Elephant

Volume 2 | Issue 3 Article 4

12-20-1987

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Cover Page Footnote
We are grateful to the staff at the National Museum of Kenya for their continuous help during the mounting of the skeleton of Ahmed, particularly the askaris who willingly carted the tusks when requested and to A.K. Kes Hillman (now Hillman Smith) who patiently held bits of bones for hours while they were fastened or measured. Special thanks is also extended to the following companies: Morris and Company of Nairobi for their help with the steelwork, Leakey Institute for help with the scaffolding and Nairobi Hospital for taking X-ray photographs of Ahmed's right tusk. We also acknowledge Wolfgang Schenk of Zimmermann's Ltd. and Ian S.C. Parker for their criticism on the final exhibit in relation to the placement for the front legs. Richard E. Leakey and Issa Aggundi generously helped us with various aspects (including access to the material in the Ahmed file) while at the NMK. Rafael Geron was very helpful in measuring the fiberglas replica and the skeleton, Joseph G. Engelhard and Jules L. Pierce made constructive comments on earlier versions of this paper, and Gary H. Marchant helped with illustrations.

"AHMED", THE LOGO OF THE ELEPHANT INTEREST GROUP: ENCOUNTERS IN MARSABIT AND NOTES ON HIS MODEL AND SKELETON

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ABSTRACT: "Ahmed", the logo of the Elephant Interest Group, was a male African elephant (Loxodonta africana) that was born about 1919, possibly in the vicinity of Marsabit National Reserve, Kenya, East Africa. The name "Ahmed" is of Arabic origin (pronounced "Ah-med"), and it means "praised." At the age of 55 Ahmed was about 3 m (10 ft) tall at the shoulder and weighed approximately 5 metric tons (about 11,000 lbs.). He had huge tusks for his size, measuring about 3 m (10 ft) each and averaging about 70 kg (150 lbs) each. Ahmed's 300 pounds of ivory attracted hunters and, as a result, raised major concern for his safety among scientists and the general public. A total of 5,000 letters and cards was delivered to the East African Wildlife Society and resulted in a Presidential Decree issued by the late President Mzee Jomo Kenyatta to protect Ahmed. In addition, a team of human soldiers was assigned to watch his whereabouts around the clock. On January 17, 1974 Ahmed died, probably of natural causes, and his carcass was found almost two days later near Lake Paradise, in the Reserve. The skin was already in an advanced stage of decomposition. Ahmed was dissected on the spot by a team from the "Zimmermann (1973) Limited Taxidermist," headed by Wolfgang Schenk, and the skeleton was transported to Nairobi, the capital, where it was prepared and mounted by J.C. Hillman. A fiberglas replica of the skin was made by Zimmermann's team. The entire operation lasted two years and cost Kenyan Shillings 143,086 (about US $14,500). Both the skeleton and the replica are now on display at the National Museum of Kenya (NMK) in Nairobi. Ahmed is Kenya's most celebrated elephant; he was and still is regarded as a national monument and remains the symbol of conservation. The NMK and the Kenyan Government should be commended for their tremendous efforts in preserving the remains of Ahmed.

INTRODUCTION

Marsabit National Reserve (MNR, see definition at the end of this article) was gazetted in 1948; it is located in the north-central region of Kenya, some 450 km (300 miles) north of Nairobi the capital (Fig. 1). The reserve covers an area of approximately 2,088 sq. km (800 sq. mi.) and it incorporates forests, mountains, hills and valleys, rising like an island-oasis in the middle of the desert. The mountains and hills are of volcanic origin; the highest peak is 1,702 m above sea level and about 1,000-1,300 m above the local topography. This elevated area is part of the Great Rift System that begins, as seen externally, in Turkey (Asia) in the north and ends in Mozambique (Africa) in the south. The Marsabit mountain region is a barrier to clouds on their way north, and they pile up and empty

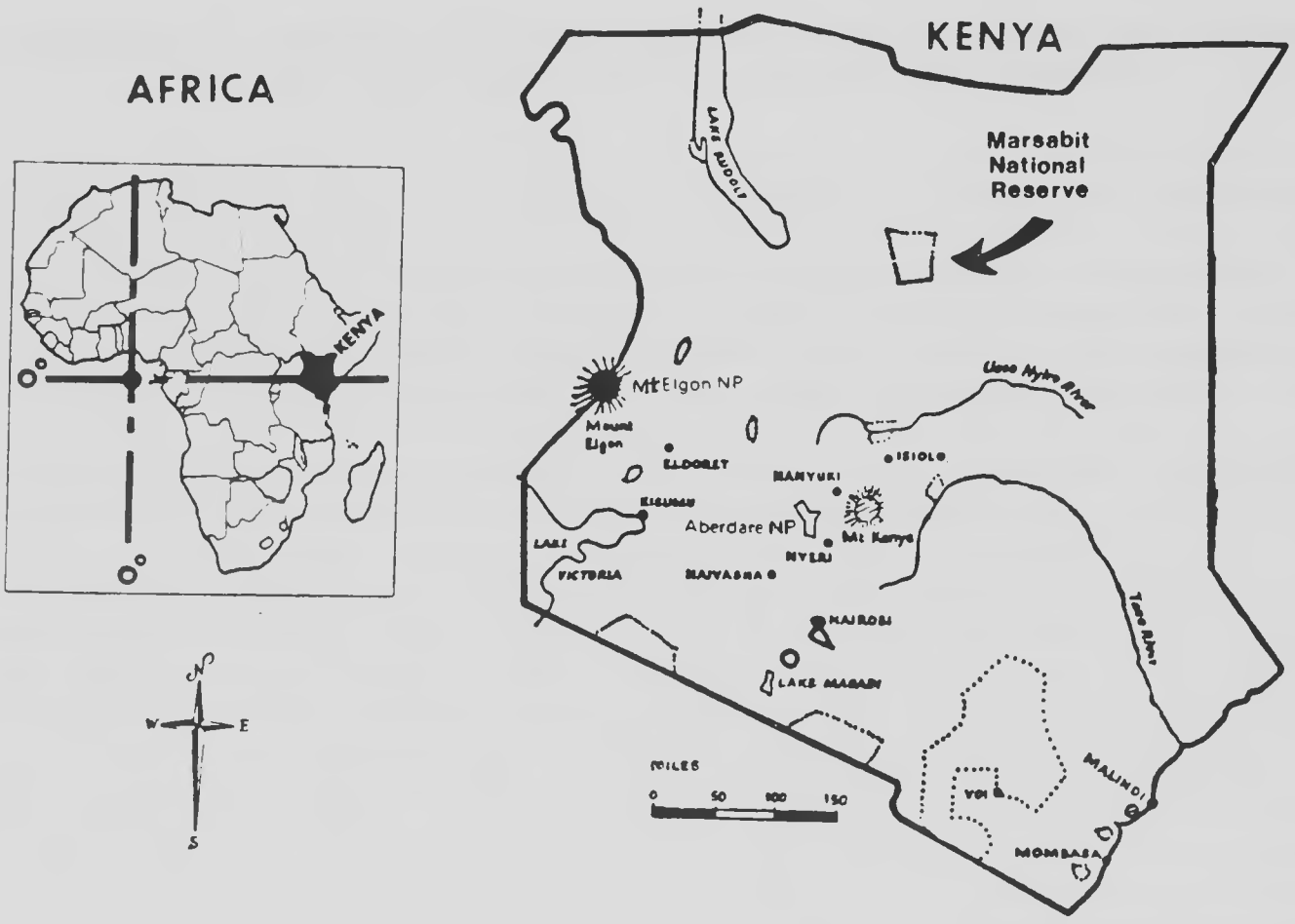


Figure 1. LEFT: Map of the African continent with the country of Kenya darkened. RIGHT: Map of Kenya with an arrow pointing to Marsabit National Reserve.

their contents on this elevated area that has become forested. This area of heavy vegetation covers only one eighth of the entire MNR. Most of the volcanic craters of MNR are void of water but some, especially those in the forest region during the rainy season, are filled with water. One such crater lake, "Lake Paradise," was made famous via the early films and writings of Osa Johnson (1941). Ahmed was frequently seen bathing in, and feeding around Lake Paradise. Ahmed's almost perfectly symmetrical pair of huge tusks brought him fame, and while still alive he acquired the legendary status (mostly because of the Presidential Decree, see below). The fascination with Ahmed led him to be featured in many popular articles, books and magazines (see for example: Anonymous, ca. 1970; Anonymous, 1974; Beard, 1977; BeVier, 1980; Bunny, ca. 1975; Hartmann, 1973, 1981; Morrison, 1972; Resnick, 1986; Shepherd, 1982; and Shoshani, 1974).

MNR is rich with wild plants and animals, and according to Williams (1967:41), "This Reserve is one of the very few places where one can still be reasonably certain of seeing elephant with tusks of 100 lbs. and over." Today, twenty years after this statement was written, that gene pool of elephants no longer exists and the average tusk weight in Marsabit (and in Pan-Africa) is much less then 100 lbs; it is about 10-30 lbs. per one tusk (Kenya Department of Wildlife and Conservation, pers. comm.). The number of

elephants at MNR in 1976/7 was estimated to be 300 (Hillman, 1979), and in 1981 the estimate was 231 (Douglas-Hamilton, 1987).

Because Ahmed has been the logo of the Elephant Interest Group (EIG) for the past 10 years, we have provided some information on him on the inside pages of the front covers of Elephant and also items in Elephant, 1(2):35 (Hillman, 1978), and 1(4):234 (Anonymous, 1980). Our objectives in this article are: 1) to gather and summarize all the available material on Ahmed, and 2) to share new or not-so-well-known information about him, such as observation in the wild and some findings while mounting the skeleton.

ORIGINS

Ahmed belonged to a subspecies of the bush or savannah African elephant, Loxodonta africana africana. Earlier investigators, however, considered Ahmed to be a subspecies called L. a. knochenhauri, but almost all recent workers (see for example Sikes, 1971; Laursen and Bekoff, 1978; and Shoshani, 1987) agree that until further evidence is available, there should be only two subspecies of the African elephant recognized: L. a africana (the bush, or savannah elephant, to which Ahmed belonged) and L. a. cyclotis (the forest African elephant).

The name Ahmed is of Arabic origin (pronounced "Ah-med," and sometimes spelled "Ahmad" or "Ahamed") and it is a variation of "Hmed" or "Muhammed" (also spelled "Mohammed" or "Mohammad"). All these names mean "praised," "thanked," or "I thank," "I praised." It is of interest that the other well known elephants from Marsabit were also given Arabic names. These include "Muhammed" (died in 1956), and "Abdul" [a short version of "Abdul-Allah" or "Abdal-Allah" and means the "servant of God;" ("Abdul" the elephant died in ?1950, additional details on "Muhammed" and "Abdul" are given later in this article)]. It is possible that the roots of the name "Marsabit" are also from Arabic and means "the place of the cold" or a "fortress," for the resemblance of the group of mountains in the middle of the desert which appear to guard major nomadic routes. (The Kiswahili language which is spoken in most of East Africa, including Kenya, was heavily influenced by Muslims and other Arab traders, and thus Arabic words are frequently encountered.)

Etymologists may be interested to learn that another possible origin for the word Ahmed is from the Hebrew root HMD (or "hamod" when pronounced phonetically) meaning "to be fond of" or "to have an affection." This alternative is not surprising since both the Arabic and the Hebrew languages are Semitic and many words are similar and in fact are spelled identically.

WHY WAS AHMED (AND NO OTHER ELEPHANT) CHOSEN TO BE THE LOGO OF THE ELEPHANT INTEREST GROUP?

In 1977 soon after the first meeting of the EIG, the question arose as to what we should call our publication (then a newsletter). The immediate response by some of the attendees at the meeting was "Ahmed" (slides of Ahmed

taken by J. Shoshani were shown during the meeting). On second thought, we decided to investigate whether or not the name "Elephant" was available (i.e., that no other organization already uses "Elephant" as the name of their publication) and use it instead. Regardless of what would have been the official name of our publication, all agreed, and Joseph Engelhard insisted, that the entire image of Ahmed (not only his head, as was suggested by others) should be on the cover.

As it turned out, we found that the name "Elephant" was twice used for publications which have been discontinued (it was issued by C. Mathews during 1848, and by J. Perreault from 1965 to 1966, both in New York; see ELEPHANT NOTES AND NEWS in this issue for details). Thus, the title "Elephant" was "free," and we adopted it as the official name of the publication of the EIG. Ahmed's image was to decorate the new publication's cover.

Anyone who was fortunate enough to see Ahmed alive would agree that he was a majestic animal. He captured the imagination of thousands and perhaps millions of people worldwide while he was alive and after his death. More than other reasons, the fact that he became the symbol of conservation is what attracted us the most to choose him as a logo for the EIG whose ultimate goal is: "To provide a support system for individuals and institutions interested in conserving elephants" [see item No. 5 in Elephant, 1(2):2]. It may be noted that the illustration of Ahmed as it appears on the cover of this publication is a composite drawn by Susan O'Neill Ratigan of Detroit, Michigan, from photographs of Ahmed in front and side views. The "kinky" tail was an "artistic freedom" adopted from a photograph that appears on page 48 in the book "The Love of Elephants" by Neil Murray (1976).

OBSERVATIONS IN THE WILD

Below is a digest of the notes taken before, during, and immediately after we (JS and JMW) observed Ahmed in Marsabit National Reserve, north-central Kenya. It may be mentioned that many tourists, Kenyan and non-Kenyan were in the Marsabit area at the time to observe the Total Solar Eclipse the center of which passed through the Reserve. The Eclipse occurred on June 30, 1973.

JOURNAL

JS, JMW, 1973

July 1, Marsabit National Reserve, Kenya.

Forested region, we joined a group of tourists with the "Ahmed Guard Unit" who were about to leave in search of Ahmed the elephant; with a vehicle, we left the Karantina Camp (over 5,000 ft, about 1,680 m) before noon.

12:00 Noon, visited a few places, including Lake Paradise and then proceeded on foot. Elephant footprints were spotted in the forest.

12:10 Fresh elephant dung.

12:15 Fresh broken branches (probably broken by elephants as we observe fresh footprints and dung nearby). The path continued to snake into the forest.

12:45 We passed by a vantage point where the view was clear towards the horizon and into the desert in the west (Fig. 2). More dung and more broken branches were found. Crossed a watershed.

13:00 Arrived at Mado Ajoftu. Elephant footprints identified by the guide from the "Ahmed Guard Unit" as those belonging to Ahmed; we followed the footprints arriving at a straight rock-wall of a volcanic origin covered with waterplants, a tiny spring oozing out of the rock, birds seen drinking.

13:55 A bushbuck observed running into the thicket.

14:00 More elephant footprints with dung (Fig. 3), presumably those of Ahmed and soon after we saw his unmistakable head with long curved tusks among the foliage at about 10-15 m downhill. Ahmed flapped his ears, raised his trunk and trumpeted softly. We retreated. We then returned to observe him from a vantage point at a close distance, about 8-10 m, we above and he below on the slope.

14:05 We could clearly see his long eyelashes. The temporal areas were so deeply sunken that we could easily identify the zygomatic arch (the cheek bone; the temporal area in younger elephants is filled by the temporal, or musth, gland, whereas in older individuals the gland atrophies, leaving a depression). Tears in the huge ears appeared to be larger than those seen in photographs, and the tusks were very impressive from such a close distance (Figs. 4 and 5). There was something special about these tusks, not only their size, perhaps their curvature, their twisting, and the fact that they reached the ground (undoubtedly, these tusks eventually gave him his legendary status). The tips of the tusks would rest on and off the forest floor as he would raise and lower his head intermittently. The tip of the trunk would also appear and disappear among the thicket and vines.

14:20 Ahmed started to walk backwards by "feeling" the solid ground underneath his feet just as a blind person would use his/her cane to test the surface before stepping. He started with his right hind leg cautiously and gently tapping the ground a short distance behind him. Once the ground was "tested" he rested his right hind leg backwards and repeated the process with right foreleg, left hind leg and finally with the left foreleg. While he was inching his way backwards and downslope in the forest, he was constantly looking at us, his head and trunk making slight movements. After about 10 minutes of slow maneuvering downhill with the head facing us uphill, he disappeared into the forest.

14:40 We returned to camp.

<u>July 2, Returned to observe Ahmed</u>

09:45 Spotted two lone bull elephants, supposedly his personal body guards or "Elephant Askaris" (elephant soldiers).

Soon after we saw Ahmed, at about 15-20 m away from us and about 50-75 m from the two bulls, well hidden in the forest. It was very difficult to tell he was there unless he moved, for his color blended well with the habitat. Once we focused on him, we could again see his

Figure 2. A view from the forested region towards the desert in the west. Inset: Two of Ahmed's Guard Unit and J. Shoshani posing for a photograph at the same spot. (All photographs in this article were taken by J. Shoshani.)

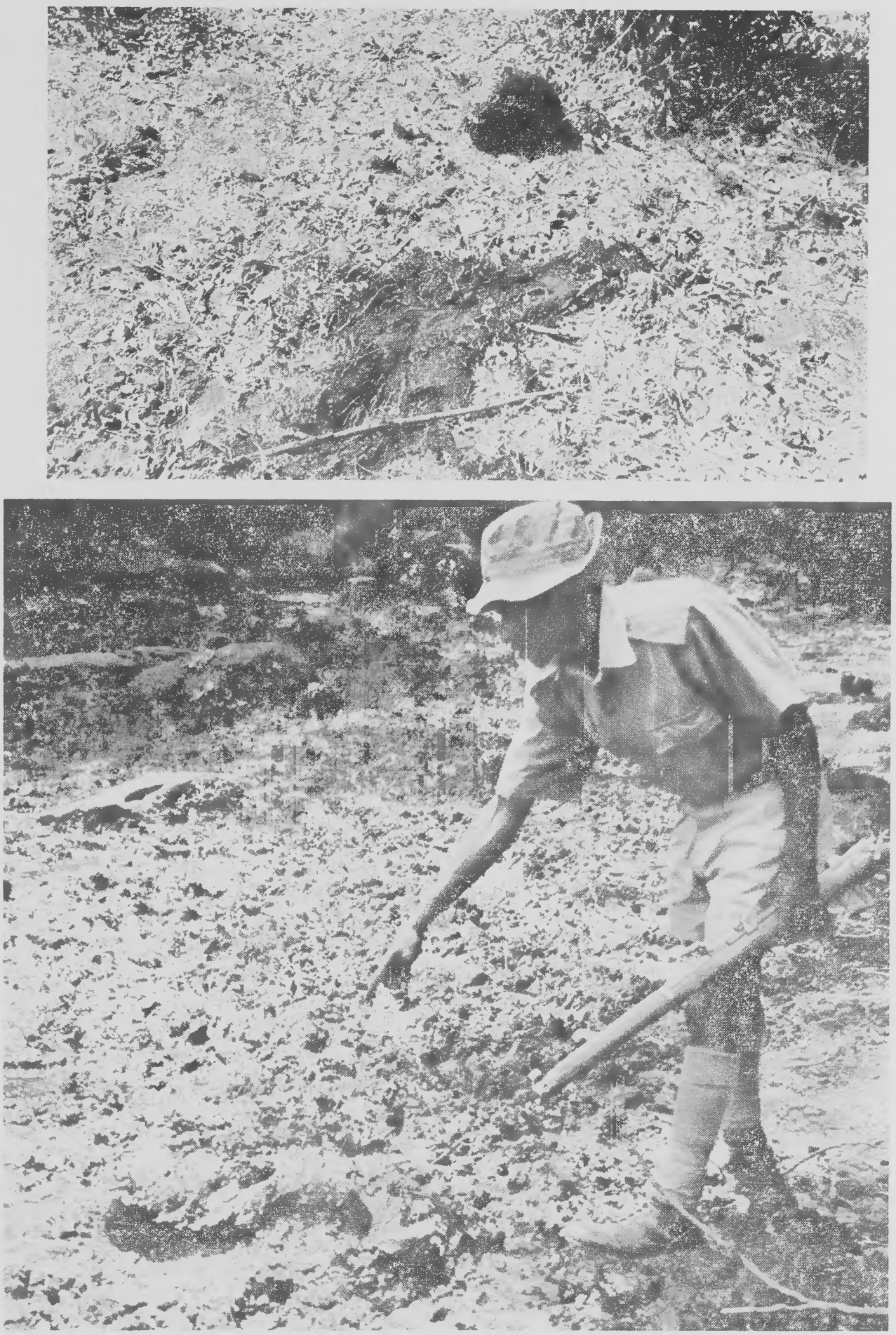


Figure 3. Spoor of Ahmed. TOP: one bolus (scat) and urine, presumably of Ahmed; matchbox, approximately 5 cm long. BOTTOM: one of Ahmed's Guard Unit is pointing to Ahmed footprint in the mud.

Figure 4. Ahmed in the thicket of Marsabit: "There was something special about these tusks; not only their size, perhaps their curvature, their twisting, and the fact that they reached the ground."

Figure 5. Close-up photography. TOP LEFT: Tusks; TOP RIGHT: eye lashes; BOTTOM LEFT: foraging; BOTTOM RIGHT: one ear extended, the other folded (compare to Fig. 4).

long eyelashes. We tried to photograph him once more but he retreated deeper into the shadows.
10:45 Trumpeting was heard from the direction of the other two elephants.

Notes: At the lodge we leafed through the pages of "Ahmed Movements Record" Book for the entries made by his Special Guard Unit since the end of 1970. There was a special table in that Record Book which included five columns: "Date, time, seen by, locality, observation and notes." We noted that Ahmed did not wander much within the boundaries of Marsabit and the distance he would cover in a 24-hour period may be a maximum of 10 mi. (about 15 km). Most of the time he was seen alone and engaged in feeding behavior. Frequency of bathing - two per month.

DEATH AND SKINNING

The carcass of Ahmed was found on Friday, January 18 1974, and it is estimated that he died at least 24 hours earlier (Karimi, 1974). According to Mungai (1976), Ahmed's body "...was found wedged between two trees and it is possible that the long tusks might have played a part in this (his death)." The same writer stated that at the time that Ahmed died there was a severe drought in the Marsabit area, which meant that "...he had to move long distances in search of food and water."

Marnham (1979:4) noted: "Since Ahmed had died deep within the forest, a special road had to be cut through the trees for several miles...". The skinning of Ahmed was conducted by a team from "Zimmermann (1973) Limited" company, headed by Wolfgang Schenk, "Nairobi's leading taxidermist." Armed policemen and National Parks staff guarded the carcass during the skinning and transporting which lasted four days. There were a few speculations on the causes of death, most of which seem to agree that he died of "natural causes." Below are pertinent excerpts from Marnham's article as it appears in Harper's Magazine (1980):

> "It took Wolfgang four days to remove the skin from Ahmed. The skin was kept damp throughout the process and salted. The ribs, limb bones and skull with tusks were separated from the rest of the carcass. At the time when Ahmed's body was found, the cause of death was unknown. Wolfgang speculated at various points during the dissection on the reason for death. Ahmed's teeth were found to be in good shape; two bullets were uncovered at the base of the tusks but they might have been there for years; and the specific wound in the side did not appear serious. Wolfgang's only suspicion was that something upset Ahmed's digestion since there had been no food in the stomach. Wolfgang was clearly not impressed by Ahmed. He is quoted as saying 'Why am I stuffing this elephant? He is not even big. His tusks weigh 100 pounds below the record. He is only ten feet at the shoulder.'"

From the material on file at the National Museum of Kenya (NMK) that one of us (J. S.) was permitted to use, we know that the skin of Ahmed was tanned

but was in "...very bad condition." We also learned that "A strong bactericide called 'Preventol' was freely used while skinning to stop decomposition. This chemical could have contributed to the inflexible condition of the tanned skin."

Despite all efforts to save the skin and use it in the final mounting of Ahmed, the time that lapsed between his death and the skinning process was too long and resulted in decomposition of the hide beyond recovery. At one point, there was a suggestion to shoot another elephant whose hide could be prepared immediately after death and used instead of Ahmed's useless skin. This idea was vehemently rejected. Subsequently, there was a need to reproduce a replica of the skin if the body of Ahmed was to be reconstructed.

FIBERGLAS REPLICA OF THE SKIN

Details on the preparation and the actual production of the fiberglas replica of Ahmed are scanty. From correspondence in the "Ahmed file" in the NMK we learned that the staff at the Zimmermann's firm tried their best to reproduce as accurate a replica of Ahmed's skin as possible. We include the passage quoted below from Mungai (1976), for it provides some interesting information on the production of Ahmed's fiberglas replica:

> "The process started with the arrangement of the dried bones of the animal in the positions in which they normally were in the body so as to provide support for the desired posture. The big bones were put together with wooden and metal supports. The taxidermist then applied soft materials such as rubber and plasticine on the skeleton to reconstruct the soft tissues which would normally cover the bones. In this way the normal contours of the body were reproduced. Plaster of Paris (the same plaster as is used in hospitals to support broken limbs) was then applied to make a hard mold of the reconstructed contours of the body. After drying, the plaster mold was then lifted off, revealing a complete mold of Ahmed.Under normal circumstances this mold would then be used to prepare the artificial model skeleton on which the natural but processed skin would eventually be displayed. This is normally done by applying a thin layer of a light and strong material such as Fiberglas onto the plaster mold. When dry, the fiberglass would then be separated from the mold, in carefully cut pieces and, when put together, the entire surface features of the animal would be produced as originally required."

On November 19, 1982, Rafael Geron and Jeheskel Shoshani visited the National Museum of Kenya in Nairobi and noted the following:

> Fibercast model of Ahmed, <u>Loxodonta</u> <u>africana</u> <u>africana</u>, mounted at the outdoor enclosure of the Museum. An explanation placard (in English and Kiswahili) that was placed by Ahmed's model read:

AHMED

THIS IS A PERFECT FIBRE-GLASS MODEL OF THE FAMOUS ELEPHANT OF MARSABIT. IN 1970, HIS EXCELLENCY PRESIDENT JOMO KENYATTA DECREED THAT THIS ELEPHANT BE PLACED UNDER PERMANENT 24 HOUR HONOUR GUARD PROTECTING HIM FROM POACHERS. HE BECAME A NATIONAL SYMBOL.

AHMED DIED OF NATURAL CAUSES IN 1974 AND WAS PREPARED FOR EXHIBITION BY ZIMMERMANS OF NAIROBI. NORMAL TAXIDERMY METHODS COULD NOT BE APPLIED IN THE MOUNTING.

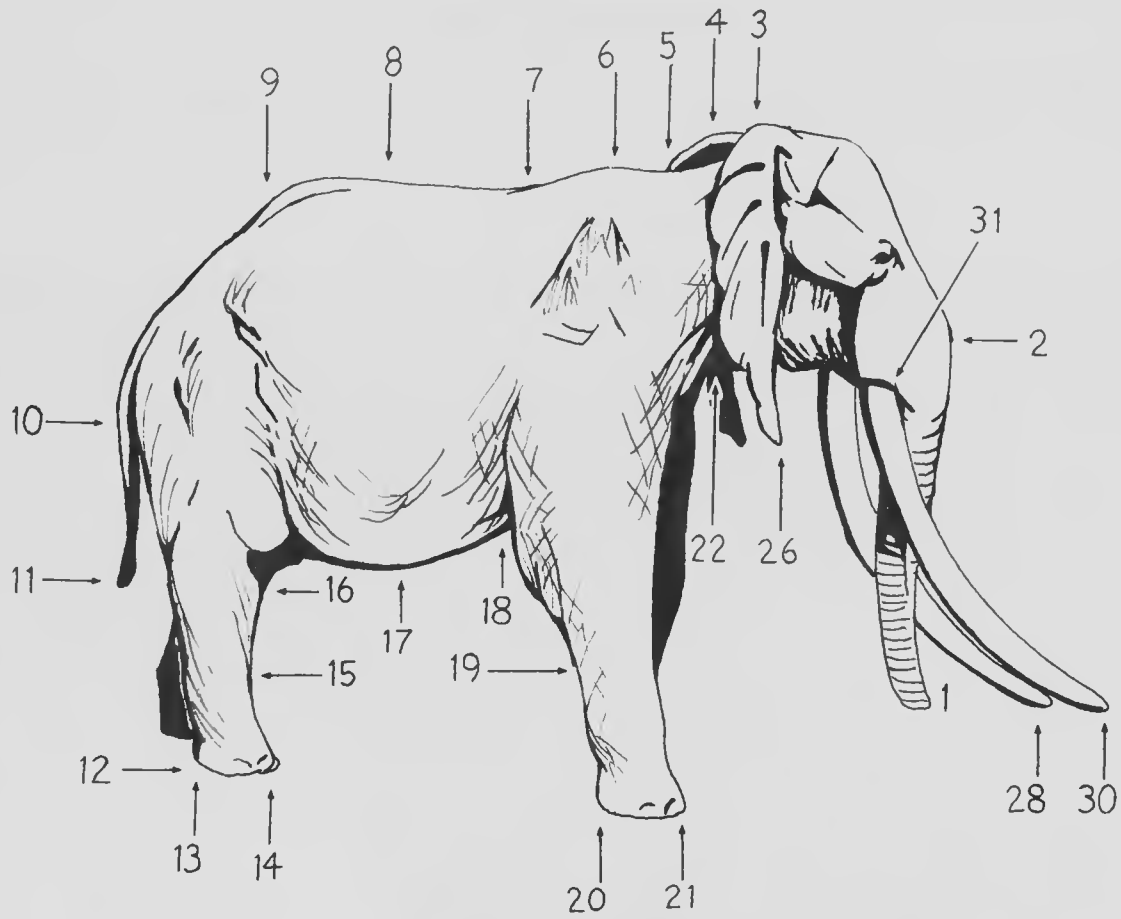
STATISTICS

Age at death		---- 55 - 62 years
Height at the shoulder		---- 3 metres (9' 10")
Tusks:	right tusk	---- 3 metres (9' 9")
	left tusk	---- 2.8 metres (9' 4")
Weight of each tusk		---- 67 Kgs. (148 lbs)
Note: record for tuskweight		---- 102.7 Kgs. (226 1/2 lbs.)
	length	---- 3.1 metres (10' 2 1/2")

Measurements and notes that we collected on the fiberglas model are summarized in Table 1 (cf. Fig. 6 and 7). Note that the numbering system in Fig. 6 begins at the tip of the trunk and continues in a clockwise direction.

Table 1. Data and notes collected on the fiberglas replica of Ahmed [except when indicated otherwise, measurements (in cm) were taken in a straight line].

SUBJECT	MEASUREMENTS AT/BETWEEN THESE POINTS	
Tip of trunk to tip of tail (along the curve = atc)	1 - 11	835.5
Tip to base of trunk (atc)	1 - 2	213.5
Base of trunk to beginning of neck (atc)	2 - 3	150.0
Neck length (atc)	3 - 5	67.0
Dorsum length (atc)	5 - 10	288.0
Tail length (atc)	10 - 11	117.0
Tip of tail to ground	11 - 12	85.0
Shoulder height	6 - 20	302.0
Height of foreleg	18 - 20	120.0
Height of hind leg	14 - 16	110.0
Circumference of neck (through 22)	4 - 4	250.0
Circumference of body behind forelegs (through 18)	7 - 7	347.0
Circumference of body at about mid-dorsum (through 17)	8 - 8	380.0
Circumference of body in front of hind legs (through 16)	9 - 9	412.0
Circumference of left forefoot at base (through 21)	20 - 20	140.5
Circumference of left foreleg at narrowest point	19 - 19	98.0
Circumference of left foreleg close to body	18 - 18	140.0
Circumference of right forefoot at base (as in left)		141.0
Circumference of left hind foot at base (through 14)	13 - 13	130.0
Circumference of left hind leg at narrowest point	15 - 15	82.0
Circumference of left hind leg close to body	16 - 16	143.0
Circumference of right hind foot at base (as in left)		130.0
Number of visible "toenails": Left forefoot : 4, Right forefoot : 4; Left hind foot: 3, Right hind foot: 3		
Trunk length (atc)	1 - 2	213.5
Trunk circumference at base	2 - 2	122.5
Trunk circumference at tip (at the thick area just posterior to "fingers"; each one 6 cm long)	1 - 1	40.0
Left ear: Dorsal length (atc)	23 - 25	150.0
Ventral length (in a straight line)	25 - 26	121.0
Anterior length (in a straight line)	23 - 27	133.0
Ear opening to tip of pinna	25 - 27	90.0
Length of medial folding of ear	23 - 24	126.0
Width of medial folding of ear (not shown)		22.0
Left tusk - Length along outside curve (from lip to tip)	28 - 29	242.0
Length along inside curve (from lip to tip)	28 - 29	236.6
Note: Medial side flat, 6.5 cm from tip (presumably from having been rubbed on ground)		
Right tusk - Length along outside curve (from lip to tip)	30 - 31	230.5
Length along inside curve (from lip to tip)	30 - 31	225.5
Note: At right angle to the tusk, there was a groove, 5.5 cm from the tip, 0.6 cm deep.		



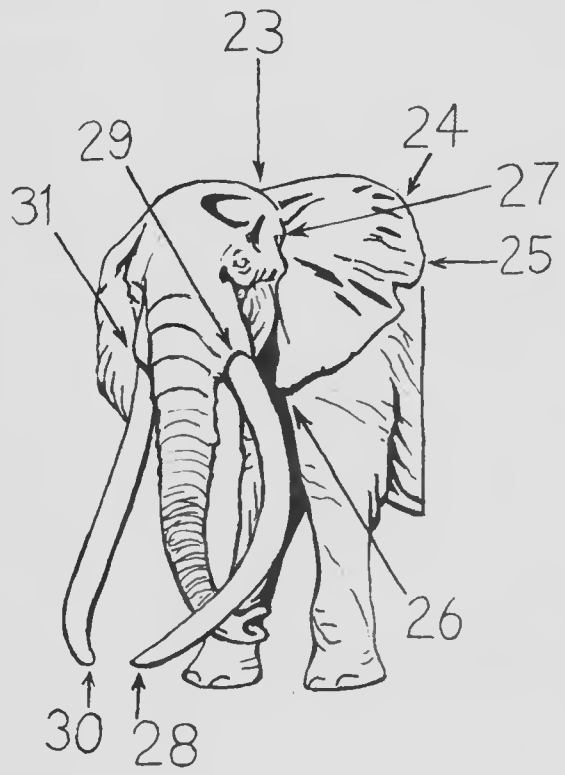


Figure 6. An outline of Ahmed's model showing the locations where measurements were taken (TOP and BOTTOM LEFT, see Table 1 for details). BOTTOM RIGHT: Rafael Geron measuring the left ear of Ahmed's model.

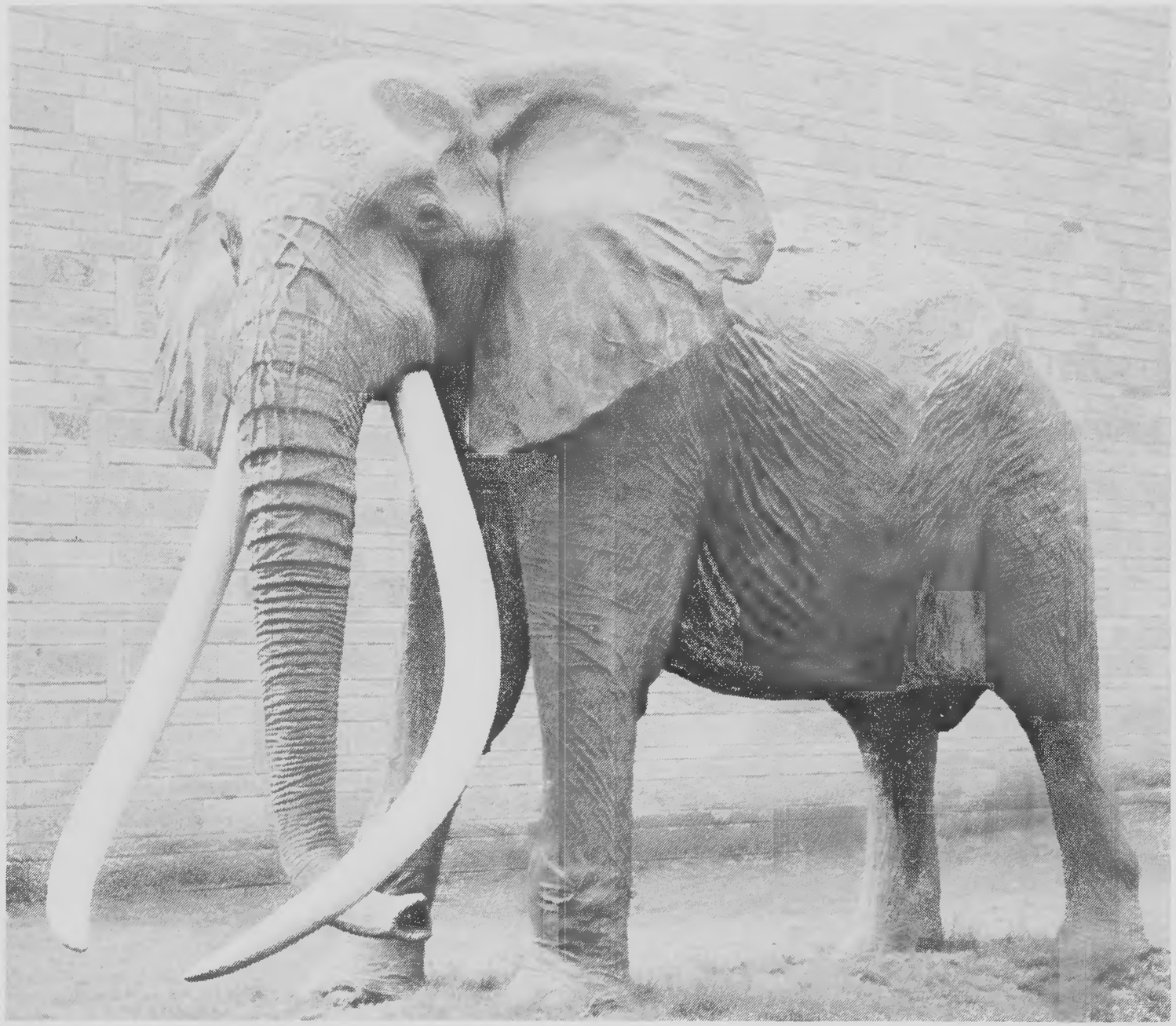


Figure 7. Fiberglas replica of Ahmed's body as it stands in the courtyard of the National Museum of Kenya, Nairobi, Kenya. This replica was prepared by a team from Zimmermann (1973) Limited Taxidermist Company, headed by Wolfgang Schenk.

THE SKELETON

On a little label by the skeleton at the Large Mammal Hall, National Museum of Kenya, this note is written:

> "Ahmed". This is the skeleton of the famous elephant at one time protected by Presidential Decree. Tusks weigh 67 kg. (148 lbs) each.
> Prepared and Erected by C. Hillman

The bones of Ahmed were cleaned by removal of most of the flesh first and then by boiling them to eliminate the remaining soft tissues. The assembling of the skeleton for the NMK in Nairobi was carried out by J.C. Hillman with help from A.K.K. Hillman during February of 1977. The notes as given below are only slightly modified from those of J.C. Hillman written in 1977.

The exhibit (Fig. 8) consists of nine basic units, viz. :
a) the forelegs, b) the cranium, lower jaw and tusks, c) the hindlegs, d) the ribs, e) the tail, f) the backbone, g) the pelvis, h) the metal support pillars, and i) the baseboard.

Dismantling the skeleton is best carried out in the above order, with re-assembly in the reverse order. Below is a detailed description of how each basic unit is mounted and articulated.

a) The forelegs. These are secured to the exhibit at three points. There is an 8 mm diameter (dia.) rod between the scapulae which is threaded at each end. Removal of the nuts on the outside of each scapula enables removal of the rod. The scapulae can then be lifted vertically, the 8 mm dia. pins in their bases sliding out of the sockets in the head of the humerus. The base of the humerus is attached via an expansion bolt to the horizontal flat bar fixed to the front pillar support. The forefoot is attached to the baseboard with two 8 mm bolts through the planking. The nuts are reached by removing the outermost full width plank of the baseboard on each side. The limb can then be leaned to the outside to free the expansion bolt from the flat bar at the humerus base and then the whole limb lifted free of the baseboard. The limb reduces to three units by pulling it apart at the humerus/radius-ulna joint and the radius-ulna and carpals joint for ease of storage. At all these joints there are two 8 mm dia. pins which are knocked into the upper bone and slide into an oversize hole in the lower. The metal stand beneath the foot is attached with long self-tapping screws into the bone. The foot is a complete unit, fixed with two 4 mm dia. pins and epoxy resin at each joint.

b) The cranium, lower jaw and tusks. On no account should any attempt be made to move the exhibit without first either removing the tusks, or immobilizing them with boxes, sponge and rope beneath their tips to prevent any movement. They are very heavy, and this whole subunit (cranium, lower jaw and tusks) weighs about 300 kg but is supported at only two points. Excess movement of the head would strain these mounting points.

The tusks are removed with the aid of at least three people supporting them and pushing them upwards into the sockets slightly. The bolts, two in each tusk, pass into expansion sockets in the tusk. [Note: some of the den-

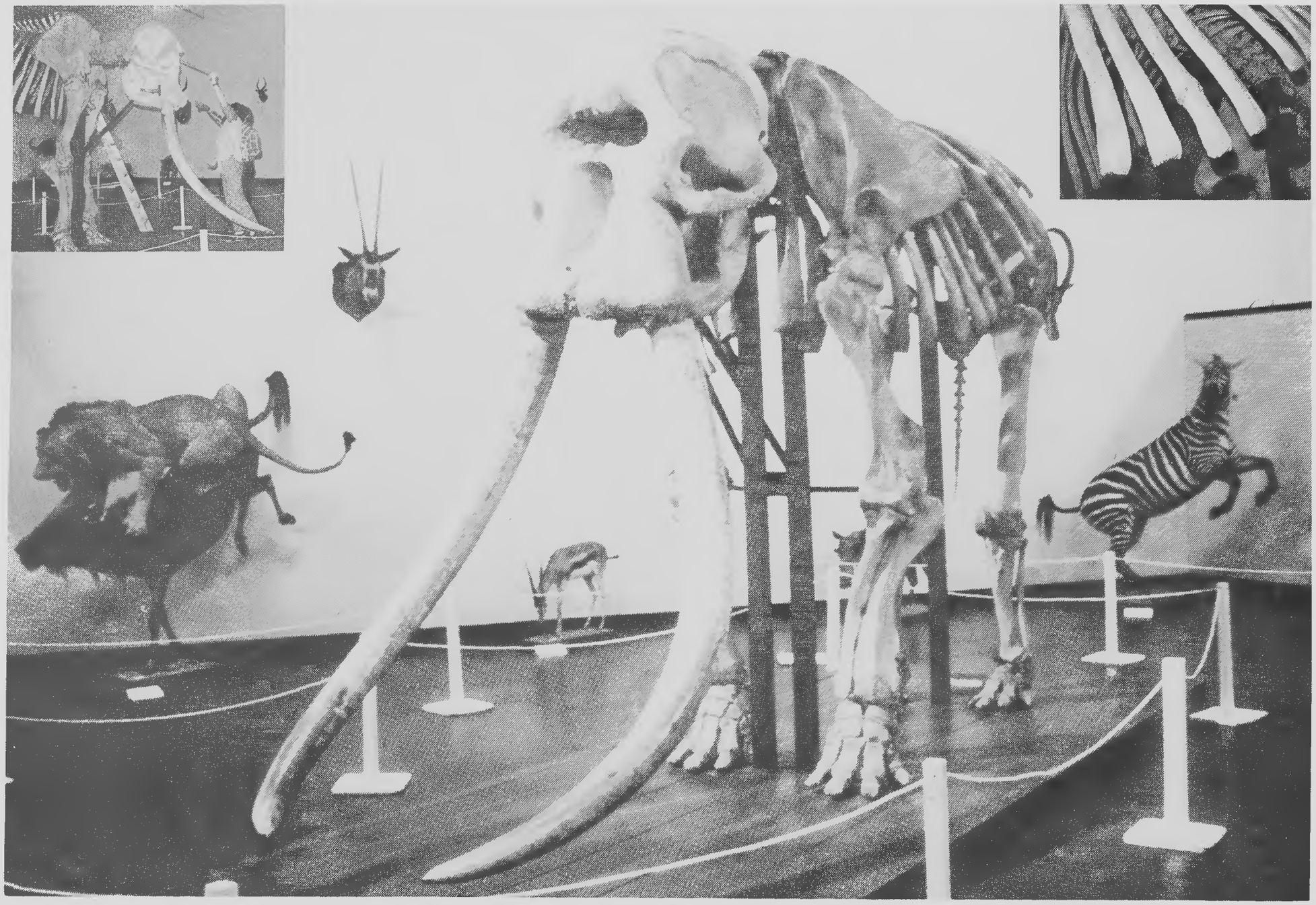


Figure 8. The skeleton of Ahmed at the indoor exhibit, Large Mammal Hall, National Museum of Kenya, Nairobi. Mounted by J. C. Hillman in 1977, photographed by J. Shoshani in 1982. TOP LEFT inset: measuring Ahmed's skeleton, as seen from the right side. TOP RIGHT inset: healed fracture on the eighth left rib of Ahmed.

tine or ivory material (17.0 grams) that was collected when drilling the tusks is presently kept at the EIG Office in Detroit, Michigan.] Once both bolts have been removed, the tusk can be gently lowered out of the socket.

The lower jaw is attached to the cranium with a long 6 mm dia. bolt through each articulation, into an expansion socket embedded in the cranium. At the front a sling of 4 mm dia. wire is hooked into a loop, also in an expansion socket in the palate. The ends of the wire sling need to be slightly unbent to enable removal from the loop.

The cranium is secured to the rod through the vertebral column and to the front via the diagonal support. The cranium should then be first supported with rope slings and block and tackle on sheer legs before any of the nuts or bolts are undone. The same equipment will be needed to remove the vertebral column and pelvis later.

Once supported, the diagonal support is first removed. It is held at the base with four nuts to the plate between the front support pillars. At the upper end it is held to the T-shaped plate with three nuts. The diagonal support can then be extracted. The cranium is now raised slightly to allow removal of the 8 mm bolt through the vertebral column. This can only be reached with a 13 mm socket spanner on a 70 mm extension bar through the gap between the atlas vertebra and the occipital condyles from underneath. It screws into a fixed nut welded to the plate which is attached to the inside of the cranium. Once this bolt is removed, the cranium can be swung forward and lowered. The plate attached to the inside of the cranium and the T-shaped palate plate should not be removed as both are very difficult to replace and locate.

c) The hindlegs. These are fitted to the pelvis via long 6 mm bolts through the back of the acetabulum into expansion sockets in the head of the femur. They are removed with a screwdriver. The feet are attached through the baseboard and metal supports with 8 mm bolts and are removed in the same way as the front feet were. The whole rear leg will then swing forward from the base until the upper end is free of the acetabulum. The leg is assembled as the foreleg was and can be dismantled carefully into three sub-units.

d) The ribs. Each rib is fixed to the lateral transverse process of the vertebra above with a 6 mm bolt through the head of the rib. The nut is at the upper surface. Each nut and bolt is unique and should not be separated from the rib. A few of the ribs had to be wedged into the correct position with wood chips and modelling clay.

e) The tail. The caudal vertebrae are strung on a 4 mm dia. wire held in the neural canal of the sacrum with a stop clamp and grub screw. The screw is reached with a long thin screwdriver through the last lateral canal on the right side of the sacrum. The lower end of the wire has a rivetted head.

f) The vertebral column. This unit is the heaviest and requires sheer legs and block and tackle for its removal. The unit is socketed into the pelvis at the rear and is bolted onto the top plate of the front support pillars. The unit should be supported with a web of rope slings and then the four bolts at the front removed. At the pelvis a loop of 6 mm dia. bar threaded at the ends passes over the bar in the vertebral column and is bolted

through the circular plate at the top of the rear support column. Once this is removed, the unit can be raised slightly until the pin which passes through the bar in the vertebral column in the top of the sacrum can be withdrawn. The unit can then be swung forward and lowered.

The vertebrae are threaded on a 32 mm mild steel solid bar, bent into the shape of the neural canal. This bar has a plate welded to it at the front end which bolts to the front support pillars. In addition, there is a shortened Volkswagen Beetle clutch cable passed through a hole in the centrum of each vertebra to provide tension. This is held at the front with a nut visible beneath the axis vertebra.

g) The pelvis. An ellipsoidal metal plate is attached to the pelvis by three 8 mm studs. This plate is bolted to the circular plate at the top of the rear support with three 8 mm bolts. The plate should not be removed from the pelvis as it is difficult to replace. The pelvis can then be removed either with block and tackle or with the help of two or three people.

h) The supports. These are hollow 76 mm square metal pillars. Removal from the baseboard entails removal of the two central planks first. This exposes the nuts, securing the pillar base plates. The studs pass through the main central beams of the board to an identical base plate beneath the baseboard.

i) The baseboard. The planks and beams are of camphorwood. The beams are jointed and bolted together. Furniture gliders every 500 mm on the lower beam surfaces should aid in sliding the exhibit across the floor. The baseboard measures 6 m x 2 m x 0.14 m. The planks are screwed on the main beams as shown below (Fig. 9).

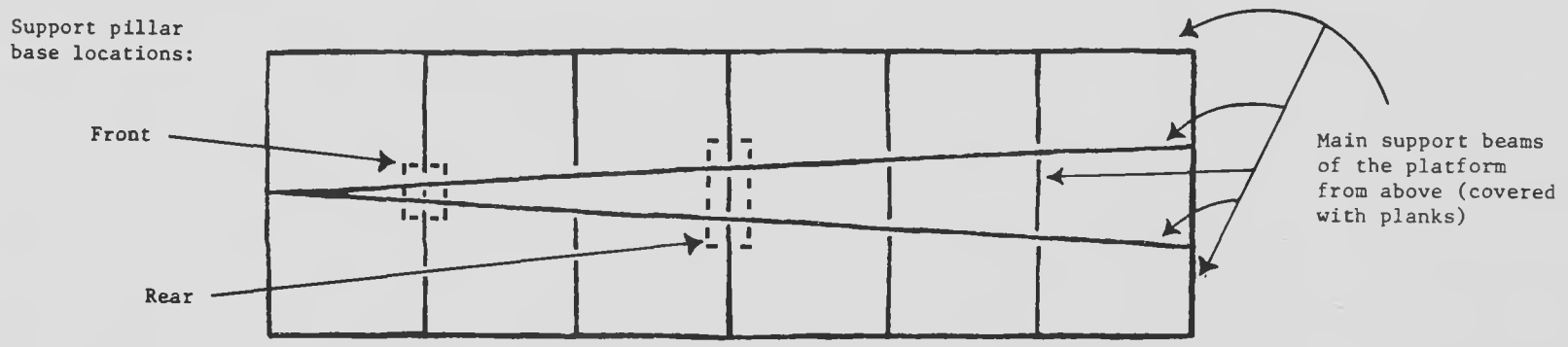


Figure 9. Details of the baseboard on which Ahmed's skeleton is mounted.

GENERAL NOTES

Number of bones

Except for a few minor differences, the number of bones in the African elephant (Loxodonta africana) is about the same as for the Asian elephant (Elephas maximus). The differences vary among individual elephants (especially in the number of the caudal or tail vertebrae), between subspecies and, rarely, between species of the same genus. Shoshani et al. (1982) tabulated the bones and their numbers for one Asian elephant and noted some of

the differences between the two elephant species. Below is a summary of the number of bones for Ahmed.

Table 2. A summary of the bones in the skeleton of Ahmed.

Name of bone, or complex of bones	Number of * bones
SKULL (cranium and mandible)	51
VERTEBRAL COLUMN i.e., cervical (7), thoracic (20), lumbar (3), sacral (5), and caudal (22) vertebrae	57
STERNUM (not on skeleton)	4
RIBS	40
FORELIMBS (including scapulae, but excluding sesamoids)	62
HIND LIMBS (including pelves, but excluding sesamoids)	66
TOTAL	280

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* Notes: If we add to this number additional bones that may have been present in Ahmed's skeleton, we get this new total:

280	subtotal from previous total
+ 1	interparietal bone (found in the cranium; according to Shoshani et al., 1982:43, the interparietal is absent in elephants, but according to Mariappa, 1986:4-5 this bone is present in the Asian elephant)
+ 9	turbinals (bones associated with the sense of smell)
+ 2	acetabuli (found in the acetabular fossae of the pelves, delineated in fetuses or newly born)
+ 2	centralia (bones in the forefeet, in most cases they are fused to the os magnum)
+ 40	sesamoid bones [found in the manus ("hands"), and pedes ("feet"); in old elephants, however, two bones on each "finger" may be fused, some may be missing].
334	possible total number of bones

Bones missing from the mounted skeleton

In the writing below Roman numbers I-V refer to digit numbers on the manus ("hand") and pes ("foot"), where I is the first digit starting on the medial side when the manus or pes are in pronation position (in human, for example, digit I in the hand is the thumb when the palm is facing down).

Hyoid apparatus:	5 bones
Sternum:	4 bones
Left manus:	phalanx No. 3 from four digits
Right manus:	phalanx No. 3 from four digits
Left pes:	I - phalanges Nos. 1, 2, and 3
	II-IV - phalanges No. 3
Right pes:	I - Phalanges Nos. 1, 2, and 3
	II-V - phalanges No. 3
some sesamoid bones	

Height

The height of the skeleton is 2.9 m at the shoulder, which is slightly lower (about 10 cm) than he stood in life, due to lack of cartilage, skin, and other soft tissues.

Weight

The weight of the skeleton is about 800 kg, exclusive of the wood and metal used for mounting it. If we assume that the weight of the skeleton constitutes approximately 16% of the total body weight when Ahmed was alive

(see calculations in Shoshani et al., 1982:42-43), then his weight was 5,000 kg or 11,000 lbs.

Assorted notes about the skeleton

Two ribs, one toe bone, and the top of one vertebra were missing and were modelled in resin by A.K.K. Hillman. The eighth left rib was broken when Ahmed was alive and healed; the fracture point is 20 cm from the distal end (Fig. 8). The first lumbar vertebra has a long and broad transverse process (pleurapophysis) on the right side; on the left this process seems to have been broken once and rehealed with a sharp end pointing anteriorly. In addition, an ossified structure was present on the left metatarsus and extended into the internal cuneiform bone. Another small piece (about 7 cm long) was found ventral to it.

In the **long bones** all the epiphyses (ends) were firmly fused to the diaphyses (shafts), indicating that the elephant ceased to grow when he was alive.

In the **pelves**, posterior view, there were small cracks in the bones on both sides; in anterior view, on the right side there was slight cracking, while on the left side the cracks are more prominent and light can be seen through the main crack. Similar cracks are present on the supraspinous fossae of the scapulae (more so on the right than on the left scapula). These details may be of interest to comparative anatomists and museum workers, for they are influenced by various parameters such as differential humidity and temperature. If such cracking is caused by these factors, they may be reduced or prevented if conditions are controlled.

In the **cranium**, there is a hole about 2 cm in diameter in the area in front of the left eye socket (?looks post-mortem); other holes in the skull look natural (foramina).

Possible route of bullet(s) that penetrated the cranium

Earlier in this article we mentioned that "two bullets were uncovered at the base of the tusks but they might have been there for years" (see under DEATH AND SKINNING). While mounting the skeleton in 1977, J.C. Hillman and I.S.C. Parker conducted detailed "forensic" examination on the cranium and found the remains of a bullet embedded in the top of the right tusk. The pieces had been completely encapsulated by ivory (dentine) growth and probably did not contribute to Ahmed's death. This finding did, however, explain the abnormal and uneven tooth wear between the right and left sides and the strange bone features in the nasal passage (swelling of the premaxillary bone on the right side of the external naris) and the back left of the occiput, as caused by the passage of the bullet(s) which occurred about 10 to 15 years before Ahmed died.

Based on the above description, and additional examination made by J. Shoshani and R. Geron in 1982, we believe that the person who shot Ahmed was at higher ground (perhaps on a tree or uphill) than the elephant. The possible route of the bullet(s) was (were):

- left scapula [where the bullet penetrated the spine at about the middle, and left an almost round hole measuring 1.0 x 1.3 cm on the posterior ("entry") side, and slightly wider on the anterior ("exit") side; the entry side of the opening is smooth, while the exit side is wider. The spine on the posterior (entry) side has a rough surface, and a deposit of bone was laid after the formation of the scapular spine (Fig. 10),
- back of the cranium on the left side and penetrated the tympanic/squamosal area about 20 cm medial to the opening of the secondary external acoustic meatus (the ear canal),
- pneumatic bone (parts of the cranium with air cells or diploe) area above and perhaps diagonally towards the upper right molar region,
- right tusk at its proximal end [X-rays show that part of bullet(s) had lodged in this region].

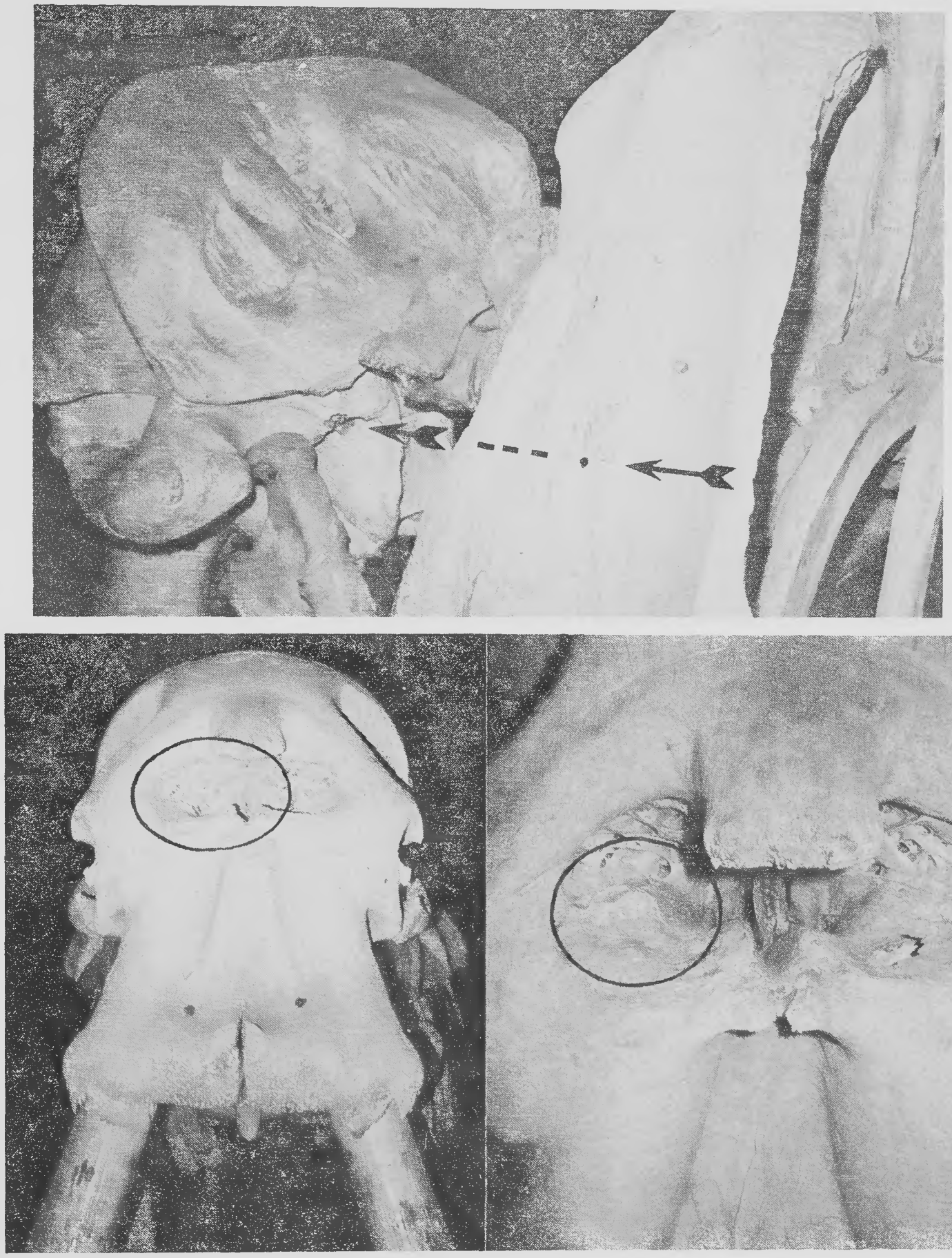

Figure 10. Selected photographs depicting the possible route of the bullet(s) that penetrated Ahmed's cranium. Estimated time of shooting is 10-15 years before he died. Possible route of bullet(s): left scapula, lower back of skull (TOP); lodged in the right side just beneath the external naris (BOTTOM LEFT) and details shown at BOTTOM RIGHT.

TEETH

Data on the real tusks	Left	Right
Length along outside curvature:	235.5 cm	231.5 cm
Length along inside curvature :	221.0 cm	217.5 cm
Circumference close to base :	46.4 cm	46.7 cm

Note: Measurements were taken at the lip lines (beginning of the alveoli); 59.0 cm of tusk was held in the alveolus in the skull (cranium).

Data on molars:

Table 3. Data and notes collected on Ahmed's (Loxodonta africana africana) molars, November 20, 1982.

	Upper		Lower	
	Right	Left	Right	Left
Number of plates	9	9.5	? 5	8
Maximum tooth length (in mm)	265	260	203	255
Maximum tooth width (in mm)	80	88	85	86
Maximum enamel loop width (in mm)	69	68	74	76

NOTES:
Upper Right: 4 loops from back of tooth are complete, 5 front loops are partly worn and confluent.
Upper Left : The 1/2 loop is on the lateral side; all loops are worn but in good condition.
Lower Right: Tooth is loose in the alveolus; only 2 loops are complete, the rest are confluent; front and medial portions of tooth are heavily worn.
Lower Left : 5 loops from back of tooth are complete, rest are confluent; tooth is fractured and loose in the alveolus (Fig. 11); coronoid canal is well delineated - 8 cm posterior to molar.

For all teeth:
a) no teeth were observed forming behind any of these teeth; a bony material was present instead.
b) all molars were stained on the lingual (toward inside of mouth) side more than on the buccal (cheek) side.
c) Laws' (1966) aging method for the Right and Left lower teeth are Group XXVIII (= 55 ± 4 years old) and Group XXVII (= 50 ± 2 years old), respectively.
d) see also comments under The Skeleton.

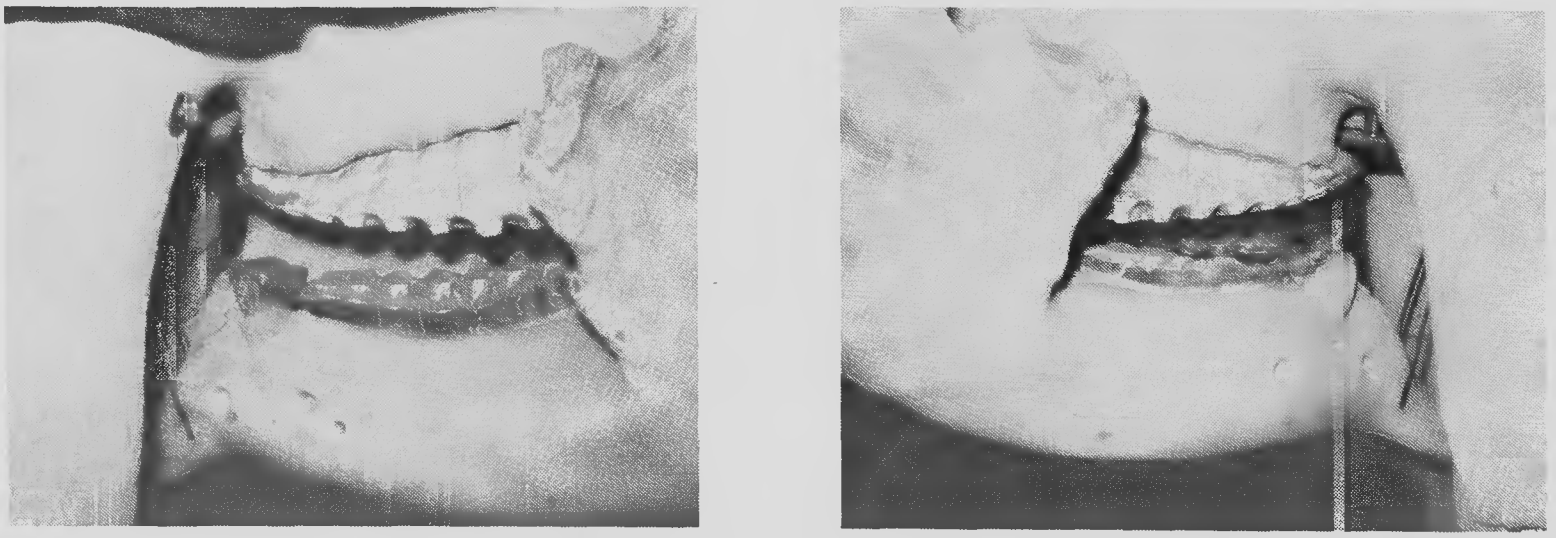

Figure 11. Close-ups of Ahmed's molar regions. Left side is on left, right side is on right. Average length of molars is 24.6 cm; average width is 8.5 cm. From the data presented in Table 3 and reference to the literature, we note that Ahmed was between 48 and 59 (average of 53.5) years old when he died.

AHMED'S TUSKS COMPARED TO OTHER GIANTS

The summary table below includes data on tusks from known records and/or from famous elephants. The notes accompanying this table include the sources from which these data were obtained.

Table 4. Comparison between tusks of Ahmed and large tusks from other elephants.

		LENGTH		CIRCUMFERENCE		WEIGHT (lbs.)	
		Left	Right	Left	Right	Left	Right
"Ahmed" (Marsabit)	1	9' 4"	9' 9"	18.4"	18.3"	148.0	148.0
The heaviest (Kenya near Kilimanjaro) at the BMNH	2	10' 2.5"	10' 5.5"	24.5"	23.5"	226.5	214.0
The second longest ("Mohammed" of Marsabit)	3	10' 8.5"				141.5	
[or		10' 10"				141.0]	
The thickest and third-heaviest (Uganda, now in UK)	4	8' 11"	9' 0"	23.5"	25.0"	174.0	198.0
The ? ? ? ("Abdul" of Marsabit)	5	?	?	?	?	?	?
Kruger elephants	6						
"Dzombo"		8' 4"	7' 9"	19.7"	20.0"	122	125
"Joao"		8' 11"	8' 2"	21.7"	21.7"	154	132
"Kambaku"		8' 6"	8' 8"	20.0"	20.5"	140	141
"Mafunyane"		8' 3"	8' 3"	18.9"	18.9"	122	122
"Ndlulamithi"		9' 5"	9' 0"	19.1"	18.9"	142	126
"Shawu"		10' 5"	10' 0"	17.7"	17.7"	116	112
"Shingwedzi"		6' 9.5"	8' 8"	18.7"	18.9"	104	128

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1. The circumferences of the tusks were measured at the lip lines. This was also done for all the Kruger elephants. Data are from the placard at the National Museum of Kenya (Nairobi) and our measurements.
2. After Smith (1986:407), and Dyer and Kuhn, 1973:151-152); BMNH = British Museum (Natural History), London. According to Resnick (1986:31), at the time of this elephant's death, the left tusk weighed 237.5 lbs. and the other 225 lbs. This means that in a period of about 100 years since the elephant died, they lost a combined total of 22 lbs. of moisture, or 3.5 ozs. (about 100 grams) of wet content per year.
3. Top numbers are from Dyer and Kuhn (1973:151-153), the bottom numbers are from Jones (ca. 1970:24).
4. After Dyer and Kuhn (1973:151-152).
5. Data could not be obtained; to be incorporated in the future.
6. After Hall-Martin (1987:26-29); tusk circumferences were measured at the lip lines (see also Note No. 1).

1-6. Some of the numbers in this table were converted from metric data. The elephants in the first five entries are from East Africa. The last seven elephants are from Kruger National Park in South Africa.

Taking into consideration that the sample size in Table 4 is small, it provides us with the opportunity to compute average tusk weight (ATW) for these selected elephants. These computations indicate the following:

ATW for 4 elephants originating from East Africa is ..... 178.6 lbs.
ATW for 7 elephants originating from South Africa is ..... 127.6 lbs.
ATW for all the 11 elephants included in this table is ... 144.6 lbs.

Therefore, Ahmed's tusks (ATW = 148 lbs.) are:

30.6 lbs. less than the ATW for the 4 elephants originally from East Africa
20.4 lbs. more than the ATW for the 7 elephants originally from South Africa
3.4 lbs. more than the ATW for all the 11 elephants included in Table 4.

According to Joseph Engelhard (pers. comm.) it is generally known that elephants from eastern Africa have, on the whole, larger ATW than elephants from southern Africa. Indeed, it is evident from the data in Table 4 that the ATW for elephants originating from East Africa is greater (by 51 lbs.) than the ATW for elephants originating from South Africa, and similarly it is greater (by 34 lbs.) than the ATW for all the elephants included in Table 4. Additionally, it may be noted that most, if not all, the elephants with large tusks originated from isolated populations (either natural geographical isolation or artificial isolation due to human encroachment) retained certain characters, e.g., genes for tusk size, to remain in the same population.

EPILOGUE

"The most famous wild elephant in the world lived in the mountain forest of Marsabit and was called Ahmed..." is the opening sentence in Marnham's book Fantastic Invasion: notes on contemporary Africa (1979:3).

The fact that Ahmed is not the tallest elephant on record or the one with the largest documented tusks is not as important as the fact that he became the symbol of conservation. We do not know of any other wild elephant that captured the imagination of presidents, men, women and children. Ahmed's legendary status has evolved from a combination of several factors including his age, the size of his tusks, the isolation in a forested mountainous island-oasis in a desert, his bathing in the famous "Lake Paradise", and the reported "acolytes" or "elephant askaris" (soldiers) that supposedly were his perpetual body guards. Without a question, Ahmed was the "Mzee" (wise old man, in Kiswahili) of Marsabit. Undoubtedly, his relatively large tusks which reached the ground, their curvature, and their almost perfect symmetry contributed much to his fame. Ironically, tusks of elephants which adorn their holders and are an inseparable entity of their survival are also, in most cases, the direct cause for their decline. Although Ahmed was not killed by poachers or hunters (he was shot once, however), he was sought by them, a situation which inspired people to write about 5,000 cards to the East African Wildlife Society in Kenya that subsequently lead to the Presidential Decree by the late Mzee Jomo Kenyatta (the only known Presidential Decree to protect an elephant).

The decision to restore Ahmed's body as a fiberglas replica in the outdoor yard and mount his skeleton in the indoor exhibit of the National Museum of Kenya in Nairobi (rather than in Marsabit as was once suggested), was a historical milestone in wildlife conservation. Thousands of visitors from around the world view Ahmed's image and skeleton annually and record their memories on film and notes. These are the witnesses for future generations.

ACKNOWLEDGMENTS

We are grateful to the staff at the National Museum of Kenya for their continuous help during the mounting of the skeleton of Ahmed, particularly the askaris who willingly carted the tusks when requested and to A.K. Kes Hillman (now Hillman Smith) who patiently held bits of bones for hours while they were fastened or measured. Special thanks is also extended to the following companies: Morris and Company of Nairobi for their help with the steelwork, Leakey Institute for help with the scaffolding and Nairobi Hospital for taking X-ray photographs of Ahmed's right tusk. We also acknowledge Wolfgang Schenk of Zimmermann's Ltd. and Ian S.C. Parker for their criticism on the final exhibit in relation to the placement for the front legs. Richard E. Leakey and Issa Aggundi generously helped us with various aspects (including access to the material in the Ahmed file) while at the NMK. Rafael Geron was very helpful in measuring the fiberglas replica and the skeleton, Joseph G. Engelhard and Jules L. Pierce made constructive comments on earlier versions of this paper, and Gary H. Marchant helped with illustrations.

LITERATURE CITED

Anonymous. ca. 1970. Cover of booklet entitled "Kenya" contains a photograph entitled "'Ahmed' - Protected by Presidential Decree". Ministry of Tourism and Wildlife, Nairobi, Kenya.

Anonymous. 1974. Elephant will never be forgotten: Ahmed will be preserved. A Kenyan newspaper, January 18, 1974, page 1 and backpage.

Anonymous. 1980. Concerning our elephants... Additional information on Ahmed the elephant. Elephant, 1(4):234.

BeVier, T. 1980. They came, they saw, they spoiled Africa. A review of "Fantastic Invasion: Notes on Contemporary Africa" by Patrick Marnham, Harcourt Brace Jovanovich, 271 pp. Detroit Free Press, May 18.

Beard, P.H. 1977. The end of the game. Doubleday & Company, New York, 280 pp.

Bunny, D. ca. 1975. Oil painting of Ahmed. Reproduction issued by the East African Wildlife Society, Nairobi, Kenya.

Carrington, R. 1958. Elephants: a short account of their natural history, evolution and influence on mankind. Penquin, London, 285 pp.

Douglas-Hamilton, I. 1987. African elephant population study. Pachyderm, Number 8:1-10.

Dyer, A., and R. Kuhn. 1973. The big five. Winchester Press, New York, 154 pp.

Hall-Martin, H. 1987. Kruger's magnificent seven still capture the imagination. Custos (June), Vol. 16, No. 5:16-25 (in Afrikaans), 26-29 (in English).

Hartmann, F. 1973. "Ahmed" -- rare photograph of Kenya's most famous elephant in Lake Paradise at Mt. Marsabit. Africana, 5(2):cover page.

Hartmann, F. 1981. Photograph of Ahmed at Lake Paradise on Mt. Marsabit, Northern Kenya. Swara, 4(4):34-35.

Hillman, A.K.K. 1978. Miscellaneous: Ahmed. Elephant, 1(2):35.

Hillman, A.K.K. 1979. IUCN Elephant Survey & Conservation Programme: summary of interim report on elephants in Kenya. Elephant, 1(3):14-21.

Johnson, O. 1941. Four years in Paradise. Halcyon House, New York, 345 pp.

Jones, D.K. ca. 1970. A pilgrimage to Ahmed. A Kenyan newspaper, page 24 and 42.

Karimi, J. 1974. Ahmed may cost 26,000 to preserve. Daily Nation (Nairobi, Kenya), Saturday, January 19, 1974, page 20.
Laursen, L., and M. Bekoff. 1978. Loxodonta africana. Mammalian Species, No. 92:1-8.
Laws, R.M. 1966. Age criteria for the African elephant (Loxodonta a. africana). E. Afr. Wildl. J., 4:1-37.
Mariappa, D. 1986. Anatomy and histology of the Indian elephant. Indira Publishing House, Oak Park (Michigan), 209 pp.
Marnham, P. 1979. Fantastic invasion: notes on contemporary Africa. Harcourt Brace Jovanovich, Inc., New York, 271 pp.
Marnham, P. 1980. Ahmed and the gamekeepers. Excerpt from "Fantastic invasion: notes on contemporary Africa," Harcourt Brace Jovanovich, Inc. (1979). Harper's, 260(1556):58-67.
Morrison, G. 1972. Photograph of Ahmed in an advertisement for John Alexander Safaris. Africana, 4(11):7. [Also in Africana, 5(2):48.]
Mungai, J.M. 1976. Sorting out facts from myth in the Ahmed Saga. Daily Nation (Nairobi, Kenya), Thursday, January 15, 1976, page 11.
Murray, N. 1976. The love of elephants. Octopus Books Limited, London, 96 pp.
Resnick, M. 1986. Stalking Jumbo ... 88 years later. Swara, 9(6):30-31.
Shepherd, D. 1982. Oil painting: "Ahmed of Marsabit" A king among elephants --. (From a page including an advertisement for Fenn Galleries Ltd., 1075 Paseo de Peralta, Santa Fe, New Mexico 87501 505/982-4631.)
Shoshani, J. 1974. Ahmed king of Marsabit. Saleet, B/9(May):26-28. (In Hebrew.)
Shoshani, J., et al. 1982. On the dissection a female Asian elephant (Elephas maximus maximus Linnaeus, 1758) and data from other elephants. Elephant, 2(1):3-93.
Shoshani, J. 1987. Elephant research in historical perspective. Proceedings of the Seventh Annual Elephant Workshop held at Calgary Zoo (Alberta, Canada, September 25-27 1986):63-76.
Sikes, S.K. 1971. The natural history of the African elephant. Weidenfeld and Nicholson, London, 397 pp.
Smith, S.J. 1986. Rowland Ward's records of big game: Africa and Asia (XX edition). San Antonio (Texas), 626 pp.
Williams, J.G. 1967. A field guide to the national parks of East Africa. Collins, London, 352 pp.

Given below is a comparison between the definitions of a National Park and a Game Reserve [see INTRODUCTION to this article]:

"The distinction between a National Park and a Game Reserve, broadly speaking, is that in the former complete protection of fauna and flora is the paramount purpose and human utilization of the land is precluded. In the Game Reserves preservation of wildlife is a primary purpose but human activities such as the grazing of cattle are sometimes allowed." (after Williams, 1967:15).