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Wooden farming tools from the South Coast of Peru

*Yae KODA**

Résumé

On a examiné des objets en bois de Ica et Chincha, sur la côte sud du Pérou, datés d'environ 1200 à 1532 de notre ère, pour déterminer leurs formes et leurs traces d'usage. On a reproduit et utilisé certains de ces artefacts en se fondant sur les données ethnographiques et historiques. L'usage de ces « outils », constitués d'une « lame » et d'un manche, reliés par une « tige » pour des activités agricoles simulées telles que le désherbage, le creusement et le nettoyage d'un canal, a permis de distinguer des traces caractéristiques de deux types de terre : la « bonne » terre agricole et la terre limoneuse des canaux. Le poli et les stries sont essentiellement dus à la bonne terre agricole, alors que la « surface pelucheuse et laineuse » est caractéristique du sol limoneux. De plus, l'épluchage des épis de maïs avec un petit outil à main a donné une fine surface pelucheuse, une concentration de fibres et une surface visqueuse et vitreuse. Les similitudes générales entre ces traits et ceux des outils archéologiques suggèrent peut-être des activités semblables. Dans cette étude, nous avons distingué les outils rituels et les outils utilitaires en identifiant l'intensité et le mode d'utilisation.

Abstract

Wooden artifacts from Ica and Chincha, on the south coast of Peru, dating approximately from 1200 to shortly after 1532 AD, were examined for forms and traces of use. Some of these artifacts were replicated and used on the basis of ethnographic and historical information. Through using these « tools », which have a blade, handle and connecting body or stem, in simulated farming activities such as weeding, digging and cleaning a canal channel, it was possible to discern traces characteristic of two types of soil : « good » farm soil and silty canal soil. Polish and striae resulted mainly from good farm soil, while « matted and woolley surface » characterizes silty soil. In addition, corn husking with a small hand tool resulted in a fine matted surface, fiber concentration and viscous and glassy surface. General similarities of these features and those on archaeological tools may suggest similar activities. The study distinguished between ceremonial and utilitarian tools by discerning the intensity and manner of use.

Introduction

Only a small number of studies have been conducted concerning use wear on wooden artifacts, due partly to the poor preservation of wood (Rees, 1981 ; Oakley, 1963 : 13-14 ; Oakley, *et al.*, 1977 ; Harunari, 1986). The dry matrix of many archaeological sites on the south coast of

Peru, one of the driest environments in the world, provides a favorable condition for wood preservation, and many wooden artifacts have been excavated here. This paper is a part of a study which examines these artifacts for their forms and for traces of use in an attempt to interpret their functions (Koda, 1989)[1]. The present paper pertains to the part of this study that deals with traces left on some of these artifacts, comparing them with those which resulted from experimental tool use.

The sample under study derives from a collection of artifacts excavated in the early 20th century by a German archaeologist, Max Uhle, from the sites in Ica and Chincha Valleys (fig. 1) and stored in the Lowie Museum of anthropology, University of California, Berkeley (Uhle, 1924 and n.d. ; Kroeber, Strong, 1924a and 1924b). They represent varied forms and time periods, ranging from ca. 1200 AD to the initial part of the Colonial period, that begins in 1532 AD, using Menzel's chronology based on the associations of Ica ceramic style vessels (Menzel, 1976). The sample of 53 artifacts from the Uhle collection were examined first hand ; another 70 items, in the forms of photographs, drawings and description, were added to enlarge the stylistic range[2].

Despite the heterogeneity of artifacts in the sample, they all have common recognizable parts ; a « working part » seen in a point or a blade with a « bladelette » that tapers sharply from the blade proper, body or stem, and handle. These artifacts are called « tools » in that they can be used to do a job by applying force on the working part, held at the handle or body/stem or both. They are roughly divided into three size categories : oversized, large and small.

The stylistic analysis identified two distinct groups of tools from Ica which I call Plain tools and Soniche tools, named after the site in Ica that yielded many of the latter. Ica Plain and Soniche tools are similar in overall form and parts, but different in many respects. Soniche tools (fig. 2 : D-F) are markedly oversized, more well-made and elaborately decorated than their more simply-made counterparts, the Plain tools (fig. 2 : A-C). Plain tools in the sample are small in number and come from various sites with few associations or secure dates.

Most Soniche tools are dated to the late Horizon, when Ica was under the rule of the Inca Empire, (1476 AD until 1532 AD)[3]. Many come from rich tombs with elaborate vessels, precious metals and, in some cases, artifacts signaling status or rank of the buried in the Inca society, such as a stool for an administrator of 100 taxpayers (Menzel, 1977 : 10). In addition, at least two belong to the late intermediate period, phases 3 and 6, between approximately 1200 and 1350 AD.

Each of the Plain and Soniche tools can be roughly sub-grouped into three types : spade-shaped with a stem and large asymmetrical blade, board-type tool with U-shaped handle and pointed sticks. Many have knobs at the top (fig. 2 : A-D, F).

The tools from Chincha in the Uhle collection are heterogenous, simply formed and lack decoration (fig. 3). Many Chincha tools come from tombs of the late intermediate period or late Horizon, and a few of the very early Colonial period (Menzel, 1966). These tombs often contain various small artifacts, such as silver plates, « balance beams », chalk, weaving tools, and small metal items, that Menzel says belong to « specialists »

(1) The study forms a basis of my dissertation and was financially supported by various sources. Tinker Foundation, through Latin American Studies Center, University of California, Berkeley, provided me a travel grant for fieldwork in Peru in 1984. A grant was provided by Sigma Xi for travel and a field experiment in Gila, Arizona, in 1987. The Chancellor's Special Award of University of California, Berkeley, supported photographic works. Department of Anthropology of the same institution provided grants, through Lowie Graduate Scholarship and Olson Graduate Scholarship, to supplement fieldworks and research. To these institutions, I am grateful.
I appreciate many people who helped me to conduct research. Dr John H. Rowe inspired me to study the subject and advized me throughout my research and writing. Dr Karen Bruhns, Dr James Anderson and Dr Roger Byrne gave me invaluable advice. Dr Nicholas Toth encouraged me to expand the study to include a use wear analysis. Dr Desmond Clark and Dr Ruth Tringham advized me of the dangers of use wear analysis ; while they gave me helpful advice, I am entirely responsible for the present study.
Mr Lawrence Dawson and Mr Eugene Prince were immensely helpful in my conducting work in the Lowie Museum.
(2) Information and photographs of the artifacts in Museo Regional de Ica and Peabody Museum were provided by Dr John Rowe and Dr Izumi Shimada, to whom I am grateful.
(3) Chronology is based on Rowe's system (1962).

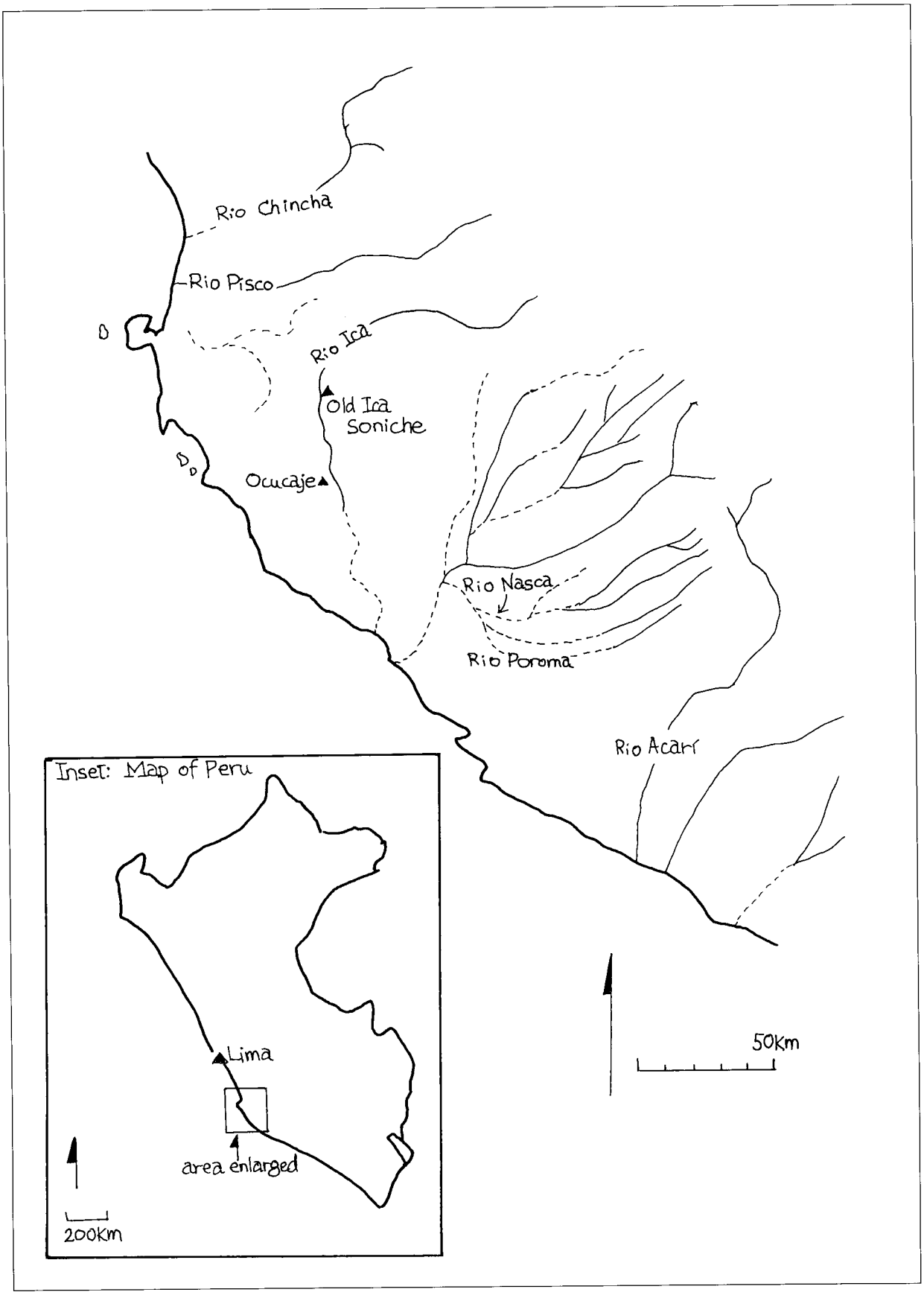

Fig. 1. Map of south coast of Peru. Adapted from Menzel, 1976, Map 1.

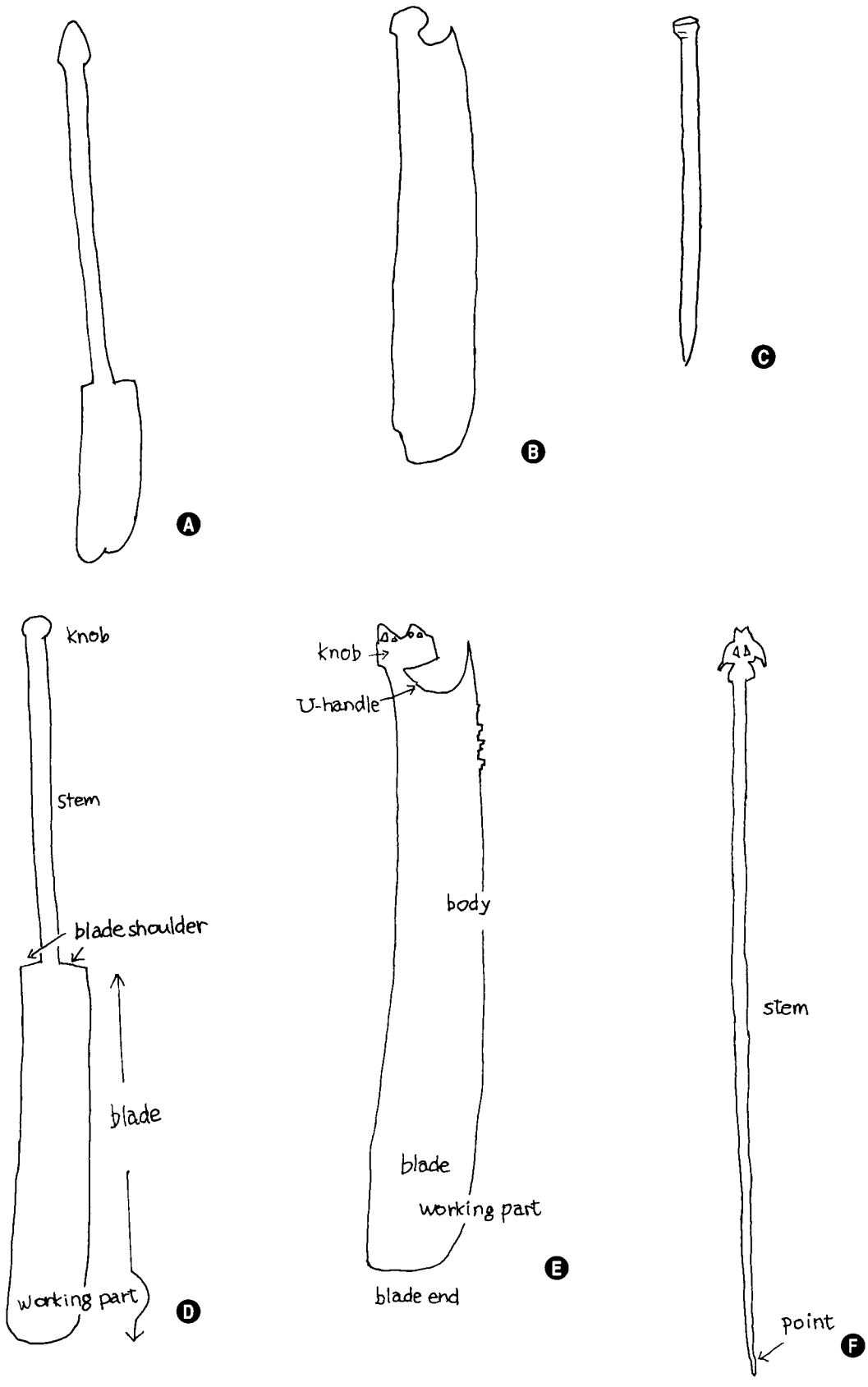

Fig. 2. Ica Plain and Soniche tools : not to scale. **A.** Ica Plain spade, 4-4211, Galagarza. **B.** Ica Plain board, 4-4209, Galagarza. **C.** Ica Plain pointed stick, MRI-3329. **D.** Soniche Spade, 4-4591, C-1. **E.** Soniche board, 4-5121, Tg. **F.** Soniche pointed stick, 4-4266, Y-1.

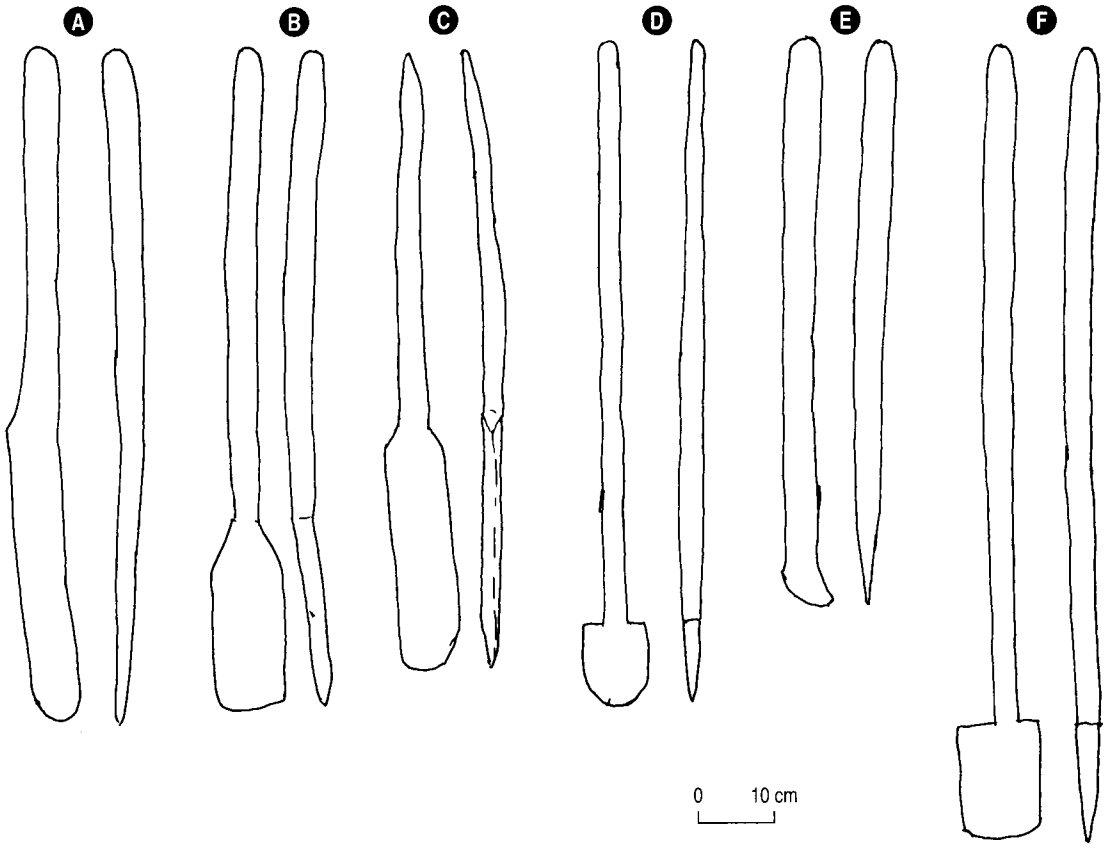

Fig. 3. Tools from Chincha (8-13 long tools ; 14-18 small tools). **A.** 4-3826i, C-14, Chincha. **B.** 16-1483 (probably from Chincha*). **C.** 16-1484 (probably from Chincha). **D.** 4-3755, C-5, Chincha. **E.** 4-3955, E-4, Chincha. **F.** 4-4201, Tambo de Mora, Chincha

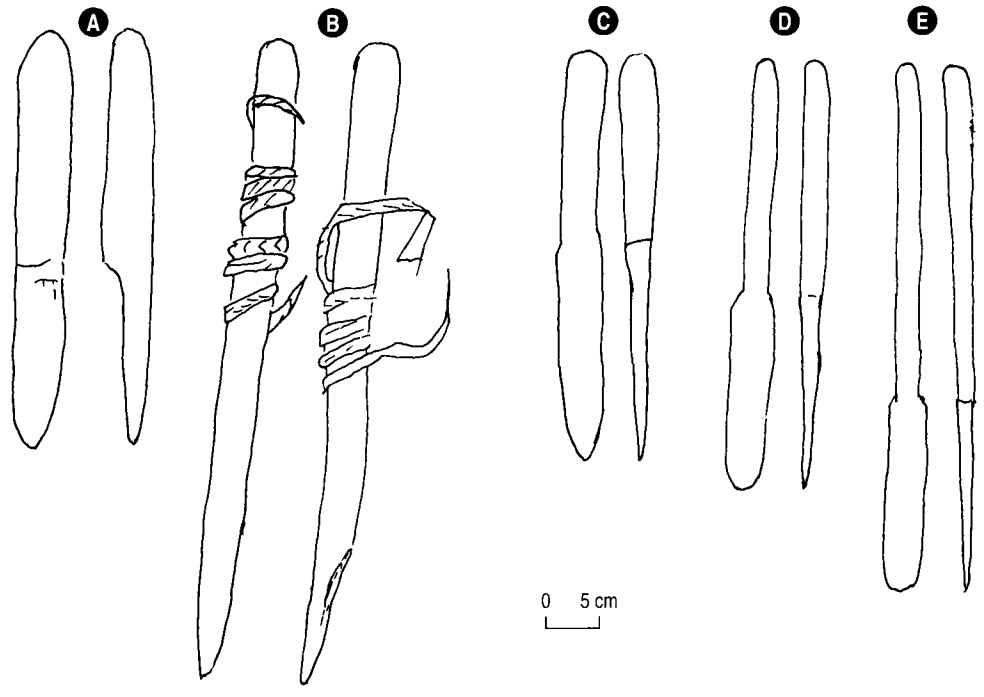

Fig. 4. A, B. 4-3692b and c, B-5, Chincha. **C, D, E.** 4-4100a, b and c, F-4, Chincha.

or « farmers ». Many tools from Chincha belong to the small tool category. The relative paucity of small tools in Ica, however, may be due to a sampling bias, as there are more rich tombs with large and oversized tools in Ica.

Trace Studies

The Sniche tools have attracted much attention for their exquisite carvings and have been called variously paddles, daggerboards or oars, identifications based on the shapes and some decorative themes such as fish and birds (fig. 5). Peter Kvietok (1987) recently found that they were used for farming purposes rather than for watercraft, based on a small-scale wear observation and iconographic and ethnohistorical study. The present study, independently conducted, is in agreement with Kvietok's conclusions. Although limited by methodological constraints, an experiment using tools roughly based on the plain tools of Ica and Chincha produced several distinguishable patterns, from different soil types and from corn husks.

Overall methodological frameworks and basic concepts of the wear study were borrowed from the lithic use wear studies (Semenov, 1964 ; Hayden, 1979 ; Hayden, Kamminga, 1979 ; Keeley, 1980 ; Tringham, 1978). However, due to the difference in materials (wood as opposed to stone, ivory, bone etc.) and the large size of the tools, the lithic usewear framework was significantly modified. For instance, such concepts as polish and striation were used, while wood-specific patterns were noted. Also, while a microscope was used to enhance the traces, the porous and non-isotropic wood surface required low-power magnification, or much of the area under observation would have been obscured.

Experiment

Tool manufacturing

Tools were manufactured within logistical constraints. Due to time restrictions, and because a major purpose of the experiment was the tool use and the resultant wear, tools were manufactured using steel tools rather than tools with bronze, chert or granite blades. Such blades were found by Uhle from the sites in Ica and Nasca as well as other Peruvian sites. Similar blades could have been used in woodworking as an adze or ax. Given that the steel tools are 3-6 times more efficient than stone adze and axes (Cranstone, 1971 ; Saraydar, Shimada, 1971), the time saved was used for tool-using experiments.

A steel adze experimentally made from a pick-ax was lent to me by Mr Lawrence Dawson, of the Lowie Museum. This tool, which has a slightly concave and straight-edged blade about 8 cm wide, was used for rough shaping, while a 2.5 cm wide chisel was used for the finer parts, at the bladelette and corners. The tool left straight and wide adze marks. Another experimental adze with a smaller slate blade (c. 5 cm wide) left much rounder tool marks when used with fresh oak ; these are similar to marks remaining on archaeological tools in the Uhle collection. A power tool was used to form a U-shaped handle in a replica of Ica board-type tool, while a draw knife was used to form the stem of some tools.

Altogether, six tools were made, some with working parts on both ends (fig. 6). The tools were made from *Prosopis* sp., a mesquite of the American Southwest, a wood of the same genus of which many Peruvian tools were made. The wood was locally obtained and was pre-cut at about 80 cm, limiting the size of the tools. In addition, a wood sample of *Prosopis chilensis* from Acarí Valley, south of the Nasca drainage on the south Peruvian coast[4] was used to provide a control. This small piece was not made into a tool, but rather was subjected to repeated motions, similar to the experimental activities conducted on six experimental tools.

Experimental Sites

The location of the experiment was an approximation, posing another restriction that may have limited the method's effectiveness. Several sites along the Gila Basin in central Arizona were chosen for their general, not specific, similarity to

(4) Dr Francis Riddell was kind enough to bring back a sample of *Prosopis chilensis* wood from Acarí Valley.

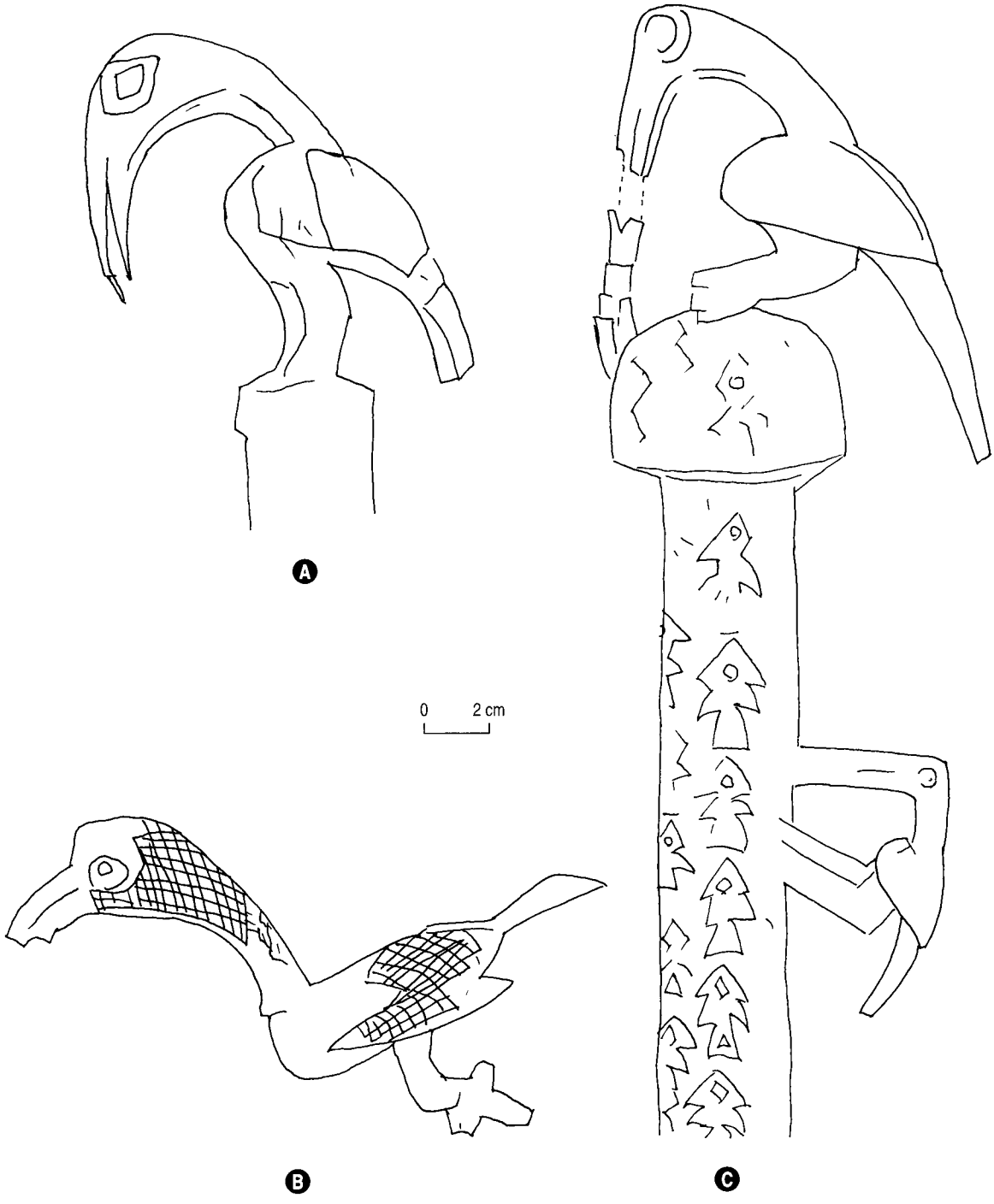

Fig. 5. Carved birds motifs on some Soniche tools. **A.** 4-4937, Ta, Soniche, Ica. **B.** 4-4939, Ta, Soniche, Ica. **C.** 45382, Tk, Soniche, Ica.

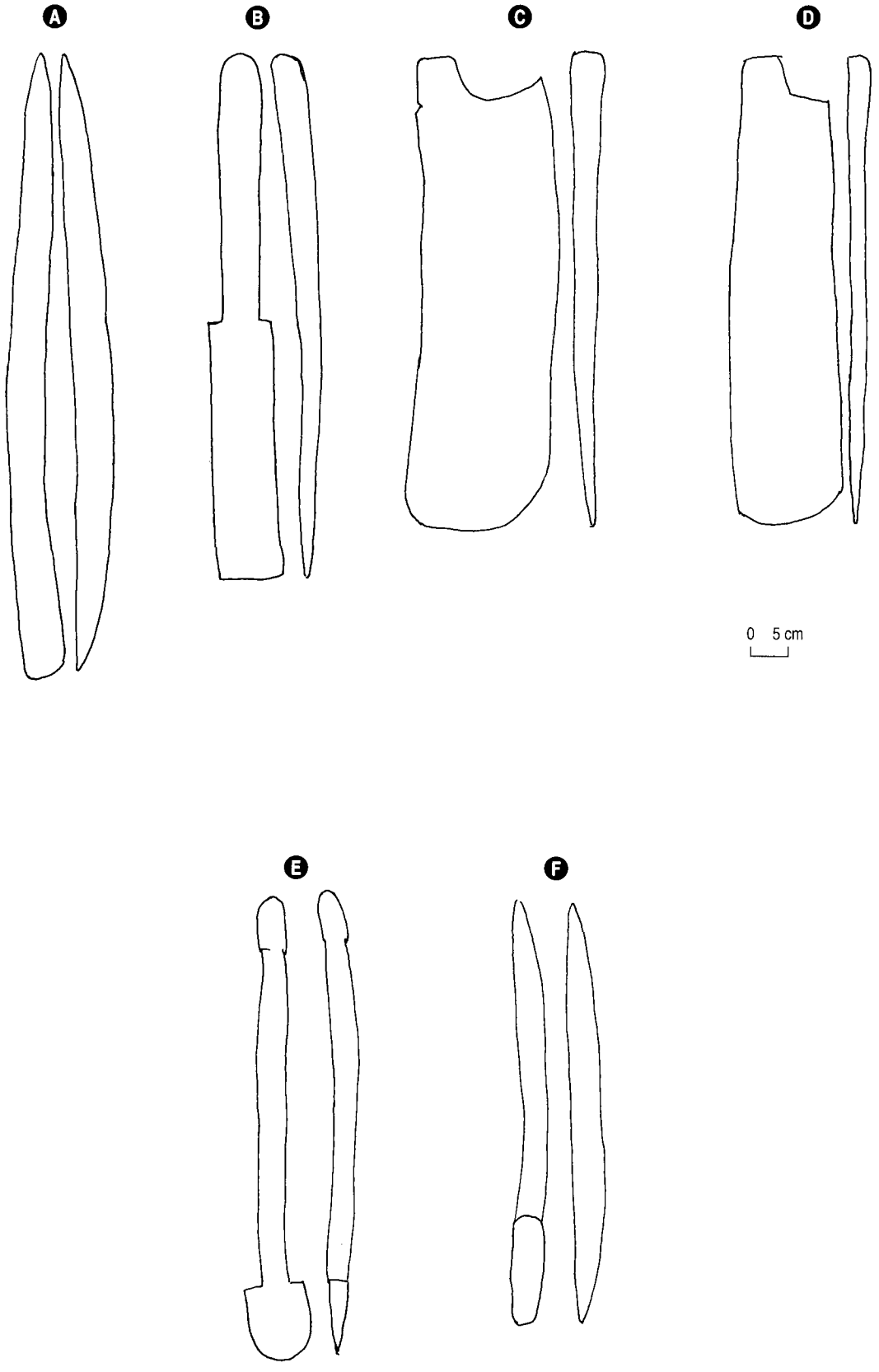

Fig. 6. Experimental tools, 1-6. **A.** Tool 1 : 76 cm (long). **B.** Tool 2 : 64 cm. **C.** Tool 3 : 58 cm. **D.** Tool 4 : 57 cm. **E.** Tool 5 : 56 cm. **F.** Tool 6 : 51.5 cm.

the arid South American valleys (Simpson, 1977). Similarities between the Gila and the south coastal Peruvian valleys include a dry environment, with xerophytic flora dominated by *Prosopis* sp. and a seasonal riverine flow with irrigation canals diverted at higher locations (Castetter, Bell, 1942 ; Menzel, Rowe, Dawson, 1964).

The experimental tools were used in fallow farmland, a water channel, a sandy floodplain, a commercial cotton field and with corn husks as a corn harvester[5]. The fallow field had been used as a family plot in which various crops were planted simultaneously in rows ; these included corn, beans, squash and watermelon. The field was planted with corn after the first experiment, and corn was experimentally harvested there five months later.

Ethno-historical information

Mixed planting is reported in many post-conquest chronicles on Andean farming. Cieza de León, in 1553, noted productive farming in the far northern valley of Tumbez, which escaped a drastic depopulation from old world diseases that decimated many fields in the South, including Ica Valley (Rowe, 1946 : 216 ; Cieza de León cap. lxx and cap. ixxv ; 1986 [1553], p. 209, 221-222) :

> « The fields were excellently cultivated, with much forethought, and they are very orderly in their watering of them. They raise many varieties of fruit and well-flavored roots. Corn is harvested twice a year, it and beans, and broad beans yield abundantly when planted (Cieza de León 1986 [1553], Ch. 101, p. 301) ».

Very little historical and ethnographic information is available on specific tool usage for farming on the coast. Bernabe Cobo tells of planting corn with a *lampa* on the coast in the 17th century :

> « Para escardar los sembrados y hacer los hoyos en que enterraban al maíz al sembrarlo, usaban de lampas, que los mexicanos llaman coas, y es un instrumento como azada, salvo que el hierro era de cobre, y no corvo, sino llano como pala corta de horno (Cobo lib. 14, cap viii ; 1956 [1653], tomo II, p. 252) ».

However, his information on weeding and making holes to plant corn using a *lampa* is not specific in the manner of use nor its form. He mentions that lampa was used as Mexican *coa*, which is a stick with a small asymmetrical blade, while it was shaped like a *pala de horno*, a tool to take bread out of the oven, probably similar to a « spade » (John Rowe's personal communication).

Guaman Poma (1980 [1615]) illustrated in the 17th century farming activities in the highlands, possibly in Lucanas, some 80 km inland from Nasca. One illustration (fig. 7 : A) shows a woman following a pair who plant corn, as if to cover the seeds with soil using a « board-type » tool. Another (fig. 7 : B) shows working on the basin wall with a similar but thinner tool. These elongated bow-like tools resemble some tools found in Poroma in the southern end of Nasca drainage, but are rather different from the Ica boards, although their general board shape is similar (fig. 8).

In addition, John Gillin details tool use in the Moche Valley to the north in the 1940"s (see below). Thus, information on farming tools on the south coast is indirect and non-specific. Experimental activities had to be broadly based on this information.

Procedure

Visible wear on the handle of archaeological tools gives some indication as to how tools could be used. The shiny spots on the tools' stem and handle were regarded as hypothetical gripping zones ; experimental tools were held at these spots.

In the experiment, such motions as straight down thrust, diagonal thrust, « thrust and pry » accompanied simulated farming activities such as weeding, tilling, making ditches, cleaning a channel. Ten or four thousand single motions were applied on each working part. In a series of heterogenous motions, such as « thrust and pry », each was counted as one motion.

(5) The work in Gila Valley, in 1987, was facilitated by Mr Cecil Antone, director of resource Management, Gila River Indian Reservation, Mr Jimmy Westfall and Miss Suzanne Leckband of San Carlos irrigation and drainage District, Florence, Arizona, Mr Donald Spencer and Mr John Andreson, both of Casa Grande National Monument. I appreciate their help.

Fig. 7. Illustrations by Guaman Poma de Ayala.
A. Guaman Poma 1980 [1615] : 1162 [1172], p. 1059. **B.** *Ibid.* : 1156 [1166], p. 1053.

All tools were observed visually, and some microscopically. Magnifications ranged from 6 to 50 times, using a Wild stereoscopic microscope. The handle and working parts were observed carefully, and the body was examined at certain intervals, depending on the size of the tools. In the following, experimental activities and the resultant traces on the handle and the working parts of selected tools will be discussed.

Traces of use resulting from experimental activities

Wooden Structure

The appearance of a tool surface that results from experimental use is affected by the wooden structure exposed on the surface after manufacture. Vessels of *Prosopis* wood on the longitudinal sections are mostly uniformly distributed or sometimes slightly grouped (Core, Cote, Day, 1979 ; Dechamps, 1980 ; Panshin, de Zeuw, 1980). In the latter, the vessel-rich zone is more likely to receive mechanical damage from abrasives because of the concentration of thin-walled large vessels. (I call it the early wood zone, EWZ). On the other hand, the dense latewood zone, LWZ, with thick-walled fibers, repels abrasives in relative terms. If the board includes sapwood and heartwood zones, the former is likewise more susceptible to mechanical damage.

At the transverse, or cross, section, such as at the bladelette, round or semi-oval pores are exposed, replacing long vessels on the longitudinal sections. Foreign substances are likely to be deposited on pores or vessels.

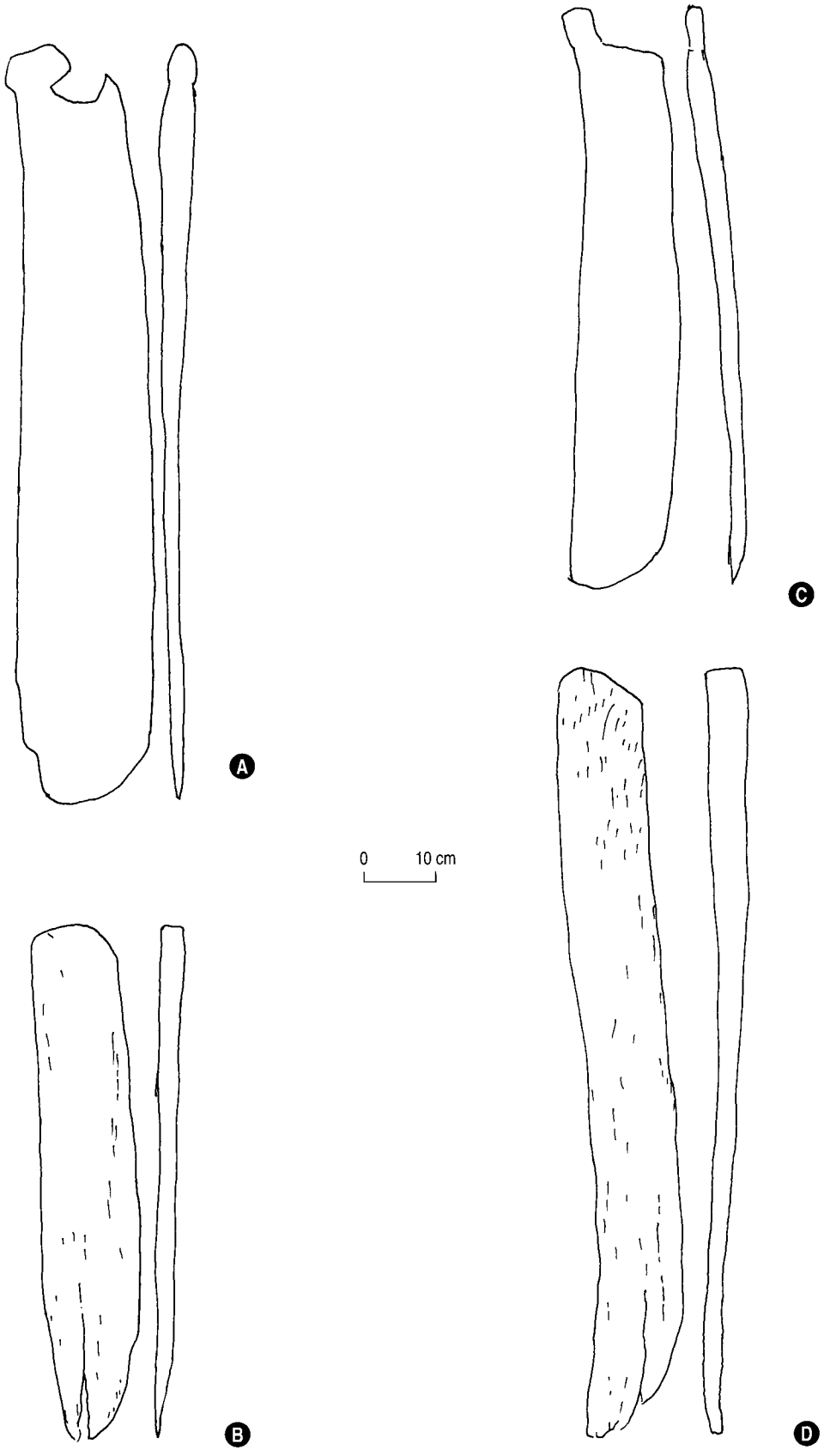

Fig. 8. Board-type tools from the south coast. **A.** Ica Boards : 4-4209, Galagarza, Ica. **B.** Ica Boards : 16-1486, possibly from Chincha (*op. cit.*). **C.** Boards from Poroma, Nasca : MRI 3445. **D.** Boards from Poroma, Nasca : MRI 2885.

Trace Patterns

Grip

A clear zone of wear from gripping resulted from all experimental activities. A « grip zone » formed where hands were pressed, on the stem and handle, seen in smooth and shiny gloss, often embedded with grit or mica (fig. 9). It is very similar to that seen on the archaeological tools, on the stem, body and knob.

Fig. 9. Grip zone polish (lower half), embedded with sand (upper half) ; knob of tool 3. x18.

Working parts

Working parts showed diverse wear, depending on materials worked and motions.

1. Motions

The direction of thrust is clearly visible, as seen in striae, either in thin scratches or thicker grooves. Mostly they run along or slightly off the tool's long axis, reflecting the direction of motions as a tool thrusts into soil in digging. Often, striae follow the vessel with an abrasive trapped in it or on the low ground (fig. 10), or leaving behind « striettes » which are short scratches made when abrasives are released.

The *coa*-like tool modeled after a Chincha plain tool was used for weeding (fig. 3 : E ; fig. 22 : A). This kind of tool is described for the Pima in the Gila region, Arizona, in the 1930's, and in the pre-Hispanic Mexican codices (Castetter, Bell, 1942 ; Donkin, 1979). The experimental tool was subjected to sawing or « diagonal quick striking », broadly based on a description of Pima farming practices in the 1930's.

Weeding activity left striae which are oblique to the blade edge, reflecting the blade's entering the soil at about 60 degrees in short strokes. A « sawing » motion, used to remove weed through moving the tool over the ground, also left a different pattern of striae. They are parallel to the blade contour, rather than oblique or perpendicular to it as in the case discussed above, which resulted from the short diagonal strikes (fig. 11).

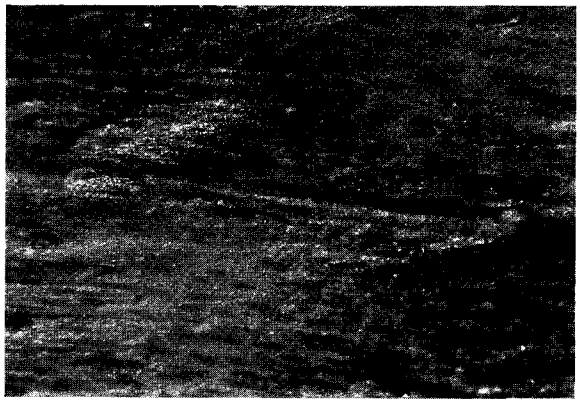

Fig. 10. A striation made on tool 5 from floodplain soil. Grit *in situ* was embedded when the tool was pulled (right side = blade contour). x12.

Fig. 11. Striae dug into polished, dense latewood zone, which is dark in color, paralleling the blade contour, from « sawing » motion in weeding. Bands of light areas on the right side reflect early wood zone and run along the tool's long axis. Working part 1 of tool 1 (tool 1-1) ; x25.

Also, in a feature more specific to wood, gross wood grain sometimes influences the size of wear, with abrasives digging into the wide zone of early wood. This creates a large-scale « wavy pattern » (fig. 12 : A).

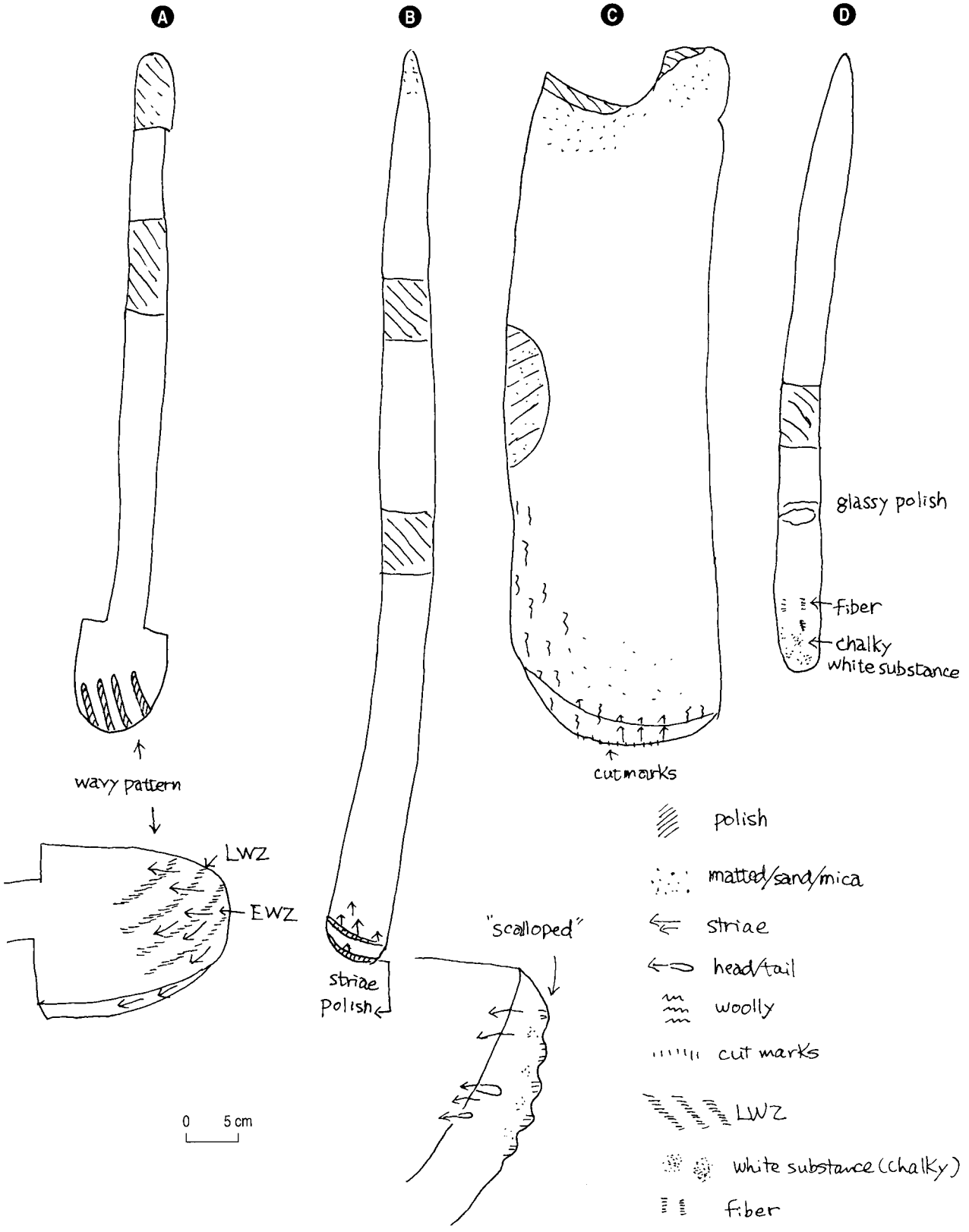

Fig. 12. A schematic drawing of traces on the experimental tools. **A.** A schematic drawing of wavy pattern resulting from coarse sandy soil of the floodplain ; lower half has wavy pattern, dug along the boundary of EWZ and LWZ. Tool 5. **B.** A scalloped contour with protruded LWZ, with striae and polish and recessed EWZ ; tool 2 used in « good soil » in the fallow field. **C.** Traces on experimental tool 3, resulting from cleaning a canal channel. **D.** A schematic drawing of locations of various features retained on tool 6-1 after its use with corn husks.

2. Materials

a. « Good soil », or dark and friable soil with a moderate amount of angular and rounded inclusions, is found in the fallow farmland. A « spade » with a symmetrical blade was used in « good soil » for tilling and making furrows with thrust-and-toss motions, at an angle of about 80 degrees. Cobo's discussion of *lampa* offers only general information on its use in weeding and planting maize. Neither ethnographic nor historical models were followed for this exercise ; rather, a general digging activity was intended. The *coa*-like tool was also used with « good soil » in the fallow field for weeding, as discussed above.

In both « spade » and *coa*-like tools, a high polish and a moderate amount of striae resulted at the working parts (fig. 13). The dense latewood zone and the high ground, formed from manufacture, retain their smooth, reflective shine with fine and thick striae, following the tool's movement. In contrast, the low ground on tool marks, porous earlywood zone, individual pores and exposed vessels received silt or grit deposits. The edge of the vessels on the longitudinal sections are rounded and smooth continuing to the higher polished areas. This produced the smooth undulation on the surface, similar to the « lattice of smoothed and reflective ridges » Kamminga observed on lithic tools (In Hayden, 1979 :145), and a « scalloped » appearance at the blade edge (fig. 12 : B).

b. Silty canal soil : two board-type tools, modeled after plain Ica boards, were used with silty canal soil. Guaman Poma's illustration shows a « Poroma »-type board used on the water basin, as if to repair its wall. No other information is available as to the use of this kind of tools. Gillin describes the Moche practice of cleaning canals ; prior to the 1940"s, canal cleaning offered a festive occasion when workers enjoyed cool water on a hot summer day while cleaning inside the ditch using a steel shovel (Gillin, 1945). The experiment was thus based on the general use of the board-type tool with irrigation work.

An irrigation ditch was cleaned using two tools modeled after Ica Plain board-type tools (fig. 6 : C, D ; fig. 8 : A, B). Held at the side and handle, as indicated in grip zones of some archaeological boards, the experimental tools were thrust at a low angle (20 deg.) to scoop the silt, inside the channel as Gillin describes.

The fine silt of the channel, with fewer large and angular inclusions than the « good soil », produced a « matted surface » (fig. 12 : C ; fig. 14). Silt and mica were deposited over a wide area with little polish. At places, the wooden surface is rough from raised wooden fiber, a « woolly surface ». A minimum amount of striae resulted except for « cut marks », or large-scale grooves dug into the earlywood zone, at the blade edge.

c. Corn husks : a group of small tools from Chincha is the model for a tool used for corn husking (fig. 4 : A-E ; fig. 6 : F). One tool from Chincha included a braided string, while the second had a hole at one end. Again, Gillin writes that corn was :

> « husked on the stalk in the field. For this purpose a bone or wooden pick, 5 to 6 inches long, perforated

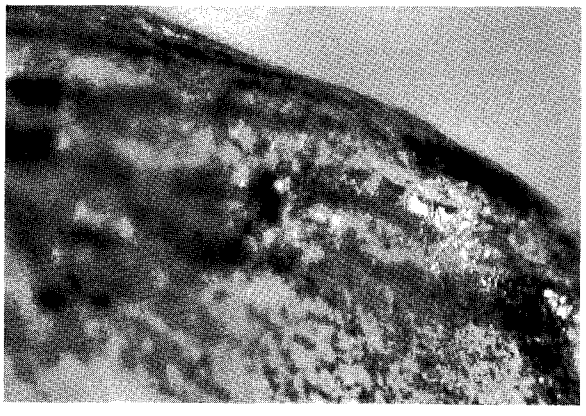

Fig. 13. Polish on the blade tip resulted from « good soil », seen in dark polish on the high ground and whitish low ground where silt is deposited. Tool 1-1 ; x25.

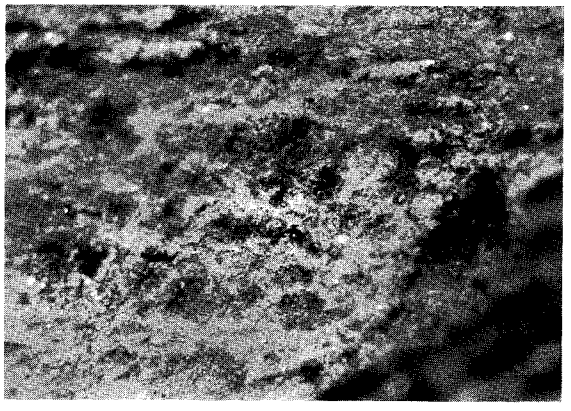

Fig. 14. Matted surface from silt in the irrigation ditch ; fine silt deposits in vessels and low ground, with no polish and minimum striae. Tool 3 ; x18.

at the butt end and attached to the wrist by a thong passing through the perforation, is used as an aid in opening the husks » (1945 : 19-20).

Tool 6-1, working part 1 of tool 6, was used in husking corn in the field, courtesy of Mrs Dora Jackson, a Pima and the owner of the corn field, which was, five months earlier, the fallow field described above. The husking task was accomplished easily with the tool by prying open the corn, although much of the experiment was made with peeled husks, as not enough corn was standing to experiment. Another experiment was made using *Prosopis chilensis* wood from Peru and observed after 500, 1 000, 2 000 and 4 000 times of thrusting into husks.

Trace Patterns : corn husks left heterogenous features on the blade, which could be seen both during working with husks and a few weeks after husking (fig. 12 : D) :

1. deposit of a matted fine white substance (fig. 15) ;
2. a thick whitish chalky or powdery substance ;
3. a thin layer of fiber bits (fig. 16) ;
4. viscous translucent deposit (fig. 17).

The thick chalky substance formed a micro-topography, resulting in a rough « moon surface ». In addition, the tool contour is rounded, and striae are visible sporadically. Wood from South America retained a similar pattern to that on the American Southwest wood, though the young branch of the former is lighter in color.

The heterogeneity of surface features may originate from different components of husks : husk, silk and silica. Phytolith polish has been proposed by Del Bene as silica particles becoming embedded into gaps onto which a further phytolith layer anchors (in Hayden, 1979 : 172). The process may be similar for wood, whose porous surface can trap various substance. A glassy polish was also observed six months after the experiment. However, low-power magnification in this preliminary experiment makes it difficult to clarify the formation process, though this was demonstrated to be wear in lithic tools by Yamada (1990).

Traces on archaeological tools

Some archaeological tools display traces similar to those on experimental tools, while others have no equivalent.

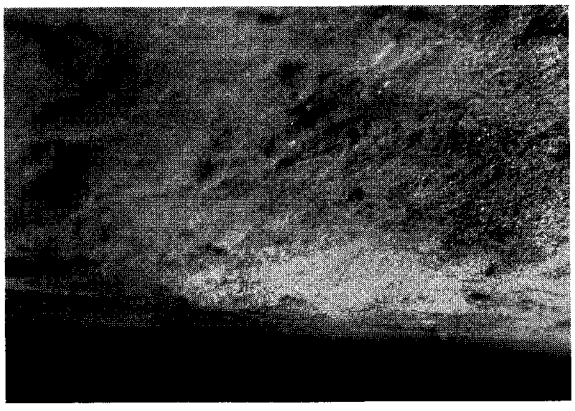

Fig. 16.– Fiber bits adhered on the *Prosopis chilensis* wood from Acarí, after 1 000 times of thrusting into husks.

Fig. 15. Matted area with white substance from corn husking. Tool 6-1 ; x12.

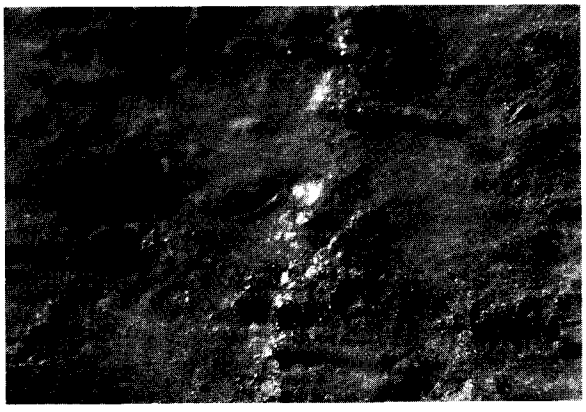

Fig. 17.– Glassy, viscous substance from corn husking, covering vessels partially. Tool 6-1 ; x18.

Grip

Soniche tools retain the grip zones at high points at the stem, indicating their use in an upright position. They were probably used nominally or for display. The blades of some Soniche tools are disintegrated or possess shrunken « ridgy grain » due to degradation from the manner they were buried – standing in a deeper more humid level. The minimum wear on the blade of most Soniche tools which escaped this process further points to this interpretation of nominal use (fig. 18 and 19).

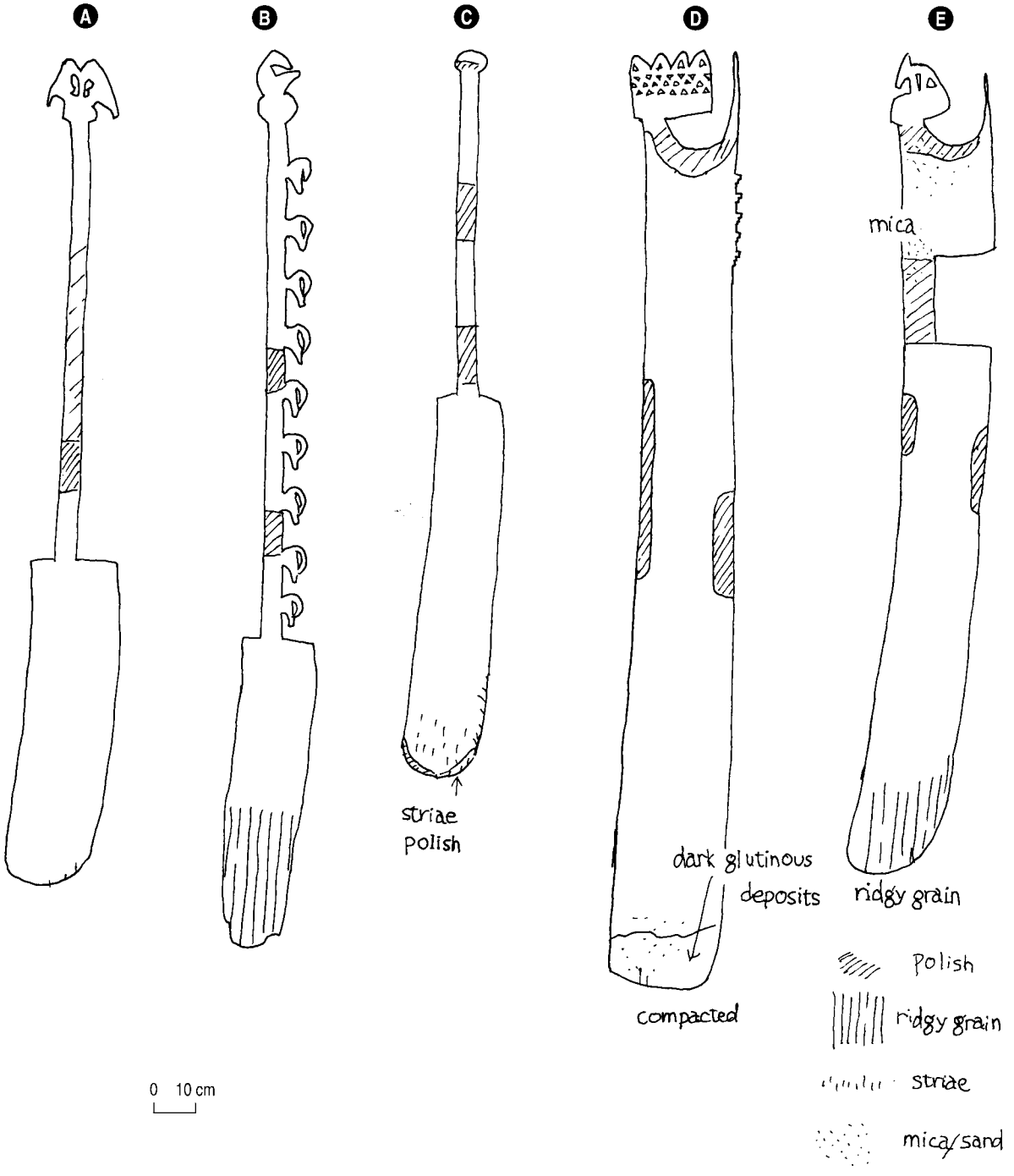

Fig. 18. Traces observed on some Soniche tools, Ica. **A.** 4-5383, Tk. **B.** 4-4940, Ta. **C.** 4-4591, C-1 ; this simply-made Soniche tool shows its more than nominal use in the blade and stem. **D.** 4-5385, Tk. **E.** 4-4944, Ta.

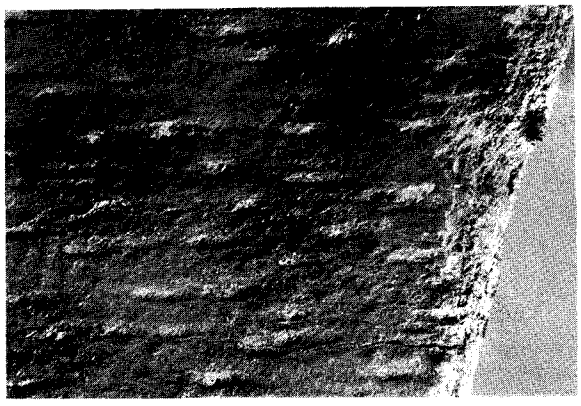

Fig. 19. A minima trace of use with little-modified wood grain, except for chipping at the contour ; 4-5383, Tk, Soniche, Ica ; x6.

In contrast, the plain tools show grip zones at the low part of the stem or body. Both plain spades and boards also have at least one grip zone at a higher location, on the stem or U-handle, probably to give the tool extra push by using the other hand (fig. 20). On one board, the darkened U-handle and the trapezoidal knob glisten highly with embedded grit and mica, indicating heavy use. These show the tools having been held at a low angle of thrust, which would stabilize a tool in repeatedly applying it deep into the soil.

Grip zones on both sides seen in plain boards may indicate their use with two hands, as done with one experimental tool used for canal cleaning.

Working Parts

a. The sample of the plain tools is small, five boards and three spades, which renders the following observations preliminary. The board-type tools retain both striae/polish and residue deposits.

One Ica plain board has diverse, heterogenous and dense trace patterns, including striae, polish and matted surface (fig. 21). In addition, heavy deposits of various substances occur, such as a dark thick substance and white powderish one (fig. 20 : C). The mixed features of wear and deposit indicate long-term multifunctional use with « good soil », silt, as well as with unknown substances.

On the other hand, three Ica boards indicate their use mostly with silt with fine silt and mica deposits (fig. 22). In case of two tools, which are possibly from Chincha, a woolly surface is prominent as in the experiment use in silt (fig. 20 : D, E).

The spade-shaped tools pose further difficulty because of small sample size. At least one with fine polish and striae suggests its use in « good » soil (fig. 20 : A). Another, though it is a Soniche tool which is very simply decorated with red pigment, was used extensively, showing a good polish and striae – probably used in good soil (fig. 18 : C ; fig. 23). The third spade shows a matted and woolly surface (fig. 20 : B ; fig. 24). Both Plain spades have well-rounded blade shoulders, indicating their use as the foot rest, as done on modern shovels. In addition, spades and boards alike, as in some Soniche tools, have distinctly asymmetrical blades ; this feature seems to have resulted from repeated thrusts at an oblique angle into the soil.

As for the manner of use, motion is suggested by the direction of striae. One tool from Chincha with a small symmetrical blade (fig. 3 : D) has polish and striae perpendicular to the axis on the tip of the blade, gradually leaning toward the sides, eventually paralleling the tool's axis (fig. 25 and 26). These features indicate its straight down thrust into a « good » soil, rather than « sawing » motions.

Five small tools from Chincha show similar wear to the experimental tool used with corn husks (fig. 27). One has a fine powdery deposit and smooth glassy polish on the blade edge and high ground as well as striae and fiber bits (fig. 28). Another has, in addition, an area of fine fiber bits concentration (fig. 29).

Conclusion

Although the experiment was limited in scope, it produced a few distinct trace patterns on wood specific to *Prosopis* sp. The existence of similar traces on the archaeological tools may suggest their use in a manner similar to that in the experiments. While it is possible that they were used for non-farming activities such as digging for construction, further experiment may clarify such a distinction.

While Soniche tools can be termed ceremonial for their minimal use, manner of gripping and formal features, plain Ica tools appear utilitarian on the basis of their size, blade forms and wear and

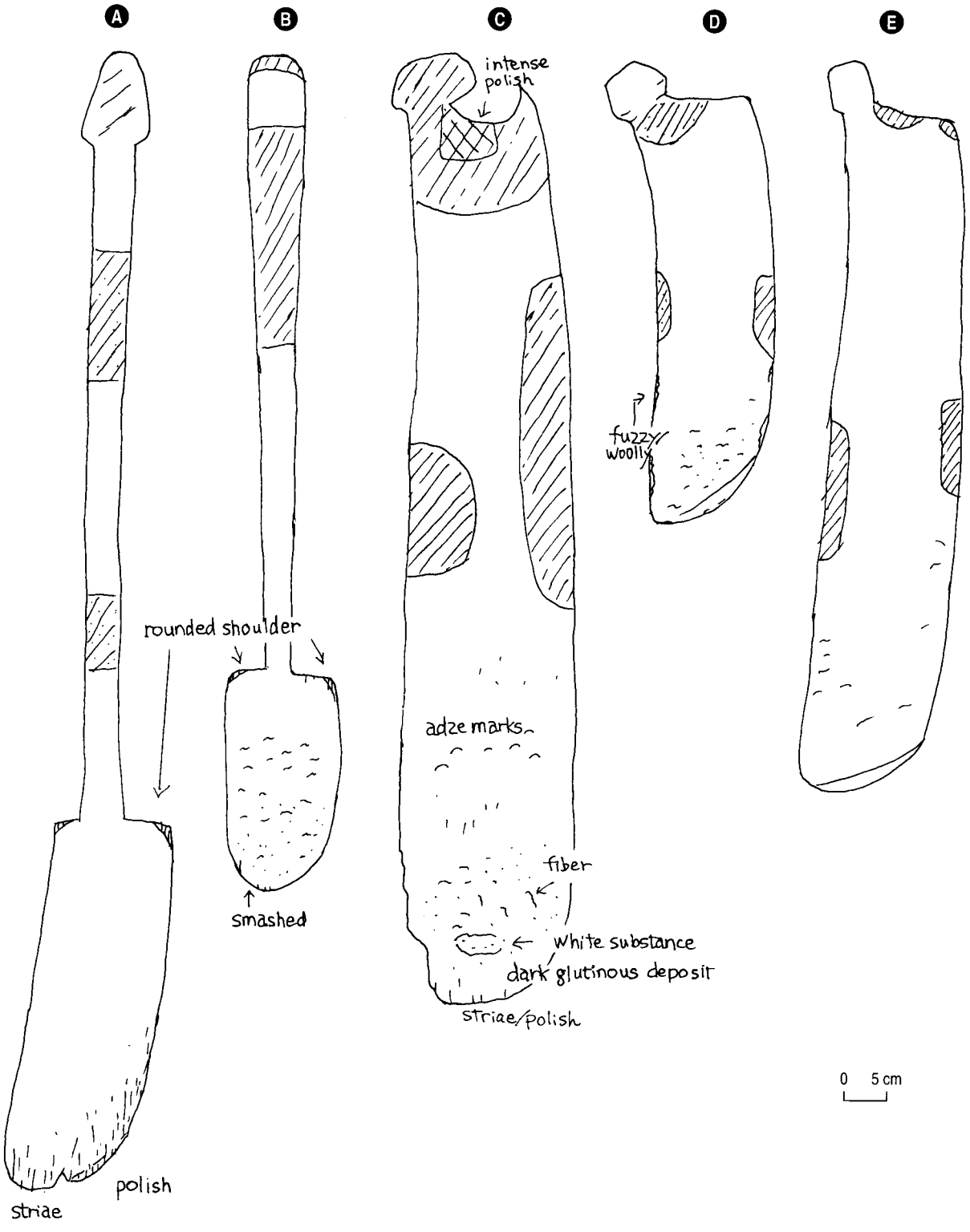

Fig. 20. Traces observed on the Plain archaeological tools. **A.** 4-4211, Galagarza, Ica. **B.** 4-4565, Site G, Ica. **C.** 4-4209, Galagarza, Ica. **D.** 16-1485, possibly from Chincha (*op. cit.*). **E.** 16-1486 (*op. cit.*).

Fig. 21. Striae and matted surface on an Ica board, 4-4209, Galagarza, Ica ; x18.

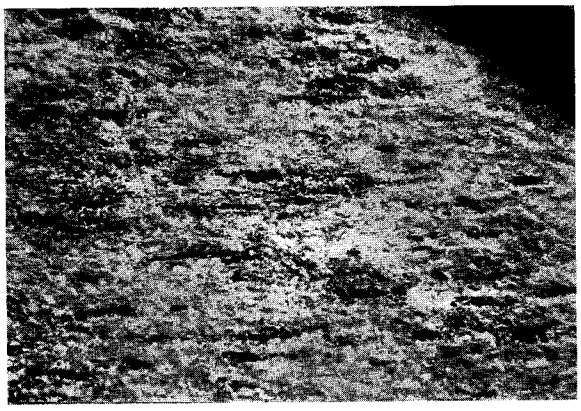

Fig. 24. Matted surface on a spade, 4-4565, Site G, Ica. ; x6.

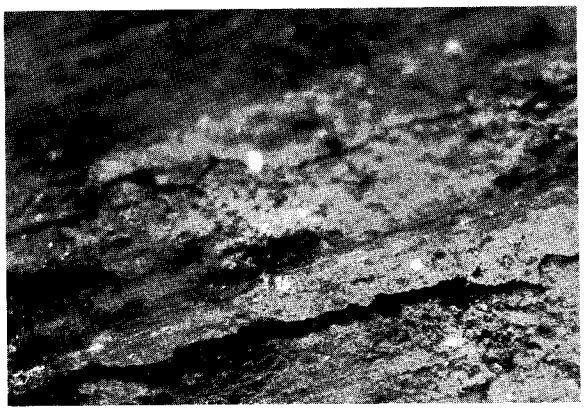

Fig. 22. Matted surface with silt and mica on an Ica board, possibly from Chincha, 16-1485 ; x18.

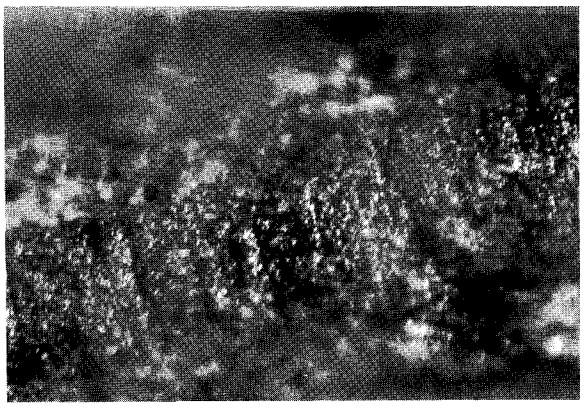

Fig. 25. Polish and striae, perpendicular to the blade contour, reflecting straight down thrust. At the blade end of a long tool with small blade, 4-3755, B-5, Chincha. x50.

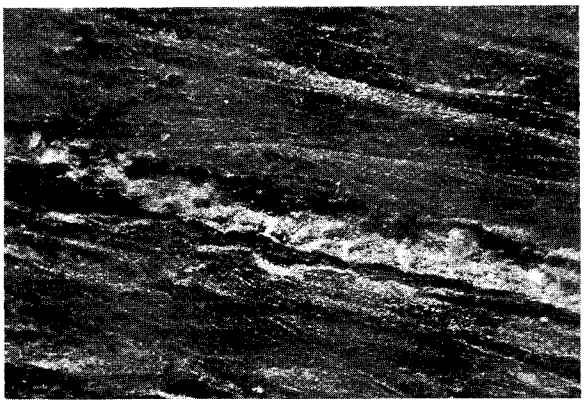

Fig. 23. High polish, striae and silt deposit in vessels in a simply-decorated Soniche spade, 4-4591, C-1, Ica ; x18.

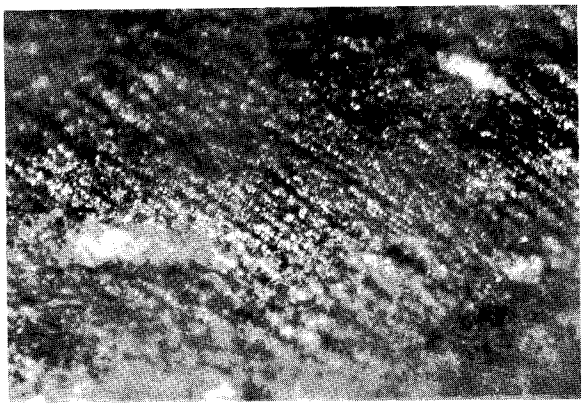

Fig. 26. Same as above, except that striae are oblique as they appear on the side of the blade, away from the blade end.

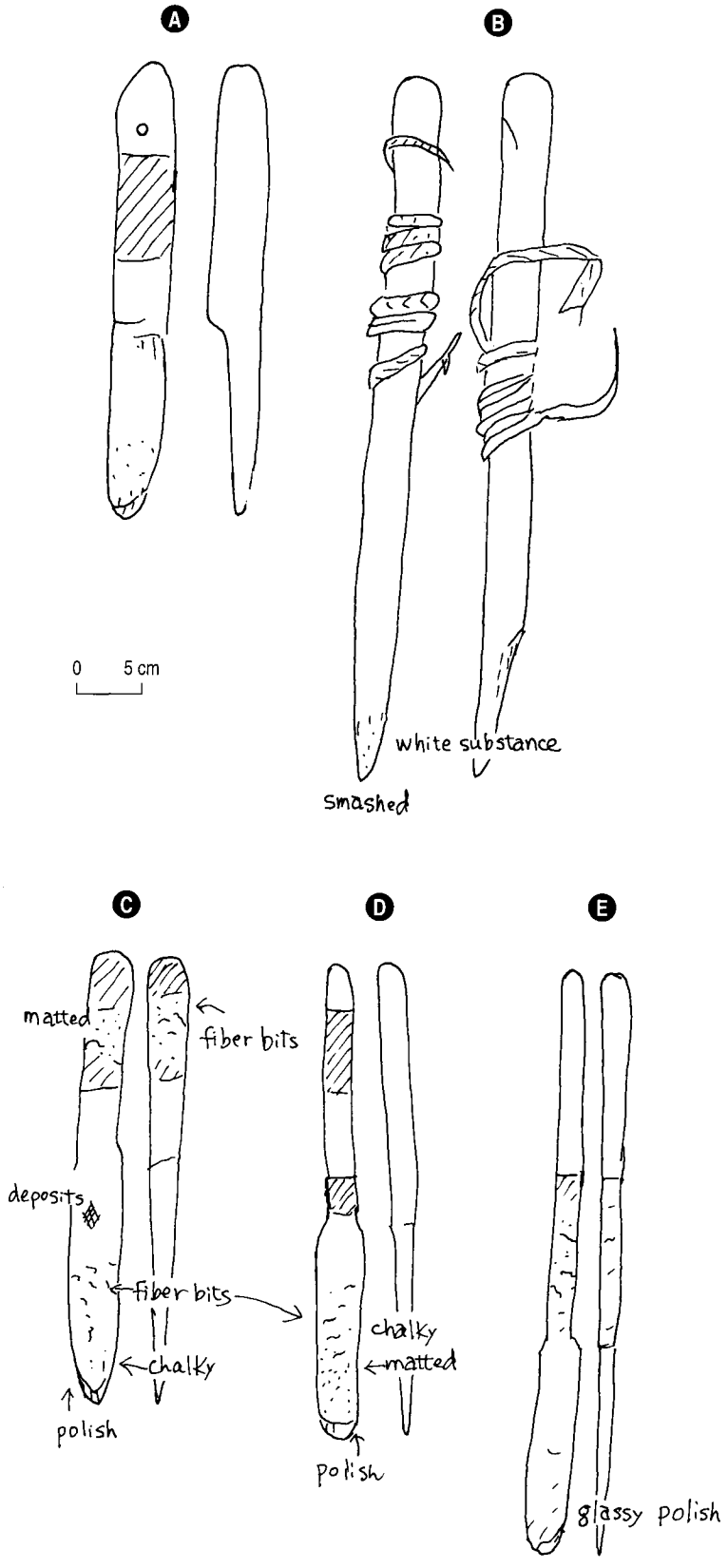

Fig. 27. Traces observed on the small tools from Chincha. **A.** 4-3692b. **B.** 4-3692c, both from B-5, Chincha. **C.** 4-4100a. **D.** 4-4100b. **E.** 4-4100c, all from F-4, Chincha.

Fig. 28. Polish on high ground and matted area with thin white substance. A small tool with thin blade ; 4-4100B, F-4, Chincha. x6.

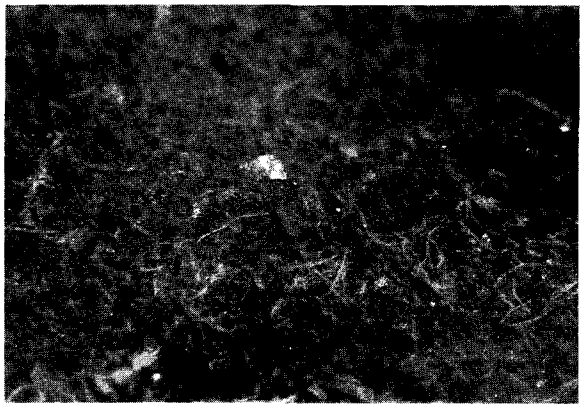

Fig. 29. Fiber bits on one of three similar small tools from F-4, Chincha. 4-4100A. x18.

deposits.

No clear distinction of possible use can be made between plain spades and boards from the given sample. Both tool categories retain traces that suggest the use in the silty soil and « good soil ». It is possible that they have been used for both soil types, that is farmland and with canal soil. They may have been used on other materials as well, since deposits of white and dark substance appear on a board-type tool.

The small tools with thin blades from Chincha exhibit features indicative of their use with corn husks. While other possibilities exist, the tool with an attached rope or hole for it also points to this interpretation.

Based on this experiment, an experiment with finer control in materials and activities should be considered, and the sample size expanded. Also, residue analysis should be a next step to test the results. An iconographical basis suggesting these tools to be farming tools is beyond the scope of this paper (Koda, 1989), but could strengthen, through further trace and residue analyses, the distinction between utilitarian and ceremonial tools.

Notes

Fig. 00 : Catalogue numbers used in Lowie Museum are listed as in 4-4211, followed by the name of the burial and/or site in Ica, or Chincha where noted (Menzel, 1976). The artifacts in the Catalogue 16, which have no provenience, are designated as, for example, 16-1484. MRI-# signals artifacts from Museo Regional de Ica.

Fig. 00 : 16-1483 and 1484 lost provenance after excavation. However, based on Uhle's description, they seem to fit artifacts excavated in Chincha, 4-3752 and 3755. Same situation applies to 16-1486, which could have been 4-3934 (see note to fig. 00).

* *123 Greenbrae Boarduwalk, Greenbrae, CA 94904, USA.*

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