USE-WEAR PATTERNS ON BARK REMOVERS

Vivian G. Scheinsohn

Asociacion de Investigaciones Antropologicas, Consejo Nacional de Investigaciones Cientificas y Tecnicas (AIA-CONICET), Rivadavia 1379 - 11 ^{0} F, (1033) Buenos Aires, Argentina

INTRODUCTION

The functional analysis of archeological tools requires experimentation. In this case experimenting implies entering the field of actualistic studies and, particularly, the field of experimental archeology. The latter includes studies that test new techniques or analytical methods, as well as imitative or replicative studies (Ascher 1961). The immediate goal of actualistic studies and experimental archeology is to generate a middle-range theory that allows the linkage of the archeological record with the dynamic context that produced it.

The paper presented here is framed within the field of experimental archeology. For some time, the author (Scheinsohn 1991a, 1991b, 1993; Scheinsohn and Ferretti 1995; Scheinsohn et al. 1993) has been studying the bone tools from Isla Grande of Tierra del Fuego. From that research arose the necessity of identifying use and manufacture traces to achieve accuracy when giving "tool" names to certain specimens which are doubtful as artifacts. For that purpose, and as a first step, an experimental study was designed. It consisted of the removal of bark fragments of *Nothofagus betuloides,* following a hypothesis generated from the ethnographic record. The first results of that work are presented here.

BACKGROUND

Functional analysis began with the pioneering work of Semenov (1981) and has continued with ether researchers since the 1970s (Keeley 1976; Odell and Odell-Vereecken 1980; Tringham et al. 1974). Because of these works, it is recognized today that the identification of the function of an instrument comes only from the application of such types of analyses and not from rough ethnographic analogies or intuitive typologies.

In the field of lithic functional analysis, intense experimental projects have been undertaken in relation to micropolish formation, striations, microchipping and other types of traces (see, for example, Anderson-Gerfaud 1981). However, many natural agents could produce similar effects in both lithic and bone artifacts. Since bone seems more affected by these natural agents, in the 1970s a series of studies attempted to identify the traces that these agents can leave and to note the differences from those left by cultural agents (see, among others, Hill 1976; Miller 1970, 1975; Olsen and Shipman 1988; Shipman 1981; Shipman and Rose 1984; Stein 1973; Sutcliffe 1973; White and Hannus 1983).

Despite the important developments resulting from these types of studies on bone, the microwear analysis of bone tools has not developed similarly. The study of use-wear patterns on bone tools was also begun by Semenov (1981). However, contrary to what happened with lithic tools, this research has neither had so many followers, nor been so successful.

Many attempts to identify manufacture traces can be cited (see Biberson and Aguirre 1965; Bonnichsen and Will 1980; Bouvier 1979; Clark and Thompson 1953; Dauvois 1974; Poplin 1974; Rueda i Tones 1983; Stanford et al. 1981; Vincent 1985, among others), though few were focused at the microscopic level (for example, Campana 1987, 1989; Camps-Fabrer and D'Anna 1977; Newcomer 1974, 1977; Stordeur 1977).

Studies pursuing the identification of use-wear patterns at the macroscopic level (for example, Corchon 1981; Julien 1985; Voruz 1984) have been very few. With regard to those undertaken at the microscopic level (Campana 1987, 1989; D'Errico et al. 1984; Peltier 1986; Peltier and Plisson 1989; Stordeur and Anderson-Gerfaud 1985), either experimental controls were not rigorous or the samples were small. However, results were obtained that allowed the beginning of a field of study.

One of the problems that the functional analysis of bone tools poses relates to the possibilities of experimentation in archeology and, particularly, to replicative experimentation. Even though it is feasible to control a certain range of selected variables in a replicative experiment -- something that, in reality, has seldom been done -- it is necessary to admit that there is a series of variables which affect the experiment and which cannot be adequately controlled. In the performance of replicative experiments, the goal is, by following certain steps, to obtain a certain outcome. In the case of a systematic experiment, all variables are kept constant except one, which is the one being analyzed. When controlling every variable, the goal of replication is set aside. Thus, when working with replicative experiments, there is no choice other than to control those variables that are considered relevant and to accept the limitations of the experiment -- one might even wonder if it deserves such a name (see Borrero 1991; Olivera 1991). On the other hand, when working with systematic experiments, better control is pursued but relevance for the archeological record may be lost.

The second problem, as stated above, is that bone tools are heavily exposed to the action of natural agents that affect the archeological record. Thus, it is worth wondering if it is possible to differentiate, within the whole group of traces, the agents that could have caused them. Furthermore, it is highly probable that the same agent (natural or cultural) could produce a variety of traces that overlap and preclude their correct identification.

Replicative and systematic experiments constrained to just one type of tool and with a limited range of uses may help to overcome these difficulties. Of course, to the data obtained through these means would be added all of the information concerning taphonomic controls available for the area under study or in the literature. The preliminary results coming from such replicative experiment are presented below.

MATERIALS AND . METHODS

From the discussion above, it follows that it is possible to perform an experimental study that allows us to approach a limited functional interpretation of certain bone tools, though without expecting a high degree of resolution. The conditions of such an experiment are:

1) Being able to control a certain number of relevant variables. Relevance depends on the specific theoretical framework and on the hypothesis or hypotheses that will be tested. The general framework within which this work is placed was provided in Scheinsohn (1989, 1991a, 1991b) and Scheinsohn and Ferretti (1995).

2) Start with a limited hypothesis. The hypothesis should be generated from the ethnographic record (for more information on the validity of this procedure see Sabloff et al. 1987 and Salmon 1978).

3) Deal with a group of instruments with a morphology that would allow only limited uses. A pointed distal end, for instance, can have such a variety of uses that the traces found on it would be the result of the total number of functions performed by that instrument, making it impossible to set them apart from one another. It is desirable that the morphological group be present both in the archeological and the ethnographic record in order to test an ethnographically-generated hypothesis.

Based on the above statements, it was decided to perform this experimental work with the morphological group of beveled pieces made on guanaco bones. These are tools made on long bones or metapodials that have an unmodified proximal end, with a beveled distal end.

By choosing this morphological group, the utility of our results is optimized: the information about use-wear patterns or manufacture traces would allow the differentiation of certain tools from the rest of the archeofaunal record. In addition, by obtaining this type of information on guanaco bones, which are present in several archeological sites from Argentina, the results would be useful to other researchers.

On the basis of the ethnographic record (and, particularly, the statements of Bridges 1892:314; Lothrop 1928:65; and Spegazzini 1882:162), it was suggested that this type of guanaco bone tool was used for the extraction of small pieces of bark to make containers and other artifacts. To support the proposed usage, it was necessary to:

1) Prove that such a task could be performed efficiently by such an instrument. As Salmon remarks (1978:67), through experimentation it is possible to determine when a tool is suitable for performing certain functions; that can be a relevant factor when justifying a functional attribution, but it is not a necessary condition. However, if it is found that the tool is unsuitable for performing that function, the use hypothesis can be rejected. On the other hand, it is interesting, on the basis of the theoretical framework applied, to determine the minimum limits within which an instrument can perform a task, either in an optimal or a suboptimal fashion;

2) Verify which types of traces are left by this task, and determine the range of variability and whether these traces are found in the archeological tools.

3) Determine which types of traces are left by certain manufacture techniques and how they differ.

Replicative Experiment

Replication Of Experimental Specimens

Even though the aim of this work was to identify use-wear patterns, the necessary replication of the tools was useful for experimenting with several manufacture techniques. The blanks of this type of tool consist of the distal halves of metapodials (Scheinsohn 1991a; Scheinsohn and Ferretti 1995) obtained on the basis of some primary fracturing technique. This experiment allowed the exploration of which technique seemed most efficient for the creation of those blanks. However, for the formation of the beveled end, only one technique was used -- abrasion with fine-grained sand paper -- in order to easily identify the traces and differentiate them from those resulting from use. For each of the experimental pieces a data base was designed, and the working end of the tool was photographed before and after its utilization.

Utilization Of Experimental Specimens

Since the hypothesis involved the removal of bark pieces, it was decided to obtain, from each experimental task, bark fragments 30 cm x 15 cm and 50 cm x 15 cm in size. The extraction itself was considered as only one variable, and it was assumed that the differences in movements and manipulations between one episode and the other were not significant enough to affect the overall result nor the use-wear patterns on the tool. A test was also performed in which the experimental piece was put in contact with the worked material in a systematic fashion, namely, rubbing the piece against it with a back-and-forth motion for a certain span of time.

The ethnographic references consulted state that spring would be the best time of the year for the extraction of bark for canoes (Bridges 1953:33; Gusinde 1986:427; Martial 1888:203), and that the bark of *Nothofagus betuloides* was preferred (T. Bridges 1892:318; R. Bridges 1953:33; Gusinde 1986:424). It was for those reasons that the spring season (November and December 1991) and a particular type of bark were chosen to perform the experiment.

Each experimental tool was used only once, that is, it was utilized until the piece of bark was finally removed from the tree. In this way it would be possible to discriminate the traces left after each episode instead of finding an overlap from several utilizations.

Following the procedure described in the literature, the bark was first scored. This task was performed with cetacean bone wedges. The effects of the latter activity have not yet been analyzed. Then, we proceeded to separate the bark from the trunk with the beveled pieces made on guanaco bone. The beveled end was inserted in the groove and the bark of the tree was removed with a lever movement. Once the upper part of the bark was separated from the tree trunk, the task was completed by pulling off the remaining part with the hands. This task was repeated in six cases.

RESULTS

For analyzing the use traces that could have formed on the experimental specimens, different observational scales were used, from inspection with the naked eye and the stereoscopic microscope, to the optical reflection microscope.

Use-wear Patterns

- Experimental Specimen 6. This piece was used in an auxiliary manner, not for doing the main lever work, but for holding the bark while it was being removed by hand. Analysis indicates that only the striations left by the process of forming the beveled end were found.

- Experimental Specimen 15. This tool was used for removing a portion of bark following the normal procedure. The dorsal face in Figure 2 (after its use) shows a slight polish that obliterated the manufacture traces, when compared to Figure 1 (before its use).

- Experimental Specimen 16. This piece was used for removing bark and shows no use traces.

- Experimental Specimen 17. This piece was used as a lever in the extraction of bark. No use traces were found in this case either.

- Experimental Specimen 18. This piece was used as a lever in the extraction of bark. When comparing Figures 3 (before the use) and 4 (after the use), only a very slight rounding on the right side of the ventral face can be observed.

- Experimental Specimen 19. This piece was used as a lever. Only a rounding of the edges on the ventral and dorsal faces can be observed (see Figures 5 and 6 of the ventral face).

Use-Wear Patterns In A Systematic **Experimental** Work

- Experimental Specimen 5. This piece was used in a fashion similar to that of a carpenter's plane, to remove the bark of a branch from a humid beech. This task took about 10 minutes. As a consequence of this use, an intensive rounding of the edge of the piece can be noted.

DISCUSSION

The results obtained from the experimental pieces were then compared with the traces found in the archeological specimens. For that purpose, the beveled specimens made on guanaco bones from site Tunel 1 were considered (n=6). In general, the most conspicuous traces found on these pieces can be attributed to the action of roots and other post-depositional processes. In some of these specimens, some chipping along the edge was noted. However, according to what could be established from the experimental series, the chipping could have been caused by the manufacture of, rather than by the use of, the tool. We also found striations that could be attributed to the manufacture of the tool. These findings are similar to those of our experimental series.

In short, we can say that few use-wear patterns can be observed in the experimental pieces. These patterns can be classified as:

1) slight rounding of the edges or polishing of prominent parts - this was the most conspicuous trace and also occurred in the systematic experiment;

2) breaking of the beveled end (recorded in only one case); and

3) increase in the size of the microchippings (in one case).

However, it must be kept in mind that each tool was used only once and that the sample of instruments was small. It is possible that if the number of uses and the sample were increased, the frequencies of the traces would increase as well.

In any case, the experimental findings are consistent with the results obtained for the archeological specimens. In the latter pieces, the most frequent traces are post-depositional; if the use-wear traces present in these specimens are as light as the ones recorded experimentally, it is highly probable that they have been obscured by the action of natural processes.

However, manufacture traces are predominant, both in the experimental and in the archeological specimens. These traces consist of:

1) striations (left by the abrasive materials employed in the formation of the beveled end);

2) chattermarks (see Newcomer 1974);

3) facets (observable with the naked eye and caused by the action of cutting elements which have scraped or flaked the bone surface); and

4) microchippings, which in the case of the archeological materials seem to be larger. These could be interpreted either as manufacture or as use-wear traces, and even as traces caused by natural agents.

In the case of the experimental pieces, the striations, as well as the facets, seem to account for most of the traces present. Many of these traces am also found in the archeological pieces in spite of the action of post-depositional factors.

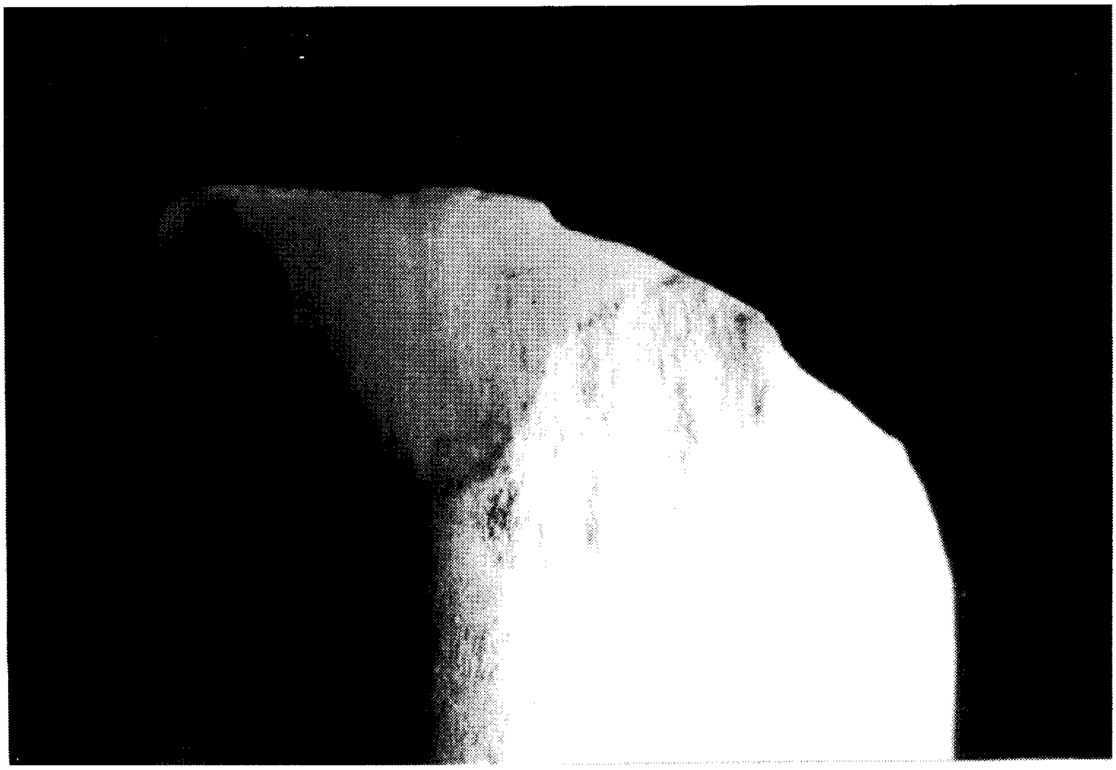

Figure 1. Experimental specimen 15. Dorsal view, 8X, before use.

Figure 2. Experimental specimen 15. Dorsal view, 8X, after use. Notice the polishing at the beveled edge.

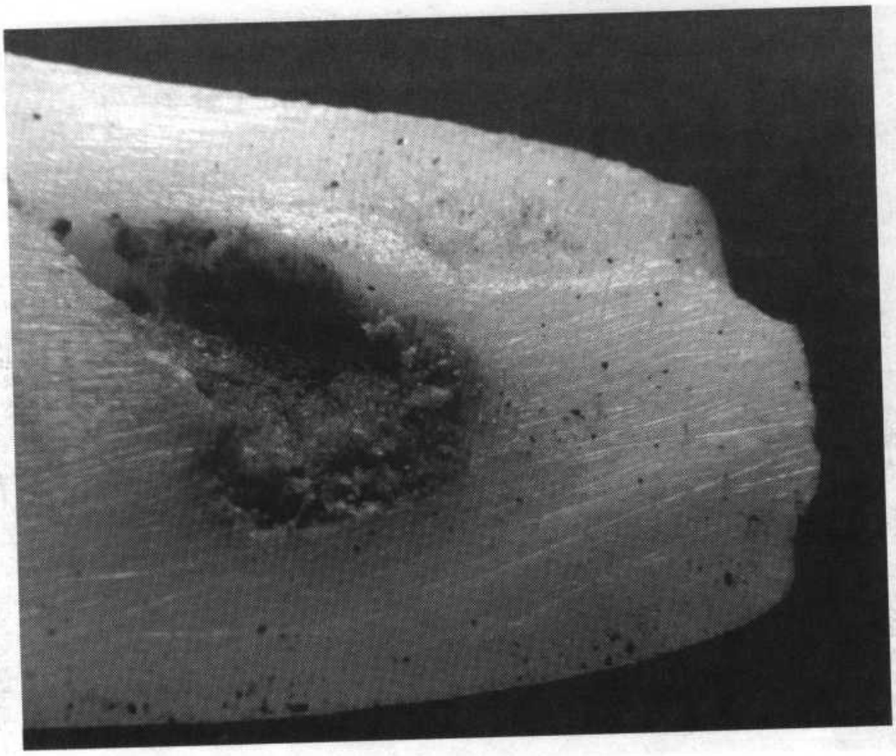

Figure 3. Experimental specimen 18. Dorsal view, 8X, before use.

Figure 4. Experimental specimen 18. Dorsal view, 8X, after use. Notice the polishing at the beveled edge.

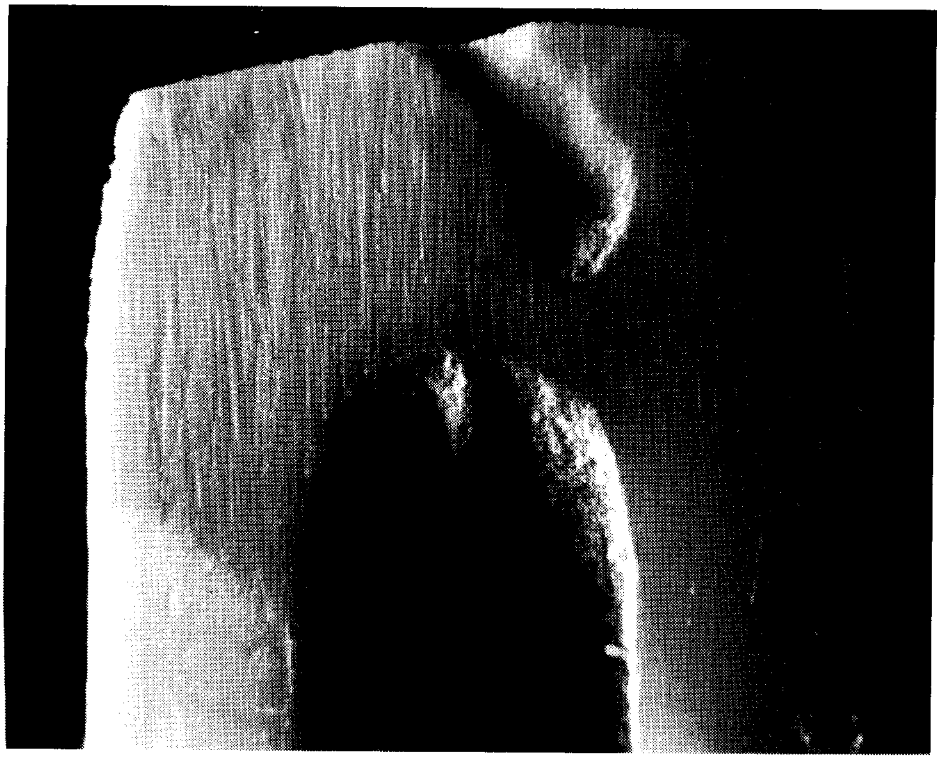

Figure 5. Experimental specimen 19. Dorsal view, 8X, before use.

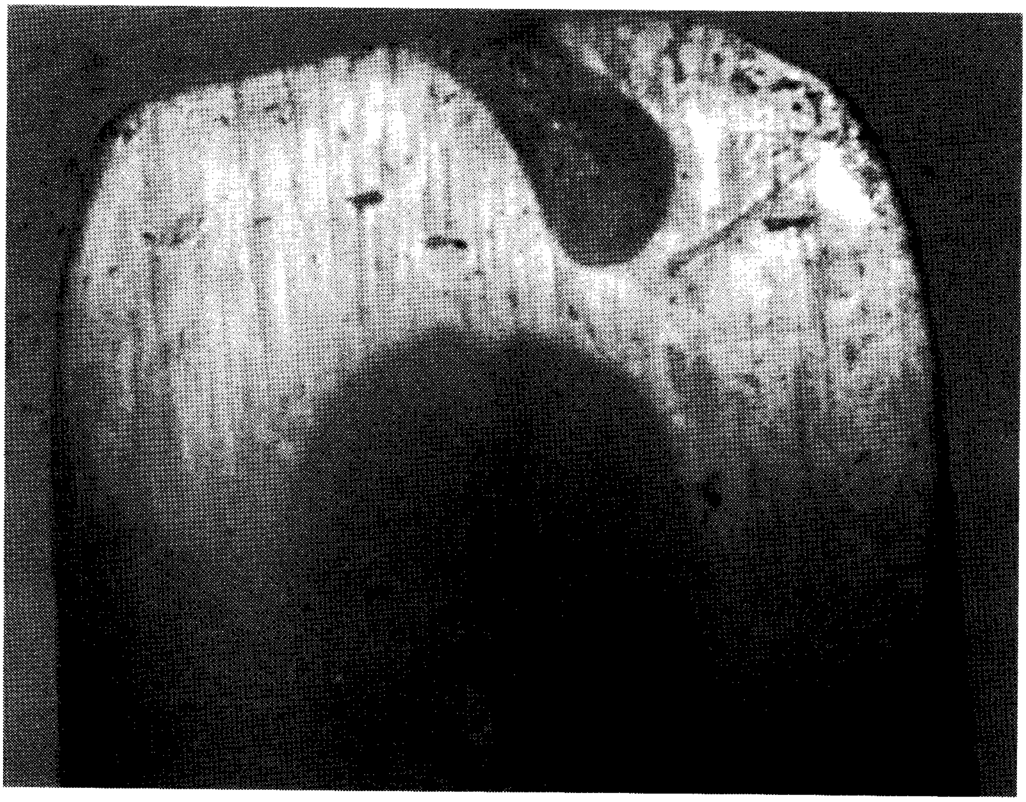

Figure 6. Experimental specimen 19. Dorsal view, 8X, after use. Notice the polishing at the beveled edge.

Tool Efficiency

With regard to tool efficiency, the following conclusions are offered:

1) The beveled pieces made on guanaco bones are generally effective for this type of task. However, a greater degree of effectiveness was noted in the longer pieces which allow better lever work (e.g., specimens 17, 18 and 19) and easier removal of the bark.

2) Data obtained from a different source (Scheinsohn and Ferretti 1995) also allow us to affirm that the metapodial from guanaco would be one of the most suitable bones to perform this type of work due to the high moment of inertia of its cross-section, a relevant factor when working with a lever.

3) The natural crests of the metapodial should be removed in order to facilitate its insertion between the trunk and the bark, and to allow greater efficiency.

4) A greater efficiency in the task was also found when working with a sharp beveled end or with metapodials from which half of the shaft was removed longitudinally, thereby reducing the tool's thickness.

CONCLUSIONS

The experimental work does not allow us to state that the archeological pieces of similar morphology have performed the task which was considered in the hypothesis. The slightness and scarcity of microwear traces in the experimental pieces, and the predominance of traces caused by natural agents in the archeological specimens, prevent the testing of this hypothesis. However, the data do not demand its rejection either and, given the effectiveness of the morphological group used in this task, we can state that it must have been one of the possible uses. Only an increase in the experimental sample size and frequency of utilization will allow the definite rejection or acceptance of such a hypothesis.

The most clearly identifiable traces are associated with manufacture. The techniques applied to the experimental pieces resulted in traces that are closely comparable to those found in the archeological specimens. This result is important because it allows us to distinguish the artifacts from those bones affected by the action of natural agents. Among the traces produced by manufacture, striations allow the best identification of human action. Their frequency, size of grain, etc. are coincident both in the experimental case and in the archeological one. In any event, it might be worthwhile to begin some sort of experimentation which allows us to identify possible natural abrasive agents which are acting on the bones so as to cause similar striations.

Microchippings are unclear with respect to their origins. Even though they have been experimentally obtained through use and manufacture, they could also have been caused by the action of natural agents.

Thus, some manufacture and use traces could be identified as an initial approach. However, as stated above, the experimental sample is small. It still needs to be broadened, increasing the number of uses performed by each experimental tool together with the number of experimental tools, and also by developing systematic experiments in order to achieve a better control of the appearance of traces detected so far.

Acknowledgments

I am grateful to the Museo del Fin del Mundo (Ushuaia, Tierra del Fuego) for the support provided and also to the Institute Forestal Nacional -IFONA- (Tierra del Fuego), for their advertisement during the development of this work.

I wish to acknowledge M. E. Mansur and D. Stordeur for their advice. I also appreciate the careful reading of the manuscript done by C. Bellelli and the translation done by D. Elkin.

Finally, I am grateful to the Consejo Nacional dv Investigaciones Cientfficas y Tdcnicas -COMCET- and Total Austral S.A. for the support provided to the research.

The author acknowledges full responsibility for the concepts expressed herein.

REFERENCES CITED

Anderson-Gerfaud, P.
1981 *Contribution methologique a l'analyse des microt races d'utilisations sur les outils prehistoriques.* Unpublished Ph.D. dissertation, Universite de Bordeaux.

Ascher, R.
1961 Experimental Archeology. *American Anthropologist 63(4):793-816.*

Biberson, P., and E. Aguirre
1965 Experiences de faille d'outils prehistoriques daps des os d'elephant. *Quaternaries VIII: 165-183.*

Bonnichsen, R., and R. Will
1980 Cultural Modification of Bone: The Experimental Approach in Faunal Analysis. In *Mammalian Osteology,* edited by B. Miles Gilbert, pp. *7-30.* B. Miles Gilbert, Laramie, Wyoming.

Borrero, L.
1991 Experimentos y escalas arqueologicas. *Shincal 3(1):l42-145.*

Bouvier, J. M.
1979 Le mystere des fendeurs de phalanges ou contribution a la connaissance du travail d l'os au Magdalen'ien IV. *Bulletin de la Societe Prehistorique Franpaise 76(4):105-109.*

Bridges, R.
1953 Las canoas yaghanes y un pequeno recuerdo al artesano indigena. *Anales del Museo Nahuel Huapi 111:33-36.*

Bridges, T.
1892 Datos sobre Tierra del Fuego comunicados por el Reverendo Thomas Bridges. *Revista del Museo de La Plates 3:313-320.*

Campana, D.
1987 The Manufacture of Bone Tools in the Zagros and the Levant. *Masco Journal 4(3).*

1989 *Natufcan and Protoneolithic Bone Tools: The Manufacture and Use of Bone Implements in the Zagros and the Levant.* British Archaeological Research, International Series *494.* Oxford.

Camps-Fabrer, H., and A. D'Anna
1977 Fabrication experimentale d'outils a partir ± metapodes de mouton et de tibias de lapin. *Deuxieme Colloque International sur l'Industrie de 1'os clans Ia Prehistoire, Methodologie appliquee a L'industrie de l'os prehistorique:311-326.* Editions du CNRS.

Clark, J. G. D., and M. Thompson
1953 The Groove and Splinter Technique of Working Antler in Upper Palaeolithic and Mesolithic Europe with Special Reference to the Material from Star Carr. *Proceedings of Prehistoric Society 19:148-160.*

Corchon, M. S.
1981 El 'tensor': un nuevo tipo de hueso utilizado en el Solutrense y Magdaleniense asturianos. ***Zephyrus XXXII-XXXIH:75-86.***

Dauvois, M.
1974 Industrie osseuse prehistorique et experimentations. *Premier Colloque International sur l'Industrie de l'os daps la Prehistoire:73-83.* Editions de la Universite de Provence.

D'Errico, F., G. Giacobini, and P. F. Puech
1984 Les repliques en vernis des surfaces osseuses faconnees: etude experimentale. *Bulletin ck la Societe Prehistorique Franpaise 81:169-170.*

Gusinde, M.
1986 *Los indios de Tierra del Fuego.* Los Yamana, CAEA.

Hill, A. P.
1976 On Carnivore and Weathering Damage of Bone. *Current Anthropology 17(2):335-336.*

Julien, M.
1985 El instrumental oseo. In *Telarmachay, chasseurs et pasteurs prehistoriques des Andes I,* edited by D. Lavallee, pp. *215-235.* Editions Recherche sur les Civilisations. Paris.

Keeley, L.
1976 Microwear on Flint: Some Experimental Results. Second International Symposium on Flint. *Staringia 3:49-51.*

Lothrop, S.
1928 *The Indians of Tierra del Fuego.* Museum of the American Indian. Heye Foundation, New York.

Martial, L. F.
1888 *Mission Scientifique du Cap Horn (1882-1883), I,* edited by Gauthier-Villars, pp. *1184-215.*

Miller, G.
1970 A Study of Cuts, Grooves and Other Marks on Recent Fossil Bone I: Animal Tooth Marks. *Tebiwa 12(1):20-26.*

1975 A Study of Cuts, Grooves and Other Marks on Recent Fossil Bone II: Weathering Cracks, Fractures, Splinters and Other Similar Natural Phenomena. In *Lithic Technology: Making and Using Stone Tools,* edited by E. Swanson, pp. *211-226.* Aldine, Chicago.

Newcomer, M.
1974 Study and Replication of Bone Tools from Ksar Akil (Lebanon). *World Archaeology 2:138-153.*

1977 Experiments in Upper Paleolithic Bone Work. *Deuxieme Colloque International sur l'Industrie de l'os daps la Prehistoire, Methodologie appliquee a L'industrie de l'os prehistorique:293-302.* Editions du CNRS.

Odell, G., and F. Odell-Vereecken
1980 Verifying Reliability of Lithic Use-wear Assessments by 'Blind Tests': The Low-Power Approach. *Journal of Field Archaeology 7:87-120.*

Olivera, D.
1991 Arqueologia empirica o arqueologia experimental? *Shincal 3(1):169-184.*

Olsen, S., and P. Shipman
1988 Surface Modification on Bone: Trampling versus Butchery. *Journal of Archaeological Science 15:535-553.*

Peltier, A.
1986 Etude experimentale den surfaces osseuses faconees et utilisees. *Bulletin de la Societe Prehistorique Franpaise 83(1):5-7.*

Peltier, A., and H. Plisson
1989 Micro-traceologie fonctionnelle sur 1'os. Quelques resultats experimentaux. *Artefacts 3:69-79.*

Poplin, F.
1974 Principes de la determination den matieres dunes animales. *Premier Colloque International sur l'Industrie de l'os daps la Prehistoire:l5-20.* Editions de la Universite de Provence.

Rueda i Tones, J.
1983 *Estudi tecnologic de la industries ossia prehistdrica a les coma rques gironines (Reclau Viver de Serinya, Bores gran d'en carreres a Serinya, Encantades de Mortis a Esponella).* Licenciature Dissertation, Univ. Autonoma de Barcelona.

Sabloff, J., L. Binford, and P. MacAnany
1987 Understanding the Archaeological Record. *Antiquity 61:203-209.*

Salmon, M.
1978 *Philosophy and Archaeology.* Academic Press, New York.

Scheinsohn, V.
1989 Ms. *Estudio de criterion descriptivos y clasificatorios porn el instrumental oseo aplicados a materiales de Tierra de Fuego.* Informe al CONICET, Buenos Aires.

1991 El aprovechamiento de less materias primas oseos en la costs meridional de la Isles Grande de Tierra del Fuego (Argentina): Tunel I y Babies Valentin. *Archidiskodon,* Madrid, in press.

1991 Ms. *Andlisis funcional de artefactos oseos de Tierra del Fuego Y Patagonia* Ms., Primer informe de beca de perfeccionamiento al CONICET, Buenos Aires.

1993 El sistema de production de los instrumentos oseos y el momento del contacto: un puente sobre aguas turbulentas. *Relaciones XVIII:121-138.*

Scheinsohn, V., A. Di Baja, M. Lanza, and L. Tramaglino
1993 El aprovechamiento de la avifauna como fuente de materia prima oseo en la Isles Grande de Tierra del Fuego: Lancha Packewaia, Shamakush I y Tunel I. *Arqueologia,* Revista de la Section Prehistoric, I.C.A., Universidad de Buenos Aires.

Scheinsohn, V., and J. L. Fenetti
1995 Mechanical Properties of Bone Materials as Related to Design and Function of Prehistoric Tools from Tierra del Fuego (Argentina). *Journal of Archaeological Science 22:711-717.*

Semenov, S.
1981 *Tecnologia prehistorica.* Akal Universidad. Translated from first (1964) English edition, Prehistoric Technology. An Experimental Study of the Oldest Tools and Artefacts from Traces of Manufacture and Wear. Translated from the Russian by M. W. Thompson. Barns and Noble, New York.

Shipman, P.
1981 Applications of Scanning Electron Microscopy to Taphonomic Problems. *Annals of the New York Academy of Sciences 376:357-386.*

Shipman, P., and J. Rose
1984 Cutmark Mimics on Modern and Fossil Bovid Bones. *Current Anthropology 25(1):116-117.*

Spegazzini, C.
1882 Costumbres de los habitantes de la Tierra dal Fuego. *Anaees de la Sociedad Cientifica Argentina XIV:159-181.*

Stanford, D., R. Bonnichsen, and R. Morlan
1981 The Ginsberg Experiment: Modern and Prehistoric Evidence of a Bone-flaking Technology. *Science 212:418-420.*

Stein, J.
1973 Earthworm Activity: A Source of Potential Disturbance of Archaeological Sediments. *American Antiquity 48(2):277-289.*

Stordeur, D.
1977 Classification multiple ou grilles mobiles de classification des objets en os. *Deuxieme Colloque International sur l'Industrie de l'os dons la Prehistoire, Methodologie appliquee a L'industrie de l'os prehistorique:235-238.* Editions du CNRS.

Stordeur, D., and P. Anderson-Gerfaud
1985 Les omoplates encochees neolithiques de Ganj Dareh (Iran). Etude morphologique et fonctionelle. *Cahiers de l'Euphrate 4:289-313.*

Sutcliffe, A.
1973 Similarity of Bones and Antlers Gnawed by Deer to Human Artefacts. *Nature 246:428-430.*

Tringham, R., G. Cooper, G. Odell, B. Voytek, and A. Whitman
1974 Experimentation in the Formation of Edge Damage: A New Approach to Lithic Analysis. *Journal of Field Archaeology 1:171-196.*

Vincent, A.
1985 Preliminaires experimentaux du fagonnage dr 1'os par percussion directe. *Artefacts 1, Outillage peu elabore en os et bois de cervides:23-32.* Editions du Centre d'Etudes et de Documentation Archeologiques CEDARC. Treignes, Belgium.

Voruz, J. L.
1984 *Outillage osseux et dynamisme industrial daps le Neolithique Jurassien.* Ph.D. dissertation, Un. de Toulouse, Toulouse, M.S.

White, E., and L. A. Hannus
1983 Chemical Weathering of Bone in Archaeological Soils. *American Antiquity 48(2):316-322.*