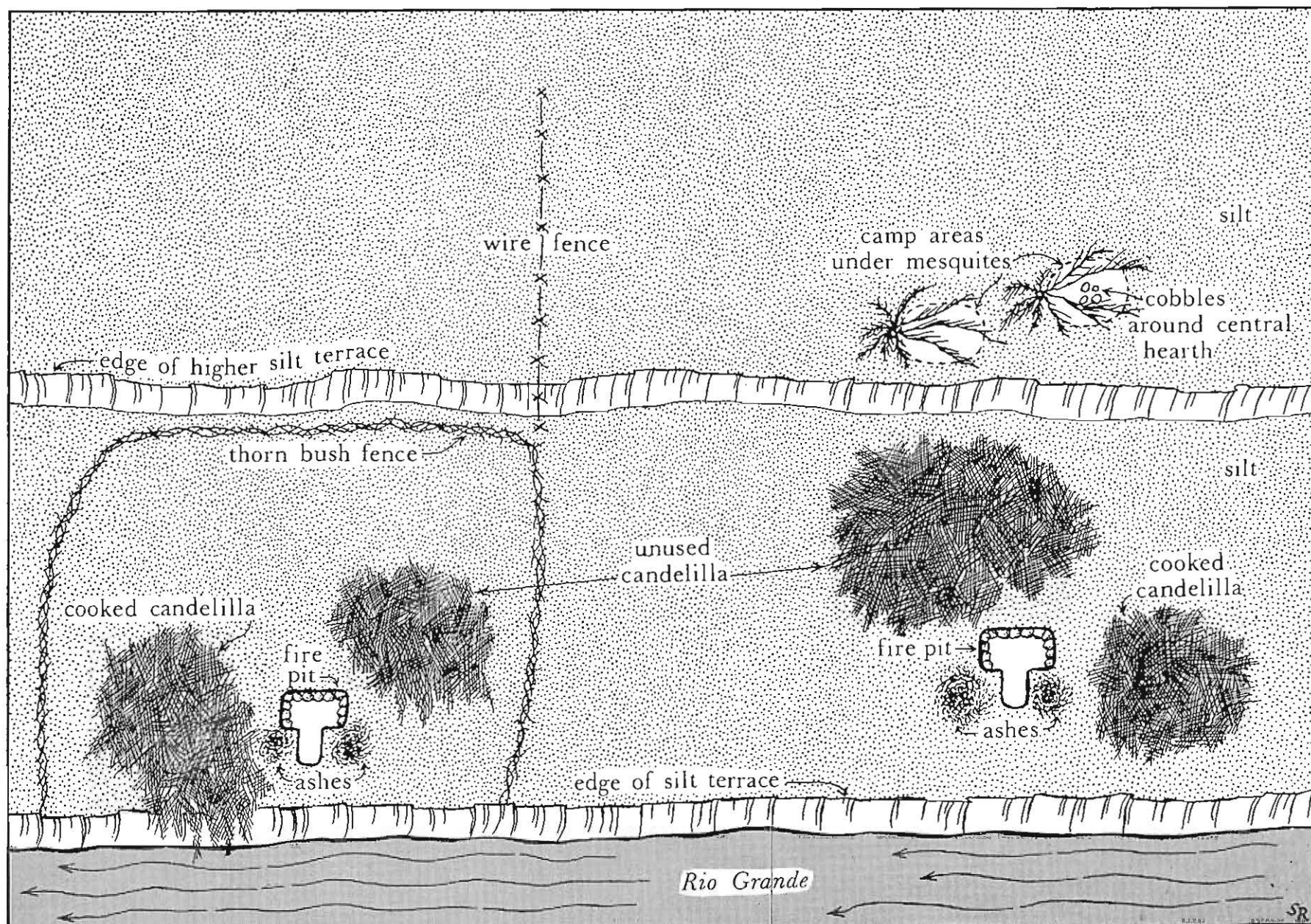


Fig. 5. Recent wax camp in Boquillas Canyon area. Note mesquite shelters at upper right and thorn bush fence.

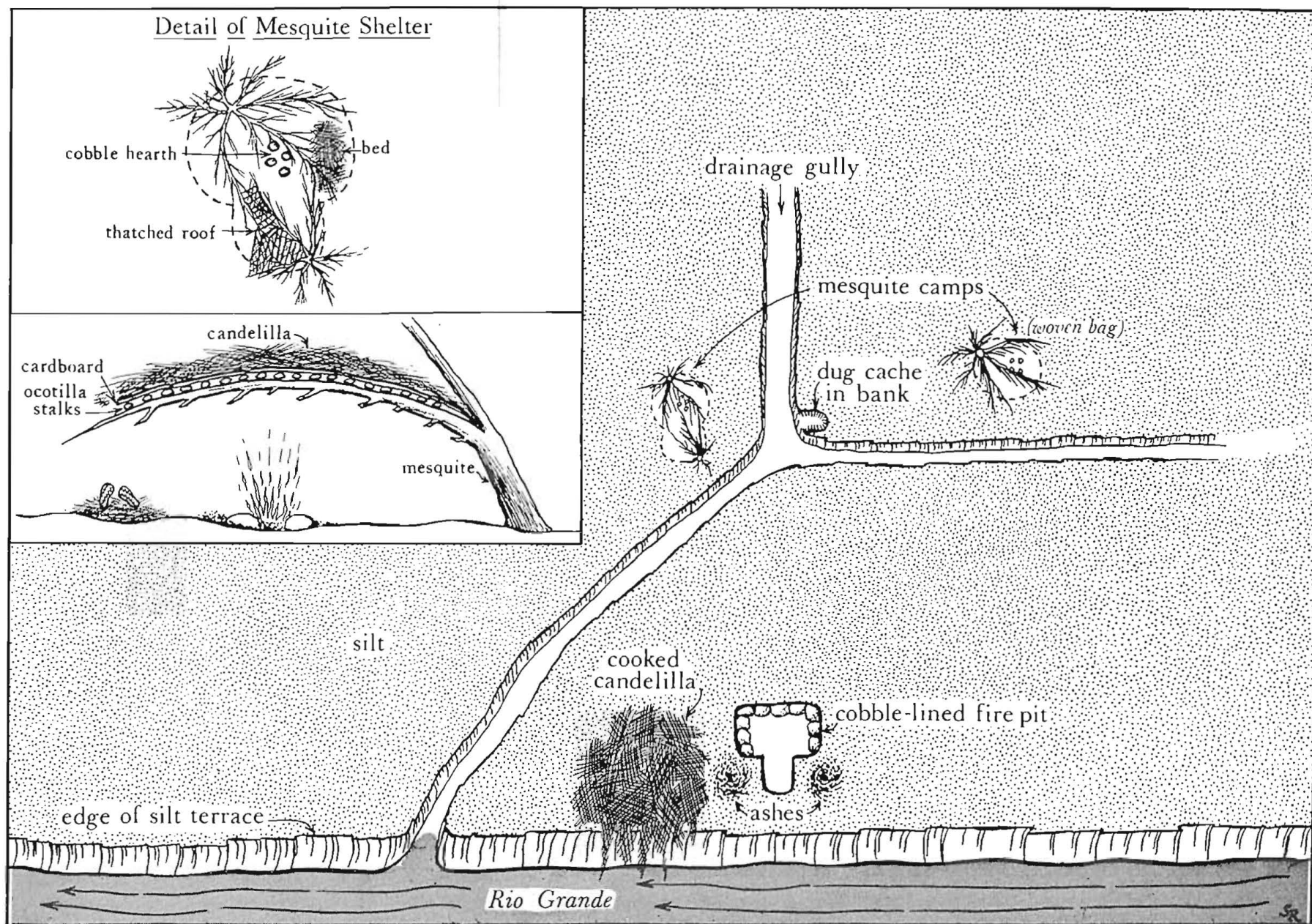


Fig. 6. Recent wax camp in Boquillas Canyon. Plan and cross section detail of mesquite shelter.

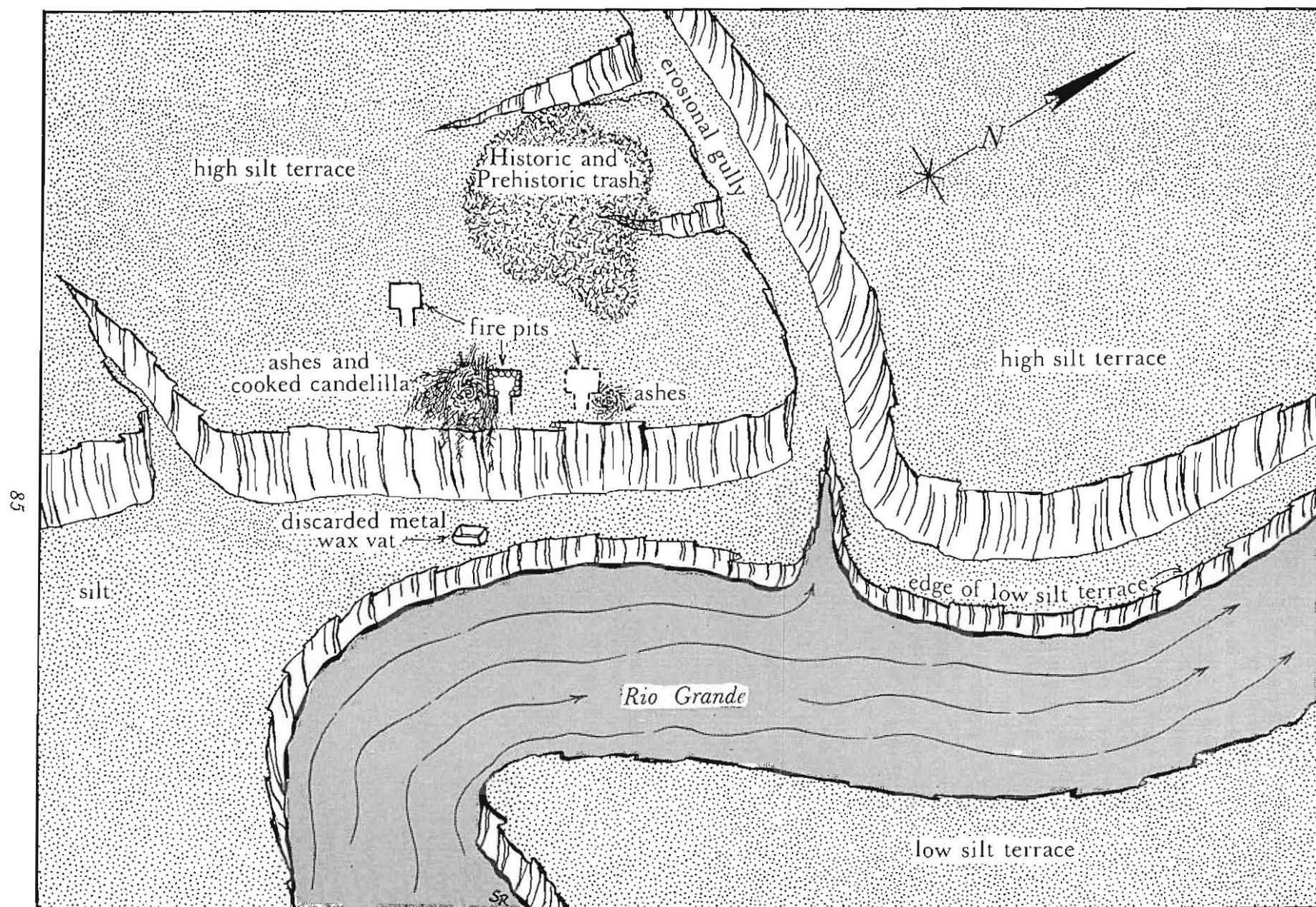


Fig. 7. Old wax camp in Lower Canyons. Note discarded wax vat at center left. Adapted, with revisions, from Mallouf and Tunnell 1977.

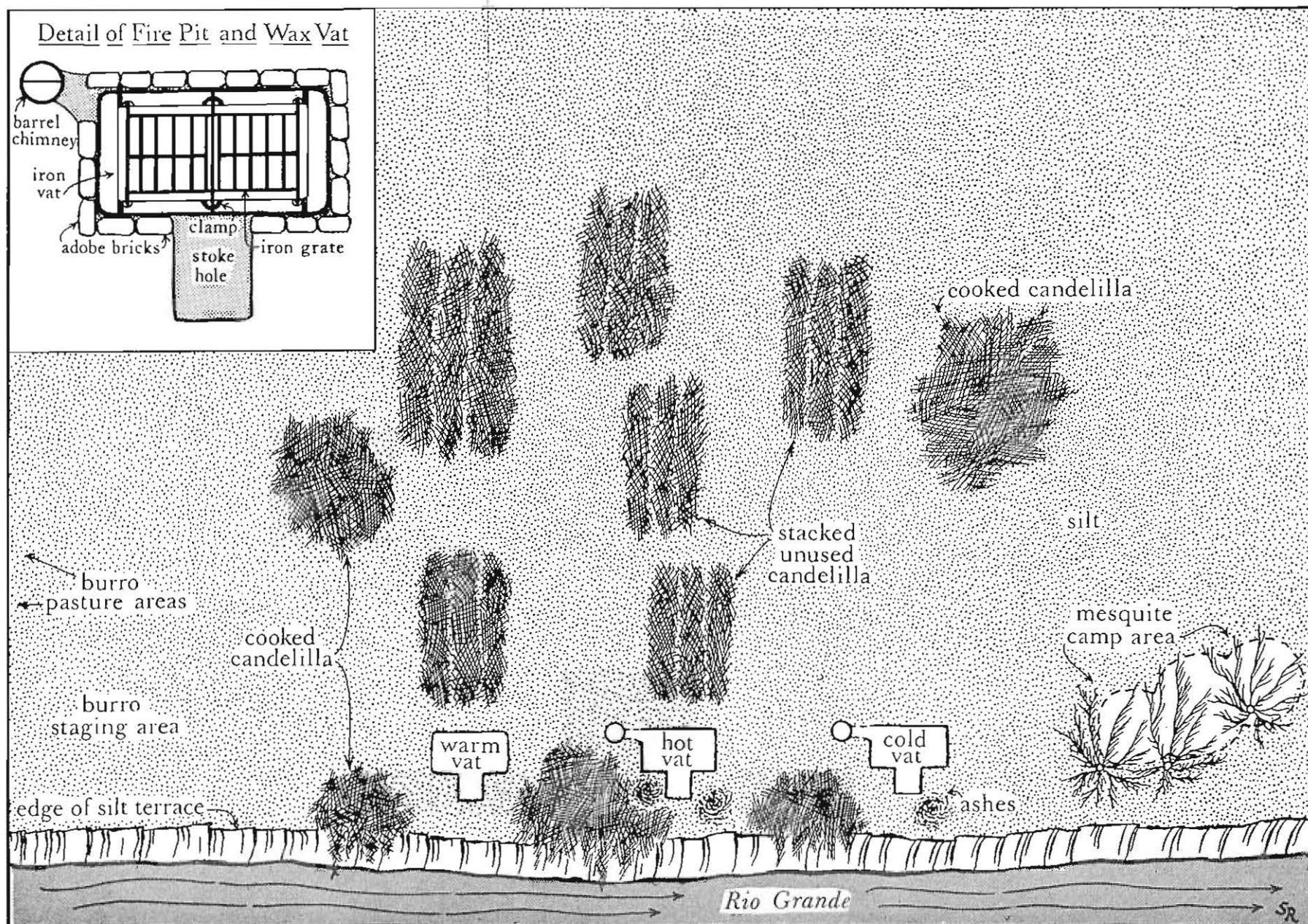


Fig. 8. Large active wax camp in Lower Canyons. Plan detail of fire pit and wax vat. Note mesquite shelters at lower right.

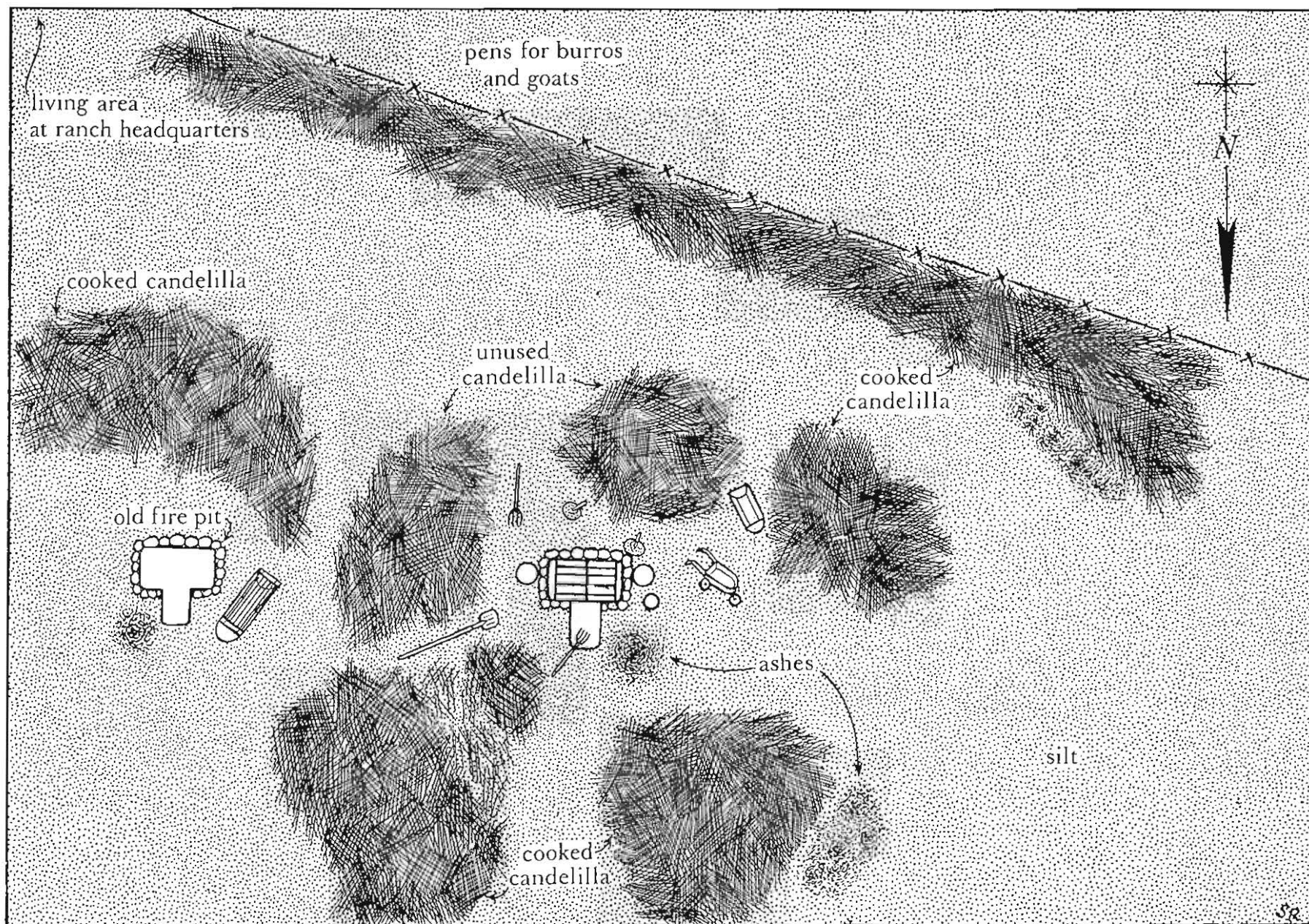


Fig. 9. Active wax camp on Adams Ranch. Note pens for burros and goats.

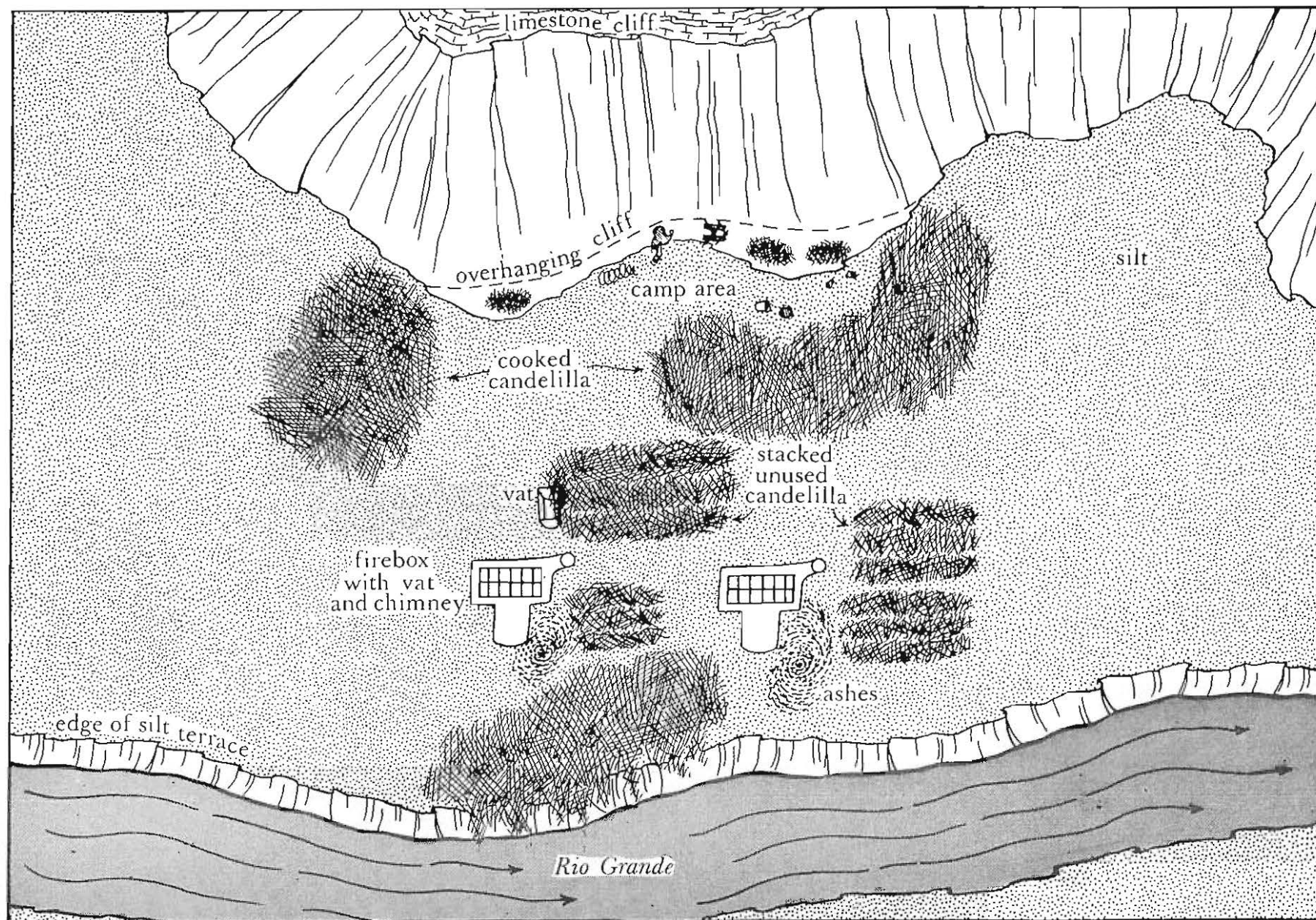


Fig. 10. Moderately old wax camp in Lower Canyons. Note cliff shelters at upper center.

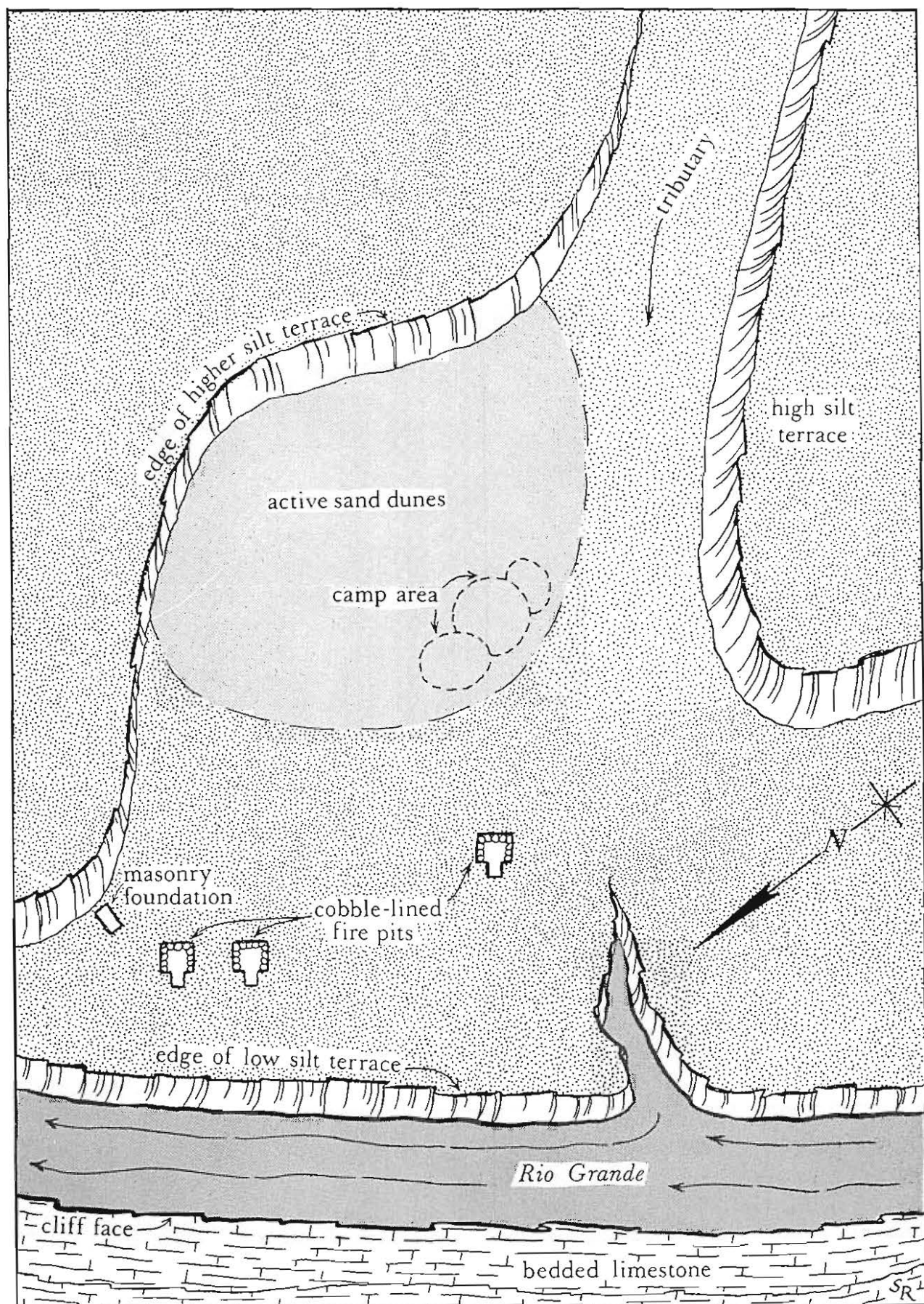


Fig. 11. Moderately old wax camp in Lower Canyons. Adapted, with revisions, from Mallouf and Tunnell 1977.

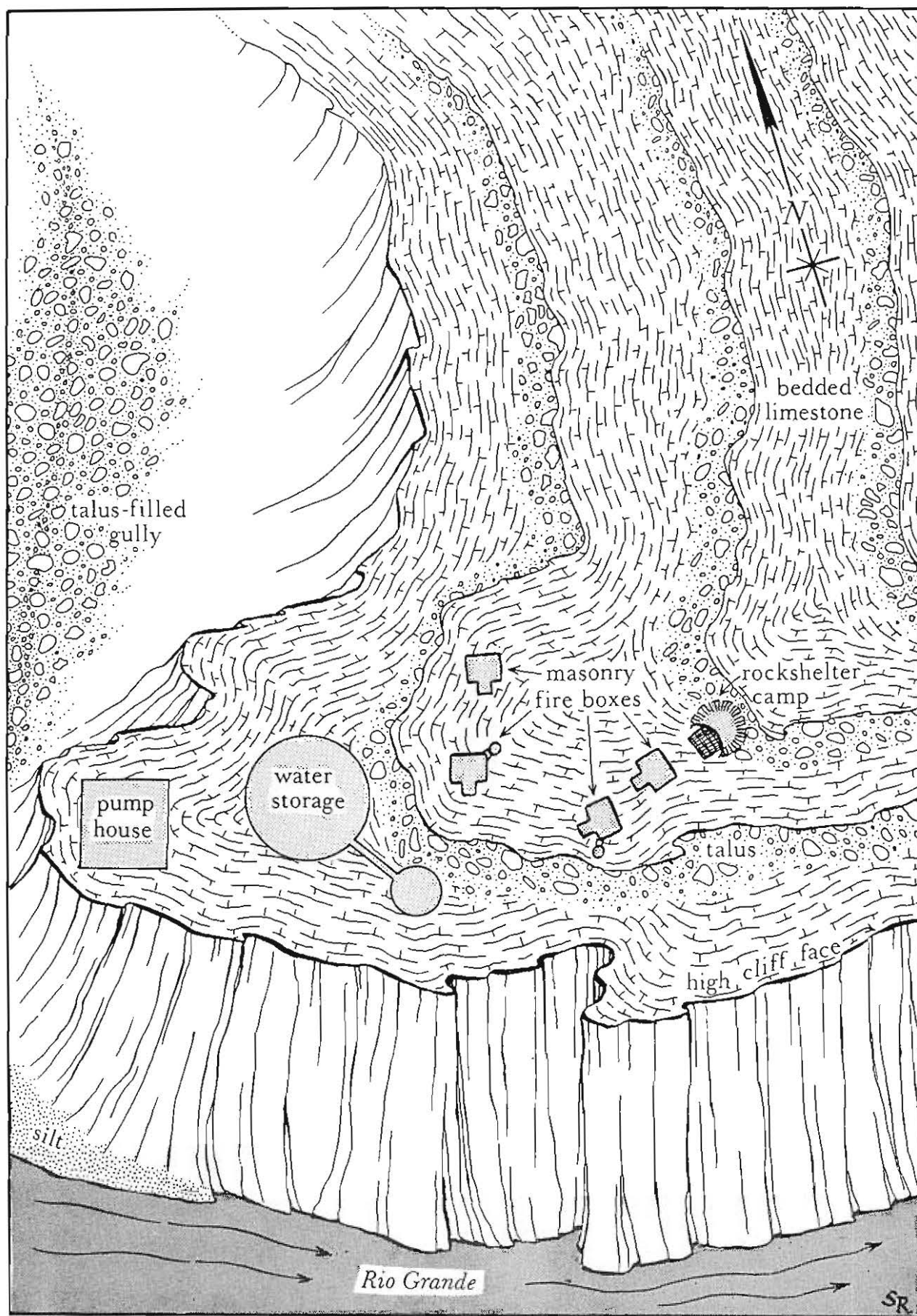


Fig. 12. Asa Jones wax camp, Lower Canyons. Note unusual water-storage system at lower left and rockshelter at right. Adapted, with revisions, from Mallouf and Tunnell 1977.

Glossary

This glossary is intended primarily to provide definitions for terms related to wax making. It also includes the names of a few foods (such as frioles) and plants (such as lechuguilla) that are familiar in the southwestern United States but may not be widely known elsewhere. Many of the Spanish terms were collected phonetically in the field, but all spellings have been verified in so far as possible.

ácido obscuro or sulfúrico: sulphuric acid, used in processing candelilla wax
 aparejo: packsaddle for a burro, used in hauling candelilla plants to camp; also called *fuste*
 ángulo: clamp that holds down the grates on a wax vat
 arriero: man who gathers candelilla plants; also pronounced *carriero*
 atieses: dry, or spent, candelilla plants being used as fuel
 bag of wax: about 140 pounds of rough wax, usually contained in a burlap bag
 Banco: Banco Nacional de Comercio Exterior (Mexico)
 burro: a small donkey; the ubiquitous beast of burden along the border
 caldera: the vat used in processing candelilla wax; also called *paila*
 candelillero: wax maker, or man who works in a wax camp; also called *cerero* and *pailero*
 carga: one burro load (four bundles) of candelilla plants
 carratilla: wheelbarrow
 cenisa: ashes from burned candelilla plant
 cera: wax of any type
 cerero: wax maker, or man who works in a wax camp; also called *candelillero* and *pailero*
 cerote: rough, or unrefined, candelilla wax
 charcador: vat for initial refining of candelilla wax in the field
 chile: hot red or green pepper
 chivo: stick for poking ends of candelilla plants into the vat
 comal: tortilla griddle; often made from the end of a steel barrel

corona: packsaddle pad
 costal: burlap bag for transporting wax
 creosote bush: a desert shrub (*Larrea tridentata*), so called because the odor of its foliage resembles that of creosote; often used as fuel
 cucharón: man who skims the wax during processing
 ejido: Mexican agricultural cooperative
 espumador: perforated tool for skimming wax
 fábrica: a small, local manufacturing enterprise, such as one for making rope from lechuguilla
 forestal: Mexican federal officer or ranger
 frioles: beans
 fuste: packsaddle for a burro, used in hauling the weed to camp; also called *aparejo*
 honda: a wooden device used in tying a load of plants to a packsaddle
 horquilla: pitchfork, commonly made from a mesquite limb
 humo: smoke, as from a firebox
 ixtle: fiber from agave plants
 jefe: a boss, such as a rancher who employs wax makers
 lasso: rope; see also *mecate*
 leche: the milky sap of the candelilla plant
 lechuguilla: any of several agaves yielding ixtle fiber
 machete: a long, heavy knife; used to clear brush, construct shelters, and as an all-purpose tool
 maneral: lever for clamping down the grate on a wax vat
 masa: the flour or meal from which tortillas are made
 mecate: rope made of lechuguilla fiber; used for tying bundles of candelilla
 mescal: may refer either to the maguey plant or to the liquor that is distilled from it
 mordida: a bribe
 ocotillo: a desert plant (*Fouquieria splendens*) often used in constructing shelters
 olla: a deep clay cooking pot used for boiling frioles
 paila: a wax vat; also called *caldera*
 paila grande: long-handled shovel for removing ashes from a firebox
 pailero: a wax maker; also called *candelillero* and *cerero*

parilla: heavy steel grate used to submerge weed in a wax vat
press: grate used to submerge weed in a wax vat; the English equivalent of *parilla*
ramada: sunshade, or covering that serves to provide shade
sotol: a desert plant of the genus *Dasylirion*; occasionally used as a food by the wax makers
spent weed: remains of the candelilla plant after wax processing; the English equivalent of *yerba seca*
tequila: a liquor distilled from the agave maguey plant
tinaja: a pothole of water, usually appearing in the

wetter summer months; tinajas provide a water source for small wax camps
tortilla: a thin, flat, pancakelike bread, usually made of ground corn but sometimes made of flour; a basic food in wax camps
troneda: smokehole for firebox under the wax vat
viga: a pole or log rafter, used in the construction of a shelter
weed: the candelilla plant; English equivalent of *yerba*
yerba: the candelilla plant
yerba seca: dry candelilla plant from which the wax has been removed

Acknowledgments

It is a pleasure to devote this section to my indispensable friends.

Ed Jelks first introduced me to the wax camps on the Cactus Cruise in 1964. Debo Featherling conceived and led that thousand-mile survey of the river. Will Thompson left a rich legacy of photos from that cruise and permitted the use of some of them in this report.

The Humanities Research Center of the University of Texas at Austin made the outstanding Smithers photographs available for publication. Anders Saustrup of the Rare Plants Study Center served as valiant leader of more recent river surveys and provided references on candelilla. Marshall Johnson of the Botany Department shared his delightful company and extensive botanical knowledge on the river trips. Don Kennard had the foresight to initiate the interdisciplinary Natural Area Surveys.

J.E. Casner of Alpine kindly shared his decades of accumulated knowledge and stories about weed and wax. David Adams of Marathon extended the hospitality of his home and ranch, endured interviews, provided data, and permitted use of family photos. Bob Burleson of Temple told detailed stories about the wax camps as only an attorney can tell them and provided various artifacts for study and illustration. Luis Armendariz of Fort Leaton arranged interviews with various wax makers and helped with bilingual interpretation.

Tom Ornelas and Mrs. Walker gave insights into the buying of wax. Joe Graham of Alpine unselfishly loaned film footage and tape cassettes from his extensive study of candelilla camps. Candy Abshire provided copies of her

excellent photographs from a wax camp on the river. Vaughn Bryant of Texas A&M University provided data on candelilla pollen. Curry Holden and Deolece Parmelee gave me several important historical references. Mavis Bryant included questions concerning wax making in her interviews of Earwood, Thomas, Harrison, and others. Bob Haraden, Russ Berry, and Dan Cockrum of Big Bend National Park took me to the sites of the Glenn Springs and McKinney Springs wax factories. Ramón Riojas, foreman at the Adams Ranch, provided details about wax making that only a master craftsman could reveal. Jesus Almance, Agapito Arenivas, and dozens of other candelilleros have treated me with patience and kindness through the years.

My colleague Bob Mallouf has pulled me from the muddy flood waters of the Rio Grande on more than one occasion while we sought wax camp data. Sharon Roos has turned my "sow's ear" field drawings into "silk purse" illustrations and added her own unique touches of realism and whimsy. Nancy Kott helped refine and revise many research ideas. Jim Bonar patiently and creatively printed the photographs. Helen Simons edited many drafts of the manuscript and has contributed significantly to the final product by reworking several sections. Virginia Wulfkuhle shouldered an increasing share of our archeological burden while I worked on this project, and she read and improved the final product. Nancy Stolleis learned more about candelilla than she ever wanted to know while typing rough drafts of the manuscript. Final typesetting was by Diana Bobbitt and design and layout by Sharon Roos and Helen Simons.

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