PRIMATES, 15(4): 351–364, December 1974

An Elementary Industry of the Chimpanzees in the Okorobikó Mountains, Rio Muni (Republic of Equatorial Guinea), West Africa

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ABSTRACT. Sticks are described which have been shaped and used by chimpanzees of the subspecies *Pan troglodytes troglodytes* in the mountainous region of Okorobikó in central Rio Muni (West Africa). References are also made to the utilization of these sticks for the obtaining of termites of the species *Macrotermes mülleri* and *Macrotermes sjöstedt*. It is indicated that in Rio Muni this elemental industry is known only to some of the groups of these pongids, inhabiting moreover areas relatively close to each other. Also presented is a new map indicating in summary manner the distribution of the principal elemental industries known to chimpanzees in the wild.

INTRODUCTION

In view of the fact that the manufacture and use of tools have been very important factors in human evolution, anthropologists and psychologists at the beginning of the present century began to study this problem in the higher primates. Of course, it is not only primates which know how to use natural objects as tools. VAN LAWICK-GOODALL (1970) refers to other species of mammals and birds able to use natural objects in a number of their activities.

The first work referring to this usage was carried out with apes in captivity; KÖHLER (1915, 1925) for many years studied the intelligent behaviour of chimpanzees and their ability to use simple tools. KHROUSTOV (1964) investigated the intellectual capacity of these apes in making tools. As far as concerns these aptitudes in chimpanzees living in a state of nature, work was not carried out until later, due to the great difficulty of observing primates in their natural habitats.

GOODALL (1964), VAN LAWICK-GOODALL (1970), KORTLANDT (1962, 1964), KORTLANDT and KOOIJ, (1963), IZAWA and ITANI (1966), JONES and SABATER PÍ (1969), STRUHSAKER and HUNKELER (1971), and RAHM (1971) have published works describing these tools and making reference to the use made of them by chimpanzees; whether as weapons, in food getting, for personal toilet use or in fetching and drinking water (see Fig. 1).

KORTLANDT and VAN ZON (1969) maintain, in speculative theory, that hominids of African origin inhabited, towards the end of the Pliocene and at the beginning of the Pleistocene, open biotopes bordering on the present savannahs of Africa stretching from the south of the Sahara to East Africa. These habitats permitted a protoculture

which possibly was related to that of the early apes which exploited the same ecological niche. These animals, according to the authors, were more in the human line than the present chimpanzees. When the hominides invented throwing weapons (spear) which permitted effective aggression at a distance, in open ground, the early apes had to take refuge in dense forests, a habitat which is not favorable to cultural development. In consequence, a large part of the cultural baggage which they had acquired was lost. Still, according to the authors, they retained considerable potential faculties which may be manifested in certain circumstances. The use and manufacture of simple weapons would be one of these.

According to ROBINSON (1963) among those factors which contributed to humanization, the use and manufacture of tools figure in an outstanding way. So also does the

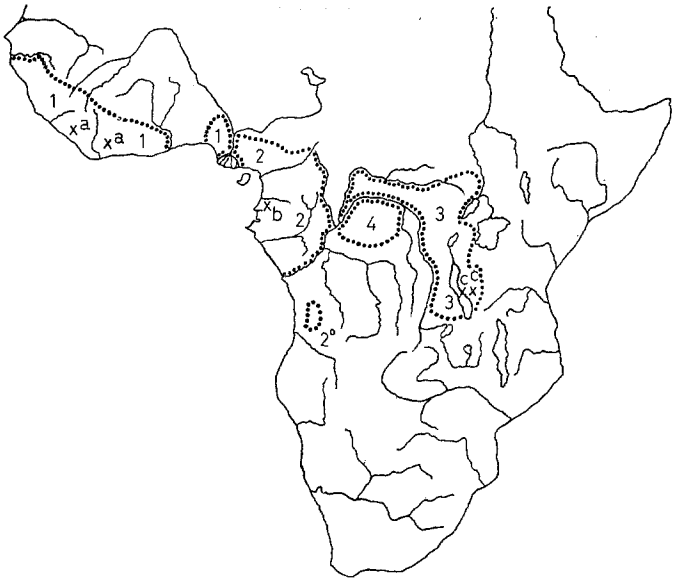

Fig. 1. Map of Africa showing geographical location of the most significant behaviors observed in chimpanzees in the wild up to the present. Chimpanzee distribution follows the map laid out by OSMAN HILL (1969) and the behavior referred to is the use of natural objects as tools.

(a) Use of stones and sticks to crush fruits. (STRUHSAKER & HUNKELER, 1971; RAHM, 1971; BEATTY, 1951). (b) Use of sticks, fairly similar in size, for the perforation and breaking down termite mounds as well as for the making of small holes. It is possible that the manipulation called "fishing for termites" is present although it has not been observed. (JONES & SABATER PÍ, 1969; SABATER PÍ, present article). (c) Use of stripped branchlets and fine branches to reach termites by the method known as "fishing for termites"; use of thicker branches, similar to those described in (b) to reach termites and ants; use of chewed leaves, in the manner of a sponge, to obtain water; use of leaves in personal hygine (GOODALL, 1964; SUZUKI, 1966). The use of unretouched sticks in threatening activities appears common to all chimpanzee populations.

(1) Area of distribution of the sub-species, *Pan troglodytes verus;* (2) Area of distribution of the sub-species, *Pan troglodytes troglodytes;* (2°) "Former extension of range" of sub-species, *Pan troglodytes troglodytes;* (3) Area of distribution of the sub-species, *Pan troglodytes schweinfurthi;* (4) Area of distribution of the species, *Pan paniscus.*

inclusion of meat in the diet, as the chase obliges to activity of a cooperative type which generates more complex social structures, see TELEKI (1973). Both capacities are to be found in several populations of chimpanzees of the sub-species *Pan troglodytes schweinfurthi,* of East Africa, especially the groups living in open savannahs. These have been studied by GOODALL (1963), KAWABE (1966), SUZUKI (1969), and others. Other populations of the same sub-species, which live in the Budongo forest in Uganda, studied by REYNOLDS and REYNOLDS (1965) do not show any of these abilities.

In respect to the sub-species *Pan troglodytes troglodytes* which live in the Cameroons, Gabon, Equatorial Guinea, Congo and Eastern Zaire, the only reference to this activity is the work published some years ago by JONES and SABATER PI (1969).

MATERIAL AND METHODS

During the program dedicated to the study of lowland gorillas (*Gorilla gorilla gorilla*) in the natural state, completed in Rio Muni from July 1966 to February 1969,

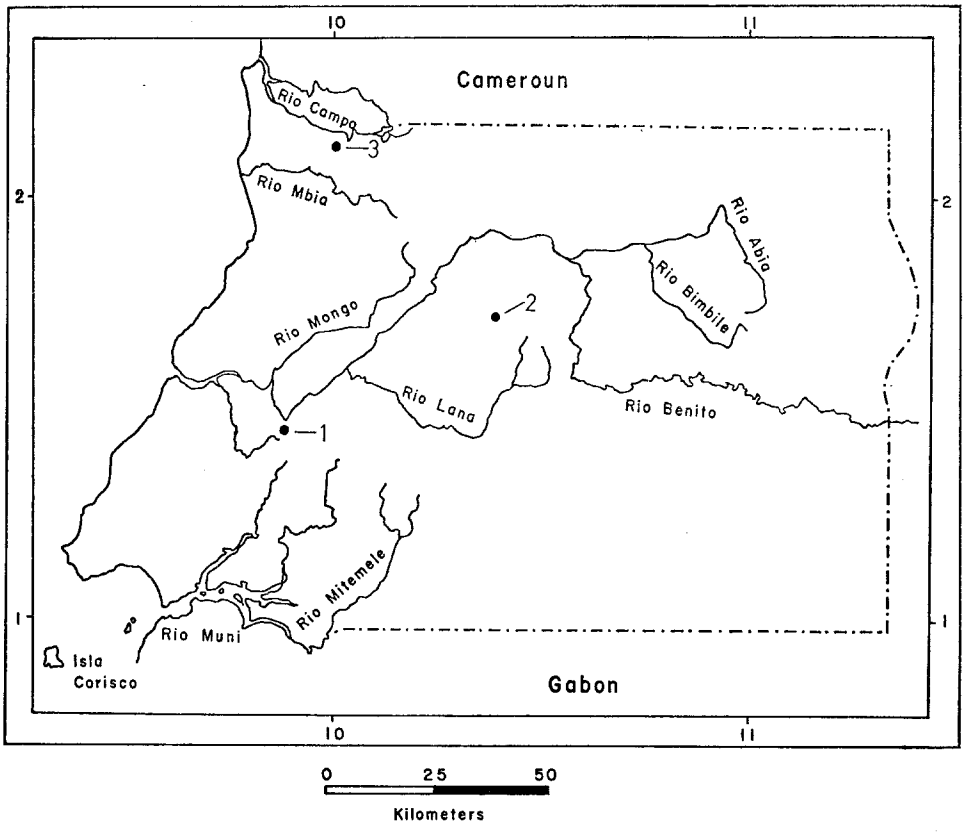

Fig. 2. Map of the province of Rio Muni in the present Republic of Equatorial Guinea. The areas where chimpanzees have been studied are enumerated in this map: (1) Okorobikó mountains; (2) Mount Alen; (3) the Ayamiken region.

we also obtained 39 contacts with chimpanzees (*Pan troglodytes troglodytes*). These contacts totalled 26 hours of direct visual observation and 41 hours of auditory contact. We dedicated ourselves to the study of chimpanzee tracks, nests and tools and habitat during a further 310 hours.

This program was supported by the Delta Regional Primate Research Center of Tulane University, the National Geographic Society, and the Barcelona Zoological Park.

ECONICHE

The observations referred to were carried out in the Okorobikó and one in Mount Alen mountains (Fig. 2). The first of these zones has an area of approximately 15 square kilometers and consists of a series of elevations of a metamorphic and intrusive geological texture (granite, gneiss) of an average height of no more than 500 meters. As far as vegetation is concerned, these mountains are covered by a dense equatorial forest of three strata in level areas with little slope. The vegetation most representative of these biotopes are the following in respect to species of trees: *Pycnanthus angolensis, Antrocaryon klaineanum, Brachistegia mildbraedi, Pachylobus buttneri, Sarcocephalus trillesi,* etc. As far as the undergrowth is concerned, one would indicate the presence of *Sarcophrynium velutinum, Trachyphrinium violaceum, Costus* sp., and *Podococus* sp. as the dominant herbaceous species.

The Okorobikó region possesses optimal conditions for these animals as it is well removed from inhabited zones and, in the most fruitful periods of the forest (November to March), includes a population of chimpanzees of more than 100 animals.

The Mount Alen region, which is much more densely populated by man, has an area of 35 square kilometers (see Fig. 2). It is crossed, longitudinally, by the road between Bata and Akurenam. From North to South it is cut by two parallel mountainous systems, whose peak, Mount Alen, reaches a height of 800 meters. The elevated zones are covered by dense forest with characteristics very similar to those described as typical of the Okorobikó mountains. However, we find in this region abundant formations of *Terminalia* sp. The lower zones, near the villages and the itinerant farms consist of typical (agrological) forests, with a predominance of the species: *Musanga cecropioides, Vernonia conferta, Trema* sp., *Aframomum giganteum, Aframomum danielli, Costus* sp., etc.

In respect to the fauna which exploit these ecological niches, there is a complete study of these in the work of JONES and SABATER PI (1971). The forest elephant (*Loxodonta africana*), the red buffalo (*Syncerus nanus*), the forest pig (*Potamochoerus porcus*), the coastal gorilla (*Gorilla gorilla gorilla*), the mandril (*Mandrillus sphinx*), the black colobus monkey (*Colobus satanas*) and three species of guenons, *Cercopithecus cephus, C. nictitans,* and *C. pogonias* are the most representative.

The climatology of these two areas is also described in the above-mentioned work.

CIRCUMSTANCES OF THE DISCOVERIES

During the studies carried out in the Okorobiko region we were surprised to find, either fixed in or loose by anthills of the species *Macrotermes muelleri* (Sjöstedt) and *Macrotermes lilljeborgi* (Sjöstedt) [the classification of these termites was carried out

Fig. 3. An aspect of the dense jungle covering the Okorobikó mountains. In this photograph the density of the forest is obvious as well as the vegetation which made it impossible to make effective observations at a distance of more than 10 meters at surface.

by Drs. ERNST and HARRIS respectively, of the Institut Tropical Suisse and of the British Museum (Natural History)], sticks of fairly uniform characteristics and size. The lack of antecedents in the region and the impossibility of observing these apes manipulating these tools made us doubtful of their origin. But we were soon able to relate them unequivocally to these primates.

In an early work, JONES and SABATER PI (1969) studied 157 of these sticks found between June 1967 and May 1968, especially in this region, and also in that of Ayamiken (see Fig. 2). The fact that we were never able to observe, during this period, the use and manufacture of these simple tools by the chimpanzees is not surprising, as observation at the surface of the forest at distances of over 10 meters is extraordinarily difficult (Fig. 3). Also in regions with inadequate husbandry, the indigenes suffer from a lack of animal proteins and, in consequence, all wild animals become potential foodstuffs, and are hunted intensely, see SABATER PI and GROVES (1972) and STRUHSAKER (1972). Due to this the relationship established between men and chimpanzee is that of predator and prey.

This work is limited to the last eight contacts established with chimpanzees during the program referred to. All were made in the Okorobiko region from August 29, 1968 to February 20, 1969, and therefore after those contacts which were the motive for the work which we published in 1969. These latter eight contacts total 6.11 hours of direct observation of the animals. During this time we were able to contemplate, on two occasions, the employment of the tools referred to. And we succeeded in obtaining the 46 sticks described below.

The 157 sticks which were the subject of the monograph quoted are to be found, in part, in the Zoological Department of the University of Tulane. Some of the 46 sticks which are the subject of this study were lost during the evacuation of Rio Muni consequent to the independence of this territory, which has adopted the name of the

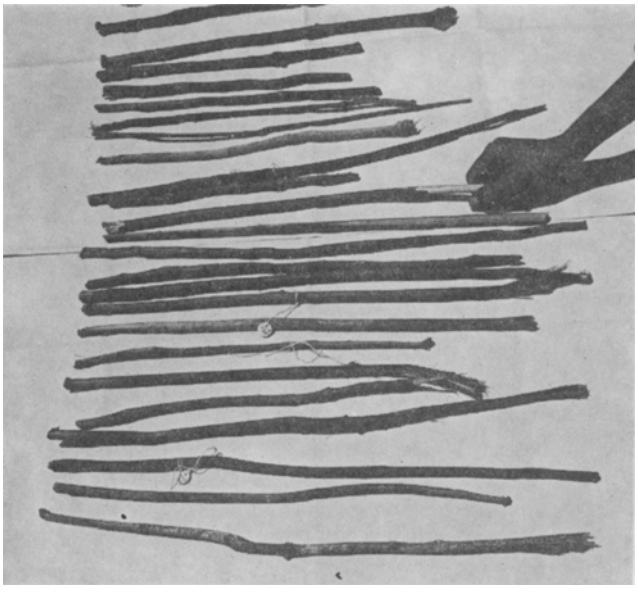

Fig. 4. Detail of some of the sticks described in this article.

Republic of Equatorial Guinea. Fortunately, their description figures in our field notes, which we were able to save. The remainder of the sticks will be found deposited in the Primates Department of the Zoological Gardens in Barcelona.

A DESCRIPTION OF THE STICKS

The sticks which are the object of this study are between 27 and 65 cms long (Figs. 4 & 5). Twenty of them measure between 49 and 57 cms. Those described in the earlier work, JONES and SABATER PI (1969) varied between 19.5 cms and 87 cms. Their diameter varied between 1 and 15 mms most being between 7 and 12 mms (Fig. 6); those described in our earlier work varied between 5 and 15 mms. GOODALL (1964) indicated that these employed by the chimpanzees of the Gombe Stream (Tanzania) in order to reach termites had a length of between 6 and 12 inches.

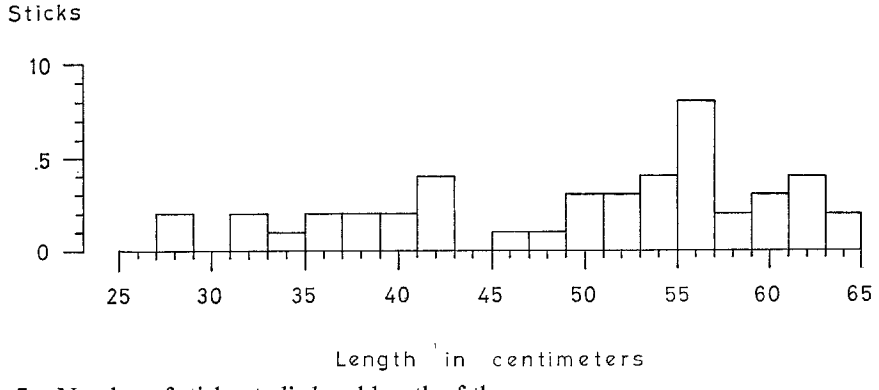

Fig. 5. Number of sticks studied and length of them.

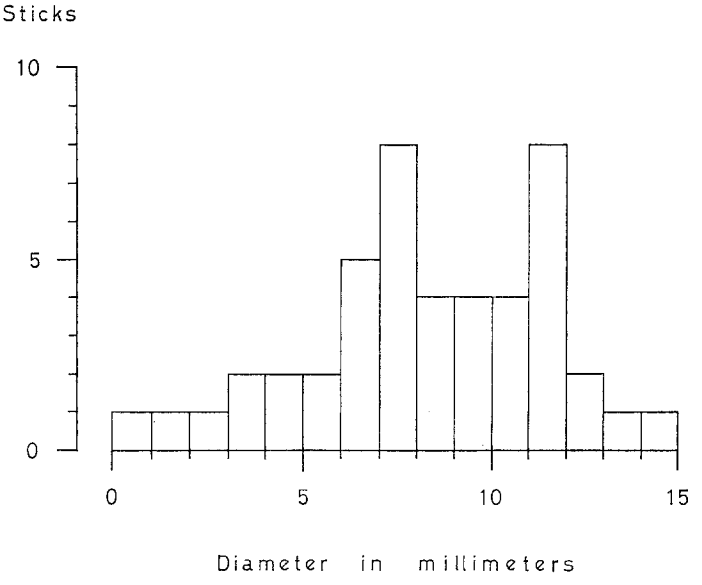

Fig. 6. Number of sticks studied and diameters of them.

It has been very difficult to identify the vegetal species chosen by these animals for the manufacture of these sticks. Three of them were made of *Pycnanthus angolensis,* one of *Erythrophloeum guineensis,* one of *Poga oleosa,* and one of *Fagara sp.* Twenty-four of the sticks are completely straight, 15 show a slight bending and only seven are irregular and twisted (Fig. 7). Practically all the sticks are rigid, and only three of them, those of smaller diameter, present a slight flexibility.

Figure 8 indicates, in an approximate way, by reference to the marks and signs seen on the sticks at the moment of their discovery, how they were cut. Nine of them have been cut only at one end, obviously because they are branches of a relatively slight thickness. The remainder (37) have been, cut at both ends. Of these, 14 have been cut with the teeth at the ends (the teeth marks were very clear). Ten have been broken with the hands at both ends, probably by means of a slight backwards and forwards movement, or by rotation. Six were cut at one end with the teeth and at the other with the hands and teeth perhaps, and seven were broken off by means of a pronounced twisting movement at one end and at the other end with the teeth. The nine cut at one end only have been removed by means of a pronounced backwards and forwards movement, and possibly by rotation.

Also as regards finishing touches, 10 of the sticks presented, at the moment of their discovery, the marks of recently torn-off leaf-stems, which clearly indicates that these apes prepare the sticks by tearing off the leaves before use. GOODALL (1964) refers also to sticks stripped free of leaves destined for the collection of termites.

Twenty-four of these sticks presented evident signs of having been used at both ends, and some with earth marks more than 30 cms high. In our work previously mentioned, we found earth marks up to 50 per cent of the total length.

I have tried to summarize by means of a diagram (Fig. 9) the average distance be-

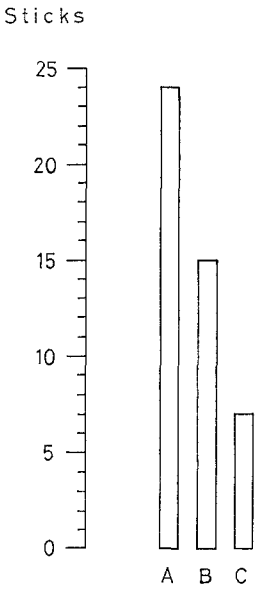

Fig. 7. Classification of sticks studied by types: (A) completely straight; (B) slightly crooked; (C) very bent.

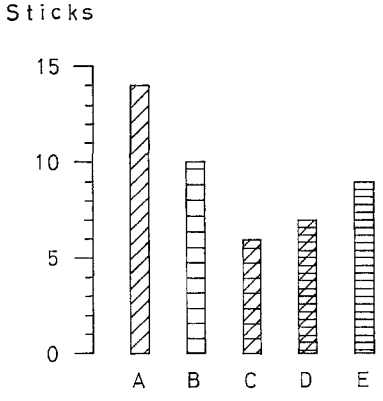

Fig. 8. Distribution of sticks as to the approximate manner in which they have been out: (A) both ends cut with the teeth; (B) both ends cut possibly by means of a slight twisting movement; (C) one end cut with the teeth and the other with the hands with the assistance of the teeth; (D) one end cut with the hands, but with considerable force, producing the splitting of the stick with many long shreds, the other end with the teeth only; (E) cut at only one end by a rotary movement which has not produced shreds.

tween the place where the stick was found and its presumed source. The distance varies between 1 and 24 meters. GOODALL (1964) refers to sticks cut at distances of up to 100 yards. In our earlier work we indicated distances of up to 5 meters.

FIELD OBSERVATIONS

I give an exact copy of what I wrote in my field notebook on September 26, 1968: "At 10:07 a.m., in a plain zone covered with dense vegetation and with very poor

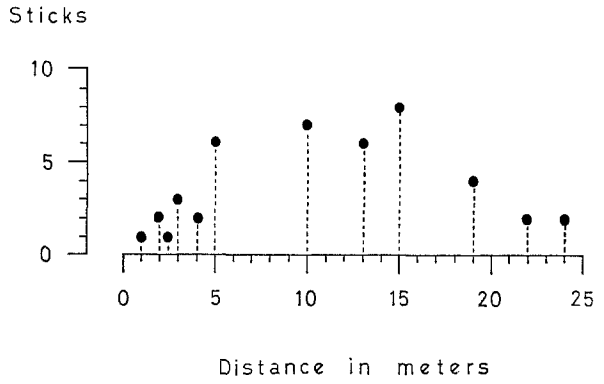

Fig. 9. Distance in meters between the place where sticks were found and the place at which they were cut.

visibility, I heard faint noises out of the vegetation, followed by faint vocalizations. A chimpanzee appeared, with a light-coloured face, who looked at me fixedly; then came an adult female, and at her side was a small animal whose age must have been between 1.5 and 2 years, and which I was not able to see clearly. He had in his hand a small branch without leaves, with which she repeatedly poked at the earth, as I was able to hear, like a child hitting the ground with the open hand; I could see how the little one stuck the stick into the earth, using the stick as shown in Figure 11. At 10:15 the little one cried again, and the group disappeared without noise, just as they had come. On going to the spot, I found the stick used by the chimpanzee stuck into the ground beside the tree. One part of the stick had broken during this activity. There was no anthill in the vicinity. The stick had been cut scarcely 2 meters from where we found it....."

In the small hole opened by the chimpanzee there were no remains of tuber or root, and consequently we must suppose that this activity was simply a game. VAN LAWICK-

Fig. 10. From the heights of a *Sarcocephalus* sp. of 35 meters in height, a female chimpanzee looks around cautiously. This photograph was secured in the Okorobikó mountains in November, 1968.

GOODALL (1970) also observed small chimpanzees playing with sticks, or using them in an imprecise manner.

Fig. 11. A chimpanzee in the Zoological Gardens in Barcelona manipulating one of the sticks obtained in the Okorobikó mountains, as detailed in the observation made on September 26, 1968.

Fig. 12. The same chimpanzee manipulating the stick as observed on January 20, 1969.

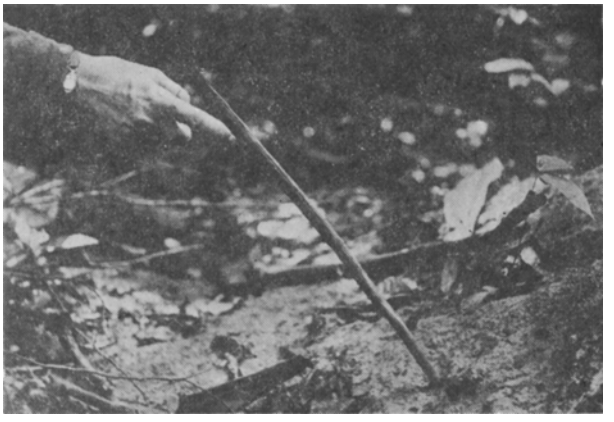

Fig. 13. A stick driven into an anthill in Okorobikó region.

According to some "behaviourists," utilization and manufacture of tools among the apes, and principally in the chimpanzee, is only eventually acquired at the end of adolescence and needs great experience in the individual, which can only be obtained after long apprenticeship. Young primates, like man, use games to acquire mastery in activities necessary for the survival of the species.

On January 20, 1969 I observed, in the same locality and at 9 o'clock in the morning, a group of four chimpanzees—three of them sub-adult males—grouped around an anthill. I noted that one of these stuck of stick in the ground and withdrew it, four consecutive times, working with the right hand closed and the thumb upwards (see Fig. 12). This method of working with a stick, together with the one observed on September 26, 1968, are variants of the "precision grip" which, according to NAPIER (1962) can only be employed by man in a perfect manner, and by some primates imperfectly. They are not anatomically well adapted for perfect employment. Afterwards the animals scraped the damp earth, it having rained the previous night. They were possessed by a great excitement and cried repeatedly but without carrying out any "display." The observation lasted 11 minutes.

When the animals had gone, I obtained three sticks, one of them forcefully stuck into the ground (Fig. 13) at the very base of the anthill. They were evidently scratching the area with their hands and sticks together. These scratches occupied an area of 50×40 square centimeters, in which area two small holes approximately 12 cms deep were to be seen. In my opinion these sticks in this area serve to perforate the anthills, or to make holes or work the earth, so that afterwards the chimpanzees can easily manipulate the earth and dig up the insects that attract them.

KÖHLER (1925) refers to the interest taken by some chimpanzees in their colony in excavating the earth to reach roots, which they later consume. VAN LAWICK-GOODALL (1970) has proved that the chimpanzees of Gombe Stream act in a similar manner to obtain honey from the hives below ground.

The difficult of these observations and their paucity do not permit us to know, in detail, the whole process of this activity. Nevertheless, we estimate that the chimpan-

zees of Okorobikó do not employ these sticks in the activity described by VAN LAWICK-GOODALL as "fishing for termites." This system consists in dipping a fine, flexible stalk into the anthill, and withdrawing it full of insects which cling to the intrusive object with their strong jaws.

We found these sticks, in a fairly regular way, during all the months of the year, located always at the base or on the small elevation typical of the anthills of the two species of termites already mentioned. The data obtained do not show any one time or season especially favorable to this activity. GOODALL (1964) indicates that the termites of Gombe Stream circulate by the anthill zones during the months of November to December, this being the season when the chimpanzees obtain these insects by means of fine branches instead of sticks.

Only on one occasion, in the region studies, did an adult male chimpanzee throw at me various large dry branches. This was done from a height of 25 to 40 meters. The animal was very excited, as he had to descend from the tree in which he had taken refuge in order to rejoin the group, and I, observing the animal from the base of this tree, prevented this descent! VAN LAWICK-GOODALL (1970) has condensed all that has been published regarding the use of natural objects by chimpanzees in agonistic activity.

CONCLUSIONS AND SUMMARY

In this monograph we have described for a second time, making first reference to their use, some simple tools made by chimpanzees of the sub-species *Pan troglodytes troglodytes*. Possibly this "protoculture," in Rio Muni, was not the patrimony of all populations of this species, as we have not found these tools in the Mount Alen region (see Fig. 2), which is also inhabited by several groups of these apes. In the Mount Alen region we also found anthills of the two termite species mentioned.

There exists unquestionable purposefulness in the manufacture of these sticks. They have a determinate diameter, their type is relatively uniform, and we believe they are adequate for the purpose for which they are designed, which is to perforate the earth to dig holes, or to move it with the object of obtaining the termites with the hands.

We have no data relative to the possible use of these sticks for the procuring of roots or tubercles; although we have classified 31 fruits, four medullas, four leaves, and two barks of different plants which are consumed by chimpanzees in Okorobikó. On the other hand we have no data indicatng that roots or tubercles consumed by these apes.

Everything seems to indicate that these sticks, after use, are abandoned at the foot of the anthill. The aspect of some of these at the moment of discovery denoted the possibility of their having been used several times consecutively. This must occur when the animals frequent the same anthill again, finding these rough tools in usable condition.

We estimate that the apprenticeship required for the fabrication of these simple tools is carried out during infancy, which has been checked in other places by various specialists and summarized by VAN LAWICK-GOODALL (1970).

It is possible that there is a cultural tradition underlying the manufacture of these utensils, and this would explain the lack of knowledge of certain groups of chimpan-

zees of this technique, although they live in areas relatively close to the mountains referred to.

The chimpanzees, which have an innate capacity for manipulation, possibly acquire this mastery by observation and a long apprenticeship of the "trial and error" variety. According to "behaviourists," human children learn by the same system.

It is our hope that the description of this simple industry will provide new perspectives for the field of archeology, in its research into the origin of human technology.

Acknowledgements. We should like to thank Dr. J. W. FERNANDEZ of Dartmouth College for the translation and revision of the manuscript. We should like to extend thanks to Dr. DESMOND CLARK of the University of California and Dr. OSMAN HILL for their suggestions in connection with the work.

I am also grateful to Dr. A. RIOPELLE, Director of the Delta Primate Research Center of the Tulane University at that time and to Dr. CLYDE JONES, for several helpful aids contributed during the programme.

I would also like to thank my son, J. ORIOL SABATER for the design of the drawings and the map.

I am indebted to the Zoological Park of Barcelona for help given throughout my research. My thanks are also due to my wife NURI for her encouragement and patience.

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—Received *December 14, 1973*; Accepted *April 5, 1974.*

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